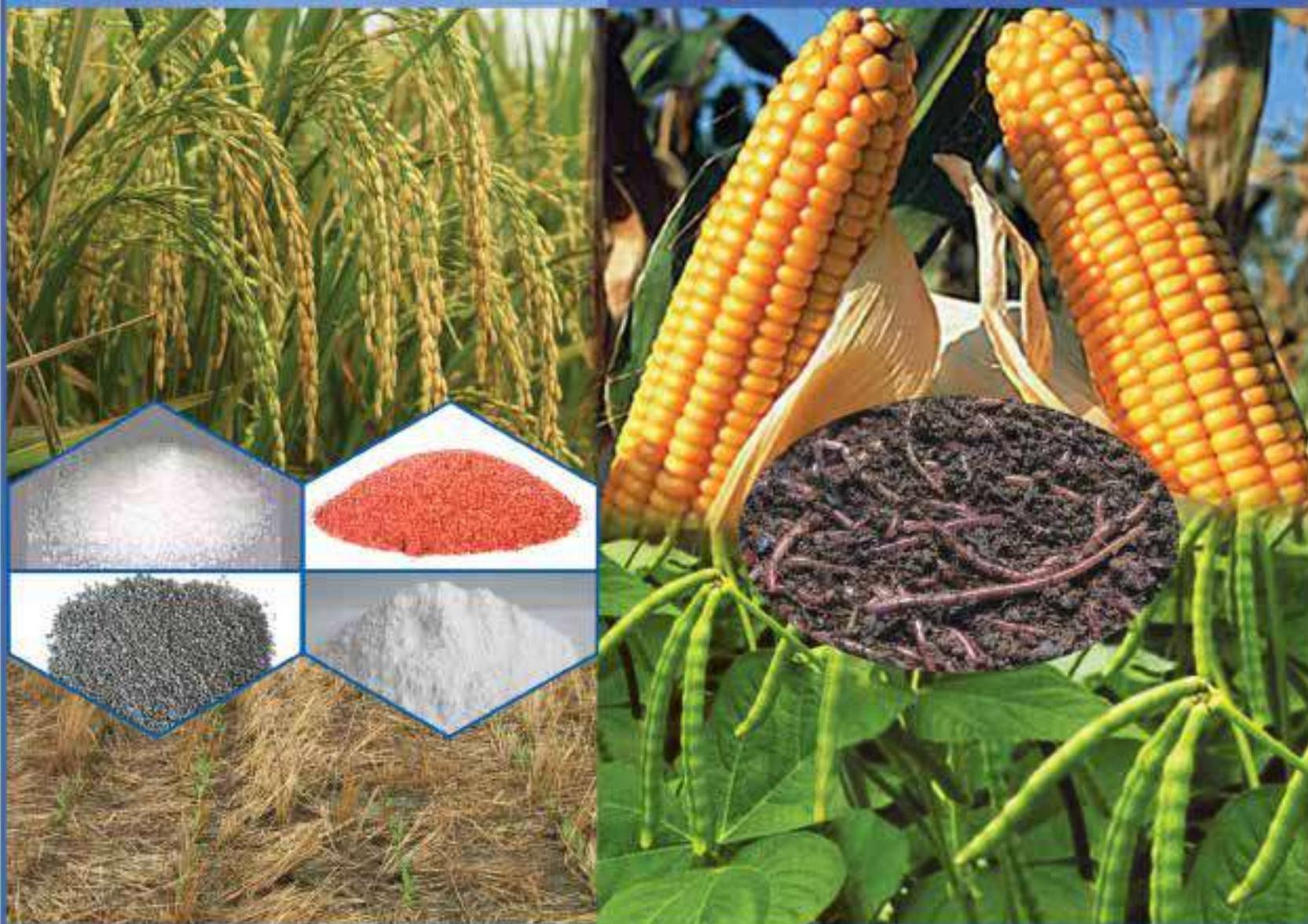


# FERTILIZER RECOMMENDATION GUIDE-2018



**BANGLADESH AGRICULTURAL RESEARCH COUNCIL**

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# FERTILIZER RECOMMENDATION GUIDE-2018

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# FERTILIZER RECOMMENDATION GUIDE-2018

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## FOREWORD

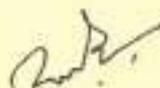
Bangladesh Agricultural Research Council (BARC) has the mandate to formulate fertilizer recommendation for major crops and cropping patterns and publish Fertilizer Recommendation Guide (FRG) periodically. BARC updates and publishes the FRG usually at five years interval. The first FRG was published in 1979 in the name of "Fertilizer Guide for Major Crops of Bangladesh" mainly based on information on soil units and field trial results. The second FRG was published in 1985 with the title of "Fertilizer Recommendation Guide for Most Bangladesh Crops". This guide introduced the concepts of soil testing and yield goals for making recommendations. Thus making it more specific for the farmers and that can be tailored to the farmers' needs and capabilities.

The subsequent two FRGs were updated and published in 1989 and 1997 using the computerized Land Resources Inventory database and information on land type, soil fertility, hydrology, agro-climatic parameters and land type-wise major crops and cropping patterns in different Agro-ecological Zones (AEZs). Later on the further updated FRG was published in 2005. The "Fertilizer Recommendation Guide-2005" included information on more crops and cropping patterns, updated soil nutrient status of different AEZs, nutrient balance, soil and fertilizer management based on Integrated Plant Nutrition System (IPNS) concept, fertilizer management in multiple cropping system, minimum tillage, hill farming etc. That guide dealt more with the principles rather than blanket recommendation.

Fertilizer Recommendation Guide-2012 was the sixth revised and updated version. The salient features of this guide were fertilizer recommendation for different crops, cropping patterns and multiple cropping targeting high yield goals based on updated soil nutrient status information of different AEZs. The Guide included information on more crops compared to the previous ones. Flowers and many traditional fruits and spices crops were new addition in the Guide. Significant improvement was also made with inclusion of new chapters/subjects like clay mineralogy, soil fertility evaluation and assessment of nutrient needs, soil organic matter management, carbon sequestration, deep placement of urea, land degradation, quality control of fertilizers etc. Fertilizer recommendations suggested in FRG-2012 were not absolute values, rather indicative since they were based on soil test values of wider areas (AEZ).

The **Fertilizer Recommendation Guide-2018** is the seventh updated version. It includes updated fertilizer recommendation for the major crops and cropping patterns based on the present soil fertility information of different AEZs. In addition to the contents of the previous guide, this guide includes some new chapters on soil acidity and liming, fertilizer management for conservation agriculture, roof top gardening and floating agriculture. It also includes chapters on fertilizer management for degraded land farming like hill farming, coastal farming, haor farming and charland farming. As of the previous guide, fertilizer recommendations suggested in this edition are also not absolute values, rather indicative since they are based on soil test values of wider areas (AEZ). The FRG-2018 has been prepared mainly targeting the extension personnel but I strongly believe that this would be useful for all levels of stakeholders in agriculture like the farmers, GO and NGO personnel, scientists, policy makers etc. as a guide for production planning and implementation at local and national level.

Contributions of the National Agriculture Research System (NARS) institutes through providing information for updating the guide are gratefully acknowledged. The remarkable and untiring assistance rendered by the scientists of the NARS institutes and officials of DAE is also gratefully acknowledged. Special thanks to Dr. M.A. Satter, Member Director (Admin. & Financ), BARC for his leading role in updating and publication of the guide. Financial assistance of National Agricultural Technology Project (NATP), Phase-II for updating and printing of the guide is thankfully acknowledged. Last but not the least, the scientists who worked hard in compilation and editing of information and publication of the guide in a very short time are admirably acknowledged.



**(Dr. Md. Kabir Ikramul Haque)**

Executive Chairman  
Bangladesh Agricultural Research Council

## PREFACE

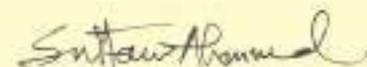
Publication and periodic updating of Fertilizer Recommendation Guide (FRG) is a routine activity of the Natural Resources Management (NRM) Division, Bangladesh Agricultural Research Council (BARC). The first FGR was published by BARC in 1979 in the name of "Fertilizer Guide for Major Crops of Bangladesh" mainly based on information of soil units and field trial results. With the advancement of technology and the progress in the soil fertility and fertilizer management research, the second FRG was published in 1985 with the title of "Fertilizer Recommendation Guide for most Bangladesh Crops" based on fundamental principles of fertilizer recommendation on the basis of soil test and crop response.

The subsequent two FRGs were updated and published in 1989 and 1997 using the database and information of land type, soil fertility, hydrology, agro-climatic parameters and land type-wise major crops and cropping patterns in different agro ecological zones (AEZs). Later on the Guide was further updated and published in 2005. The FGR-2005 included information of crops and cropping patterns, updated soil nutrient status of different AEZs, nutrient balance, Integrated Plant Nutrition System (IPNS) based soil and fertilizer management, fertilizer management in multiple cropping system, minimum tillage, hill farming etc. That guide dealt more with the principles rather than blanket recommendation. The FRG was updated again in 2012 and published as Fertilizer Recommendation Guide-2012. Fertilizer doses for moderate yield goal (MYG) of different crops were dropped and the doses only for high yield goal (HYG) were provided in FRG-2012. Fertilizer doses for fruit crops like Malta, Lemon, Jujube, Lotcon, Amlaki, Jamrul, Straw berry; spices crops like Onion seed, Kalijira, Methi, Golmorich; flower crops like Marigold, Gladiolus, Tuberose, Orchid were new addition and narcotic crop Tobacco was dropped from the FRG-2012. The guide was also updated with new crop varieties and cropping patterns.

The **Fertilizer Recommendation Guide-2018** is the seventh updated version. The salient features of this version are fertilizer recommendation for different crops and cropping patterns and multiple cropping targeting high yield goals based on updated soil nutrient status information of different AEZs. This guide includes information of more crops compared to the previous guides. Flowers and many traditional fruits and spices are new additions. Significant improvement has been made with updated fertilizer doses and inclusion of new topics in the theoretical part like clay mineralogy, soil fertility evaluation, soil organic matter management, carbon sequestration, deep placement of urea, land degradation, quality control of fertilizers etc. Fertilizer recommendations suggested in this guide are not absolute values, rather indicative since they are based on soil test values of wider areas. The FRG-2018 has been prepared targeting mainly for extension personnel. However, I strongly believe that the guide will be useful for all levels of stakeholders in agriculture like farmers, GO and NGO personnel, scientists, policy makers etc. for production planning and implementation at the local and national levels.

Contributions of the National Agriculture Research System (NARS) institutes and universities through providing information for updating the guide are gratefully acknowledged. The remarkable and untiring assistance rendered by the scientists of the NARS institutes including BARC, teachers of universities and officials of DAE is highly appreciated. Financial assistance of National Agricultural Technology Project (NATP), Phase-2 for updating and Printing of the guide is thankfully acknowledged.

I wish to extend cordial thanks to those who were actively involved in compilation, editing and printing of this document.



**(Dr. Sultan Ahmed)**  
Member-Director (NRM)  
BARC

# FERTILIZER RECOMMENDATION GUIDE-2018

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# FERTILIZER RECOMMENDATION GUIDE-2018

## 1. INTRODUCTION

### 1.1 Updating of Fertilizer Recommendation Guide

Fertilizer Recommendation Guide is an outcome of soil fertility research in Bangladesh. In 1957, a research scheme titled, "Rapid Soil Fertility Survey and Popularization of the Use of Fertilizer in East Pakistan" was implemented. According to the soil test values, fertilizer recommendations for different crops were formulated and published for the first time in the name of Fertilizer Use in East Pakistan in 1961. During early 1960s, the soils of Bangladesh, based on the origin and properties, were broadly classified into seven tracts. The Department of Soil Survey carried out reconnaissance surveys during 1961-70 and classified the soils into 18 General Soil Types and 20 Soil Units. The second Fertilizer Recommendation Guide entitled, Soil Fertility Investigation in East Pakistan, was published in 1967, and updated recommendations were published in 1969 in the name of Studies on Fertilizer and Soils of East Pakistan.

The FAO/UNDP Fertilizer Demonstration and Distribution Project during 1975-80 conducted a series of on-farm trials and demonstrations across the country on local/improved local varieties of crops. The BARC published the first FRG in 1979 entitled, Fertilizer Guide for Major Crops of Bangladesh. Eventually with the progress of soil fertility research, the second FRG was published in 1985 in the title of Fertilizer Guide for Major Crops of Bangladesh. This Guide had provided fundamental principles for fertilizer recommendation on the basis of soil test and crop response.

After 1985, a good progress has been made in the area of soil fertility and fertilizer management research. During the period, computerized data base on land type, soil & hydrology and agro climatic parameters have been developed and subsequently used in preparing the AEZ Map of Bangladesh. Information on soil fertility and land type-wise major cropping patterns along with crop management practices in different AEZs were compiled. The previous FRG was updated and published in the name of Fertilizer Recommendation Guide-1989. Later, with the advancement of time and research progress, the former FRG was updated and it appeared as Fertilizer Recommendation Guide-1997.

The FRG was further updated and published as Fertilizer Recommendation Guide-2005. In this Guide, some important issues were taken into account, notably changing cropping patterns and crop varieties, changing soil nutrient status, IPNS based fertilizer management and fertilizer management in multiple cropping.

Lastly the FRG was updated in 2012 and published as Fertilizer Recommendation Guide-2012. This time fertilizer recommendation for crops and cropping patterns were updated. Fertilizer recommendation for multiple cropping and conservation agriculture was addressed. Scenario of land degradation and carbon sequestration was presented.

The **Fertilizer Recommendation Guide-2018** is a revised and updated version of the FRG-2012. This is the seventh FRG published by the BARC. The salient features of this Guide are as follows:

- Fertilizer recommendation for specific crops based on the soil test result, crop varieties and HYG target
- Fertilizer recommendation for major cropping patterns in different AEZs with HYG target under irrigated condition
- Fertilizer recommendation for multiple cropping, conservation agriculture, roof top gardening and floating agriculture
- Fertilizer recommendation for hill, coastal, haor and char land farming

- Clay mineralogy and updated nutrient status of different AEZs
- Updated rationale of fertilizer use
- Soil fertility evaluation and assessment of nutrient need
- Soil organic matter management and carbon sequestration
- Deep placement of urea
- Quality control of fertilizers

### **1.2 Steps in using the Fertilizer Recommendation Guide**

The Fertilizer Recommendation Guide-2018 has been developed primarily for use by the extension personnel for advising the farmers to use recommended dose of fertilizers. The FRG focuses on the principles of fertilizer application. It's not a blanket recommendation. Thus, the user should carefully read and follow the Guide. To consult this Guide, the following steps are important:

- I. Read the guide thoroughly to understand the rationale and the principles of fertilizer application.
- II. Use general fertilizer recommendations for cropping patterns (pages 151-186) for those areas for which site specific soil test values and their interpretations are not available.
- III. Develop location specific fertilizer recommendations for crops (upland and wetland) where soil test values are available. Interpret the soil test values into soil fertility classes, such as very low, low, medium, optimum, high and very high based on Appendix 8
- IV. Prepare fertilizer recommendation for a target yield of a specific crop based on the tables given on pages 74-149 and Appendix-8 and 9. Develop fertilizer recommendations for the cropping patterns based on the rationales given on pages 50-51.

## 2. PLANT NUTRIENTS

### 2.1 Essential nutrients

Plants contain more than 90 elements, however, only 16 elements are known to be essential for their normal growth and development. Criteria for essentiality of a nutrient (Arnon and Stout, 1939) are: (i) omission of the element in question results in failure to complete life cycle of a plant, (ii) the function of the element can not be carried out by another element and (iii) the element is directly involved in plant metabolism. Essential plant nutrients are of two types: macronutrients and micronutrients. Macronutrients are required in larger quantities and micronutrients in smaller quantities. Macronutrient content of plants is usually above 0.1 % (dry weight basis) and micronutrient content is usually below  $100 \mu\text{g g}^{-1}$ . Macronutrients are carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur. Micronutrients include iron, manganese, zinc, copper, boron, molybdenum and chlorine. In addition to the 16 essential nutrients, there are four elements (nickel, cobalt, silicon and vanadium) which have been found beneficial to some plants. Nickel is considered essential for legumes and small grains (e.g. barley). Cobalt is required indirectly by leguminous plants as because this element is essential for Rhizobium bacteria which fixes atmospheric  $\text{N}_2$  and provided it to the host legume plant. Silicon has been found to be required to maintain stalk strength in rice. Vanadium compliments the functioning of Mo in the  $\text{N}_2$  fixation process. Except carbon, hydrogen and oxygen, all other 13 elements are taken up by plants from soils. Plants usually obtain carbon, hydrogen and oxygen from air and water.

The term 'trace elements' is sometimes used that is based on element's abundance. Its concentration in soil solid is below  $100 \text{ mg kg}^{-1}$  and in soil solution is  $10^{-6} \text{ mol L}^{-1}$ . It could be metals (Zn, Cu, Mn, Ni, Co, Cd, Cr, Pb, Hg, V & Ti), metalloids (B, As, Sb), non-metals (Se) and halogen (Cl, I & F). Iron and Cl are not trace elements since its concentration in soil exceeds  $100 \text{ mg kg}^{-1}$ .

Micronutrients, Fe, Mn, Zn and Cu are also known as heavy metals since their atomic weights are greater than 50. The micronutrients when present in high concentration would be toxic to plants. From environmental aspect Cd, Cr, Hg and Pb are called heavy metals which even at low concentration can be toxic to plants.

#### Essential nutrients and their sources

| Macronutrients                           |   | Micronutrients                                |   |   |
|--|---|---|---|---|
| Air and water                            | Soil  |   | Soil  |   |
| Carbon (C)<br>Hydrogen (H)<br>Oxygen (O) | Nitrogen (N)<br>Phosphorus (P)<br>Potassium (K) | Calcium (Ca)<br>Magnesium (Mg)<br>Sulphur (S) | Iron (Fe)<br>Manganese (Mn)<br>Zinc (Zn)<br>Copper (Cu) | Boron (B)<br>Molybdenum (Mo)<br>Chlorine (Cl) |

## 2.2 Functions of nutrients in plants

| Nutrient   | Functions  |
|------------|--|
| Nitrogen   | Constituent of proteins and nucleic acids, integral part of chlorophyll; helps vegetative growth with dark green color   |
| Phosphorus | Role in energy storage and transfer (ADP and ATP); constituent of nucleic acids, phytins and phospholipids; stimulates root growth; promotes fruit and seed formation; enhances nodulation in legumes  |
| Potassium  | Involved in activation of enzymes related to starch synthesis, translocation of carbohydrates; regulation of stomatal openings; produces stiff straw in cereals; imparts disease resistance to plants, involved in maintaining turgor pressure of plant cells                          |
| Calcium    | Essential to cell integrity and membrane structure and permeability; role in cell elongation and division; helps in translocation of carbohydrates and protein synthesis, detoxify heavy metals in plants  |
| Magnesium  | Constituent of chlorophyll; involved in phosphate transfer from ATP & ADP; stabilizes ribosome particles, serves as a cofactor of phosphorylatic enzymes in carbohydrate metabolism  |
| Sulphur    | Constituent of amino acids (e.g. cystine), biotin, Vit. B <sub>7</sub> , and coenzyme A; helps in nodulation of legumes; present in glucosides (mustard oil)   |
| Iron       | Component of cytochromes, ferredoxins and leghaemoglobin; involved in the nitrogenase and nitrate reductase enzymatic reactions, associated with chlorophyll formation, protein synthesis  |
| Manganese  | Involved in the oxidation-reduction processes in the photosynthetic electron transfer system, acts as a bridge for ATP and enzyme complex (phosphokinase), activates IAA oxidases.   |
| Zinc       | Synthesis of tryptophane needed for the production of auxins; activation of dehydrogenase and carbonic anhydrase enzymes; helps protein synthesis, high P interferes with Zn uptake by plants.   |
| Copper     | Acts as an electron carrier in photosynthesis and respiration; part of enzymes e.g. cytochrome oxidase; involved in protein and carbohydrate metabolism and N <sub>2</sub> fixation, helps in pollination and seed set, involved in the desaturation and hydroxylation of fatty acids. |
| Boron      | Regulates carbohydrate metabolism; involved in protein synthesis; helps in transport of photosynthetic sugars to meristematic (growing) tissues; role in pollen viability and seed formation.  |
| Molybdenum | Constituent of nitrate reductase and nitrogenase enzymes; role in Fe absorption and translocation in plants  |
| Chlorine   | Involved in the evolution of O <sub>2</sub> in photosynthesis; increases cell osmotic pressure, stomatal regulation, increases hydration of plant tissues.   |

### 2.3 Soil conditions causing nutrient deficiency of crops

Nutrients are taken up by plants in ionic forms as cations or anions. Ions are present in soil solution and are adsorbed on the exchange sites of soil colloids (clay and humus). The availability of a nutrient in soil refers to that fraction of the nutrient which is accessible to plant roots. It is often observed that the total status of a particular nutrient in soil is high but the plants grown on this soil suffers from deficiency of that element. This indicates that the extent of availability is a big concern in question of plant uptake and consequent growth. Thus, a portion of the total content becomes available for plant uptake depending on some soil conditions, viz. soil pH, soil texture, organic matter content, flooding, nutrient interaction, temperature, etc.

Soil pH is the most important factor of nutrient availability in soil. Generally, availability of macronutrients and Mo increases as soil pH increases and the reverse is true for micronutrients except Mo. Again, P availability is low in acid as well as calcareous soils. The effect of soil pH on nutrient availability is illustrated in Fig. 1. In most cases, pH 6-7 is optimum for an adequate availability of a nutrient in soils.

| Nutrient   | Dominant soil conditions causing nutrient deficiency                           |
|------------|--|
| Nitrogen   | Low soil organic matter (SOM), submerged soils, sandy soils.                   |
| Phosphorus | Low SOM, acid soils, calcareous soils.   |
| Potassium  | Low CEC, sandy soils, low mineral K.   |
| Calcium    | Acid sandy soils, strongly acid peat soils.                                    |
| Magnesium  | Acid sandy soils, strongly acid peat soils.                                    |
| Sulphur    | Low SOM soils, submerged soils.  |
| Iron       | Calcareous soils; acid soils with high soil Mn, Cu & Zn contents.              |
| Manganese  | Sandy soils; high soil Fe, Cu & Zn contents.                                   |
| Zinc       | Calcareous soils; saline soils; submerged soils; high P, Ca, Mg & Cu contents. |
| Copper     | High soil N, P & Zn contents, peat soils, calcareous soils.                    |
| Boron      | Sandy soils; calcareous soils; low SOM soils, peat soils.                      |
| Molybdenum | Acid soils, sandy soils.   |

### 2.4 Nutrient absorption and translocation

In general, during rapid vegetative growth and development, the uptake of element ions from the rooting medium is substantial, and as the plant approaches maturity, the rate of accumulation begins to decline. The uptake of element ions and their distribution and redistribution within the plant are governed by time. During the reproductive (flowering and seed and/or fruit development) period, considerable redistribution of elements accrues, although the rate and extent vary with element. Thus, the plant nutrient elements can be classified by their mobility within the plant from the most mobile to the least mobile:

- Very mobile: Mg, N, P, and K
- Slightly mobile: S
- Immobile: Cu, Fe, Mo, and Zn
- Very immobile: B and Ca

These plant nutrient element mobility characteristics will determine in what portion of the plant one would expect deficiency symptoms to appear, the most mobile occurring in the older leaves, and the least mobile in the newly emerging and young leaves. Fruit disorders that are associated with either B or Ca (blossom end rot, for example) not only occur because of their inadequate supply, but being very immobile, their movement from other portions of the plant into the developing fruit is minimal. Root uptake of an ion does not mean

that the absorbed ion will be automatically translocated into the other portions of the plant. As with the root, there exists a mechanism of transport that carries ions across cell membranes and on into the vascular system, which is as complex as that required for ions to enter the root.

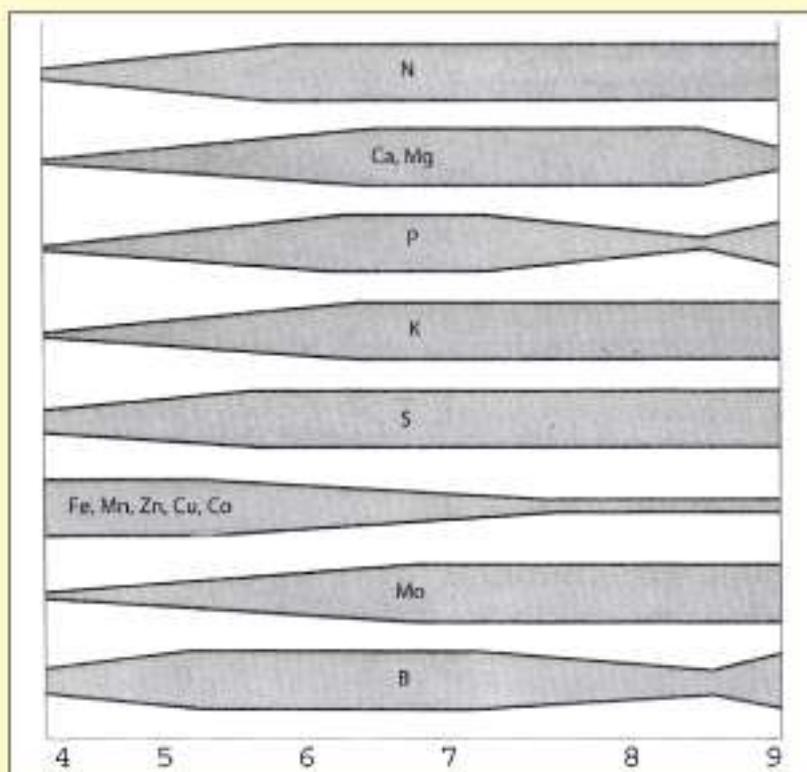


Fig. 1 Effect of soil pH on nutrient availability in soils

## 2.5 Nutrient uptake by crops

Nutrient uptake by a crop is the resultant product of the nutrient composition of the crop and the level of yield including the by-product. In general, the higher is the yield, the higher is the removal of nutrients. Modern varieties of crops absorb relatively higher amount of nutrients than the traditional varieties. Nutrient uptake by various crops is given in Table 1.

Table 1. Nutrient uptake by various crops at definite yield level

| Crop      | Yield (t/ha) | Total nutrient uptake (kg/ha)* |    |      |    |
|-----------|--------------|--------------------------------|----|------|----|
|           |              | N                              | P  | K    | S  |
| Rice (MV) | 6            | 108                            | 18 | 102  | 11 |
| Wheat     | 4            | 118                            | 22 | 98.5 | 17 |
| Maize     | 8            | 160                            | 29 | 134  | 34 |
| Millet    | 0.7          | 30                             | 7  | 53   | 4  |
| Potato    | 30           | 131                            | 20 | 193  | 14 |
| Jute      | 3.0          | 98                             | 20 | 200  | 35 |
| Cotton    | 10           | 26                             | 9  | 70   | -  |
| Tobacco   | 2            | 130                            | 18 | 199  | 10 |
| Sugarcane | 100          | 140                            | 25 | 325  | 51 |
| Mustard   | 1.5          | 82                             | 15 | 91   | 32 |

Table 1, Cont'd

| Crop        | Yield (t/ha) | Total nutrient uptake (kg/ha)* |     |     |    |
|-------------|--------------|--------------------------------|-----|-----|----|
|             |              | N                              | P   | K   | S  |
| Groundnut   | 2            | 170                            | 13  | 91  | 15 |
| Soybean     | 3            | 220                            | 18  | 141 | 20 |
| Sesame      | 1.2          | 62                             | 10  | 53  | 14 |
| Sunflower   | 3            | 120                            | 26  | 199 | 15 |
| Chickpea    | 1.5          | 91                             | 6   | 47  | 13 |
| Lentil      | 1.0          | 57                             | 6.5 | 18  | -  |
| Blackgram   | 1.5          | 118                            | 10  | 82  | -  |
| Mungbean    | 1            | 106                            | 21  | 59  | -  |
| Pigeonpea   | 1.2          | 85                             | 8   | 16  | 9  |
| Cabbage     | 70           | 110                            | 11  | 120 | 24 |
| Cauliflower | 50           | 100                            | 18  | 116 | 20 |
| Tomato      | 50           | 140                            | 29  | 158 | 30 |
| Carrot      | 30           | 125                            | 24  | 167 | -  |
| Cucumber    | 40           | 70                             | 22  | 100 | -  |
| Brinjal     | 60           | 175                            | 17  | 250 | -  |
| Pumpkin     | 50           | 90                             | 31  | 133 | -  |
| Radish      | 20           | 120                            | 26  | 100 | -  |
| Sweetpotato | 40           | 190                            | 33  | 283 | -  |
| Spinach     | 25           | 120                            | 20  | 166 | -  |
| Onion       | 35           | 120                            | 22  | 133 | 26 |
| Banana      | 40           | 250                            | 26  | 350 | 15 |
| Pineapple   | 50           | 185                            | 24  | 290 | 2  |
| Tea         | 2            | 128                            | 17  | 60  | -  |

\* Total nutrient uptake (kg/ha) includes nutrient uptake by main product and crop residues.

## 2.6 Nutrient balance

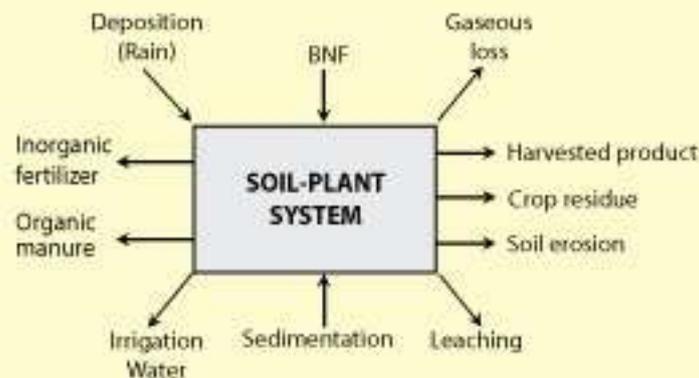
Nutrient balance is the sum of nutrient inputs minus the sum of nutrient outputs; the balance may be positive or negative. Nutrient balance may also be termed as nutrient budget or nutrient audit. Positive balance indicates nutrient accumulation and negative balance shows nutrient depletion (mining). To achieve sustainability, the quantity of nutrient inputs and outputs should be equal. Nutrient mining may eventually cause soil degradation and affect crop production. On the other hand, excess nutrient accumulation may lead to soil and water pollution including imbalance in ratios.

In calculating nutrient balance, fertilizer, manure, BNF, deposition (dry and rain), sedimentation (flood) and irrigation water can be regarded as nutrient inputs, and the crop produce, crop residues, leaching, gaseous losses (volatilization and denitrification) and soil erosion as nutrient outputs (Fig. 2). The most vital routes for nutrient inputs are fertilizer and manure, and those for nutrient outputs are crop produce and crop residues. Hence, these major inputs and outputs can be considered for calculating nutrient balance to understand partial or apparent nutrient balance. Nutrient balance values vary with locations, cropping systems and nutrient management practices.

With the advancement of time, nutrient balance is becoming more negative (Fig. 3). Again, land use with higher cropping intensity may show higher negative balances (Fig. 4). On the other hand, the addition of

organic manure may help reduce negative balances; the magnitude depends on the types and amounts of manure used. Any reduction through removal of crop residues would have positive influence on nutrient balance and this is especially important for K. Nutrient balance appears to be less negative (Figs. 5 & 6) in Barind areas (AEZs 25, 26 & 27) in comparison with the Brahmaputra, Ganges and Meghna Floodplains (e.g. AEZs 9, 11, 12, 13 & 17). Incorporation of grain legume residues (e.g. mungbean) can reduce nutrient depletion to a considerable extent. Thus grain legume based patterns (e.g. Mustard- Mungbean-T. Aman rice, Wheat- Mungbean-T. Aman rice, Lentil- Mungbean-T. Aman rice etc.) are suggested to adopt at farm level.

Although the nutrient balance value tells us a little about available nutrient status of a soil, it has important implications when considering the future long-term total status of nutrients in soils. To minimize nutrient depletion, it is not justified to just increase the use of inorganic fertilizers, rather the organic sources of plant nutrients, especially cowdung, poultry manure, solid waste and human excreta need to be considered.



**Fig. 2 Nutrient input-output system**

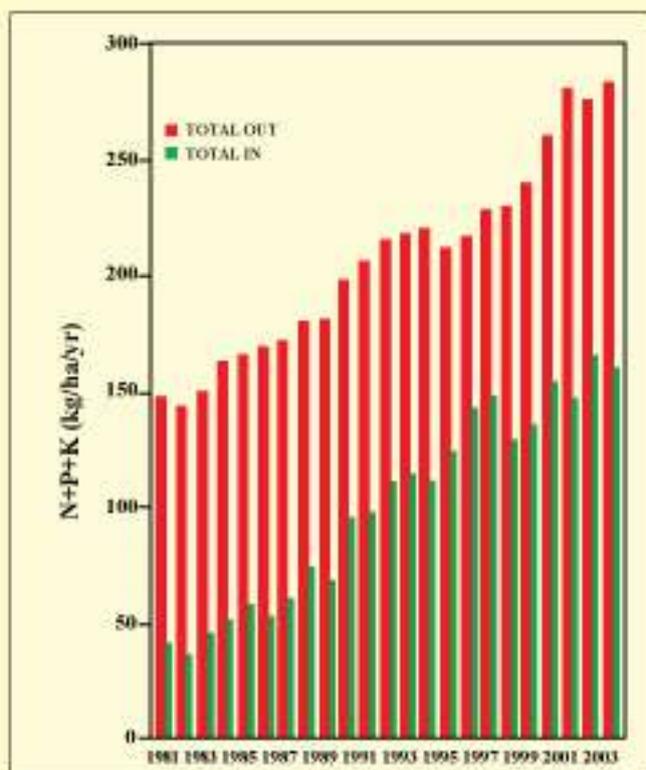


Fig. 3 /Total N+P+K Input and Output in Bangladesh

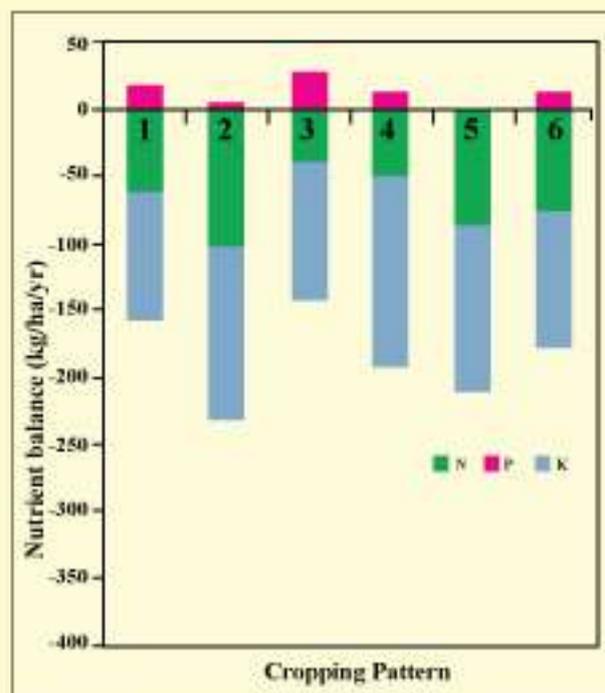


Fig. 4 /Nutrient balance in different cropping patterns:

- 1-Boro - Follow -T.Aman, 2-Boro - T.Aus-T.Aman
- 3-Boro - T.Aus -T.Aman, 3- Mustard - Boro-T.Aman
- 5- Wheat -T.Aus -T.Aman, 6- Wheat -Mungbean -T.Aman

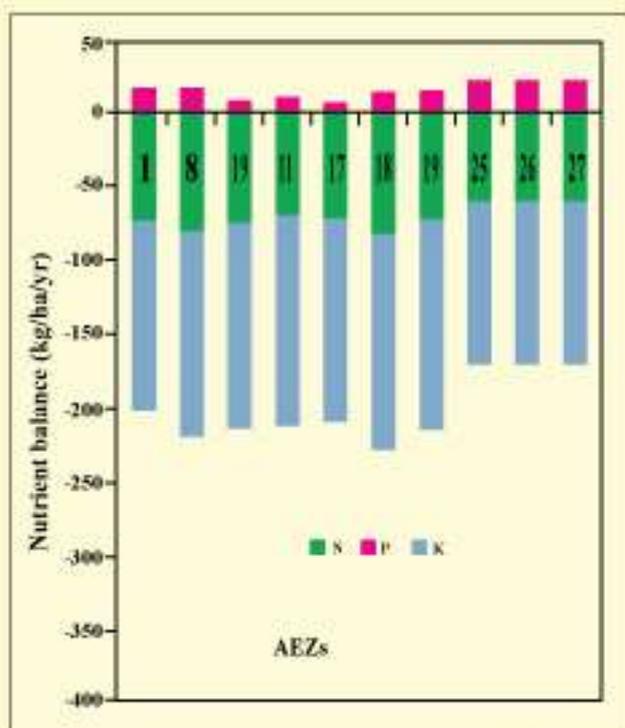


Fig. 5 /Nutrient balance in Boro-Follow-T.Aman rice cropping pattern of different AEZs

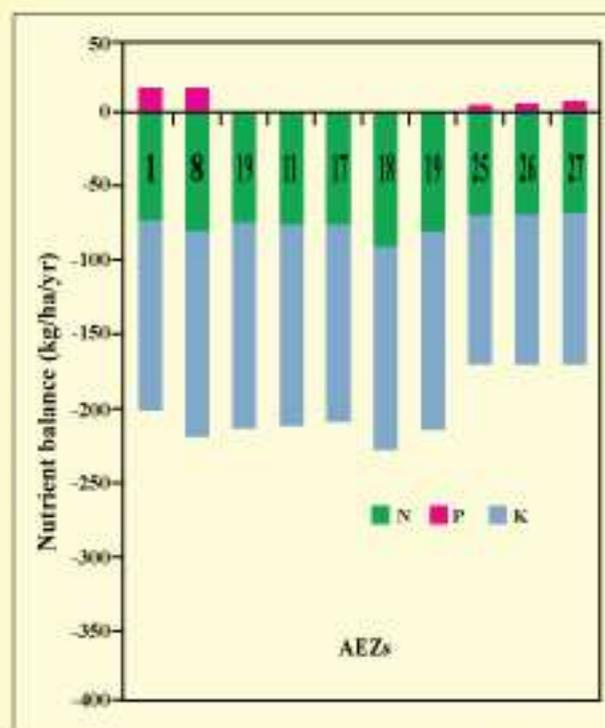


Fig. 6 / Nutrient balance in Wheat-Follow-T.Aman rice cropping pattern of different AEZs

### 3. MINERALOGY AND SOIL FERTILITY STATUS OF DIFFERENT AEZs

#### 3.1 General Features

There are 30 agroecological zones (AEZs) in Bangladesh. These AEZs have been sub-divided into 88 subregions and subregions into 535 subunits. Each AEZ has similar agricultural and ecological characteristics, however, this similarity is prominent at subregion and subunit levels. There are four elements which serve as a basis of AEZ classification. These elements are as follows:

- Physiography (land forms and parent materials)
- Soils (soil characteristics such as soil texture, water holding capacity, fertility)
- Land types (based on depth and duration of flooding e.g. highland, medium highland, medium lowland lowland and very lowland)
- Agro-climatology (length of kharif and rabi seasons, length of pre-kharif period, length of winter temperature (<15 °C) and length of high summer temperature (> 40 °C).

Area, location and land types of different AEZs of Bangladesh are presented in Table 2. For detailed information about physical and chemical properties of soils, respective Upazila Nirdeshika may be consulted. However, for fertility data of a specific area soil samples should be collected for detailed analysis.

**Table 2. Area, location and land type under different agro-ecological zones of Bangladesh.**

| AEZ Number, Name and AAAA                   | Major districts, area & coverage |               | Land type and extent |            |
|---|----------------------------------|---------------|----------------------|------------|
|   | District                         | Area (*00 ha) | Land* type           | Extent (%) |
| 1. Old Himalayan Piedmontplain (398154 ha)  | Thakurgaon                       | 1903          | HL                   | 58         |
|   | Panchagar                        | 1121          | MHL                  | 34         |
|   | Dinajpur                         | 958           | MLL                  | 1          |
|   |                                  |               | HS+WB                | 7          |
| 2. Active Tista Floodplain (83644 ha)       | Kurigram                         | 329           | HL                   | 2          |
|   | Lalmonirhat                      | 148           | MHL                  | 72         |
|   | Nilphamari                       | 142           | HS+WB                | 26         |
|   | Rangpur                          | 116           |                      |            |
|   | Gaibandha                        | 51            |                      |            |
| 3. Tista Meander Floodplain (946803 ha)     | Rangpur                          | 1719          | HL                   | 35         |
|   | Nilphamari                       | 1489          | MHL                  | 51         |
|   | Gaibandha                        | 1439          | MLL                  | 4          |
|   | Dinajupur                        | 1127          | LL                   | 1          |
|   | Kurigram                         | 957           | HS+WB                | 9          |
|   | Naogaon                          | 948           |                      |            |
|   | Lalmonirhat                      | 935           |                      |            |
|   | Panchagar                        | 300           |                      |            |
|   | Bogra                            | 290           |                      |            |
|   | Joypurhat                        | 254           |                      |            |
| 4. Karatoya- Bangali Floodplain (257158 ha) | Sirajganj                        | 1494          | HL                   | 23         |
|   | Bogra                            | 998           | MHL                  | 44         |
|   | Pabna                            | 78            | MLL                  | 14         |
|   |                                  |               | LL                   | 4          |
|   |                                  |               | VLL                  | 1          |

Table 2, Cont'd.

| AEZ Number, Name and Area                                    | Major districts, area & coverage |               | Land type and extent |            |
|--|----------------------------------|---------------|----------------------|------------|
|  | District                         | Area (*00 ha) | Land* type           | Extent (%) |
|  |                                  |               | HS+WB                | 14         |
| 5. Lower Atrai Basin<br>(85105 ha)                           | Naogaon                          | 374           | HL                   | 2          |
|  | Natore                           | 354           | MHL                  | 8          |
|  | Sirajganj                        | 72            | MLL                  | 21         |
|  |                                  |               | LL                   | 65         |
|  |                                  |               | HS+WB                | 4          |
| 6. Lower pumabhaha Floodplain<br>(12896 ha)                  | Naogaon                          | 72            | MLL                  | 10         |
|  | Chapai                           | 57            | LL                   | 60         |
|  | Nawabganj                        |               | HS+WB                | 30         |
| 7. Active Brahmaputra-Jamuna<br>Floodplain<br>(319001 ha)    | Kurigram                         | 843           | HL                   | 5          |
|  | Sirajganj                        | 687           | MHL                  | 37         |
|  | Gaibandha                        | 499           | MLL                  | 20         |
|  | Jamalpur                         | 338           | LL                   | 8          |
|  | Tangail                          | 337           | HS+WB                | 30         |
|  | Bogra                            | 297           |                      |            |
|  | Manikganj                        | 114           |                      |            |
|  | Pabna                            | 75            |                      |            |
| 8. Young Brahmaputra and Jamuna<br>Floodplain<br>(592394 ha) | Jamalpur                         | 943           | HL                   | 18         |
|  | Mymensingh                       | 861           | MHL                  | 42         |
|  | Kishoreganj                      | 776           | MLL                  | 19         |
|  | Manikganj                        | 710           | LL                   | 9          |
|  | Sherpur                          | 174           | HS+WB                | 12         |
|  | Munshiganj                       | 134           |                      |            |
|  | Narshingdi                       | 93            |                      |            |
|  | Narayanganj                      | 56            |                      |            |
| 9. Old Brahmaputra Floodplain<br>(723037ha)                  | Mymensingh                       | 2270          | HL                   | 28         |
|  | Netrokona                        | 1568          | MHL                  | 35         |
|  | Jamalpur                         | 671           | MLL                  | 20         |
|  | Sherpur                          | 630           | LL                   | 7          |
|  | Tangail                          | 592           | HS+WB                | 10         |
|  | Narshingdi                       | 590           |                      |            |
|  | Kishoreganj                      | 439           |                      |            |
|  | Narayanganj                      | 286           |                      |            |
|  | Gazipur                          | 170           |                      |            |
| 10. Active Ganges Floodplain<br>(333447 ha)                  | Shariatpur                       | 509           | HL                   | 12         |
|  | Pabna                            | 476           | MHL                  | 33         |
|  | Chapai                           | 450           | MLL                  | 18         |
|  | Nawabganj                        |               | LL                   | 4          |
|  | Faridpur                         | 402           | HS+WB                | 33         |
|  | Rajshahi                         | 274           |                      |            |
|  | Kushtia                          | 247           |                      |            |
|  | Munshiganj                       | 206           |                      |            |
|  | Manikganj                        | 180           |                      |            |
|  | Rajbari                          | 161           |                      |            |

Table 2, Cont'd.

| AEZ Number, Name and Area                        | Major districts, area & coverage |               | Land type and extent   |            |
|--|----------------------------------|---------------|------------------------|------------|
|  | District                         | Area (*00 ha) | Land <sup>a</sup> type | Extent (%) |
|  | Chandpur                         | 159           |                        |            |
|  | Dhaka                            | 134           |                        |            |
|  | Natore                           | 82            |                        |            |
|  | Madaripur                        | 52            |                        |            |
| 11. High Ganges River Floodplain<br>(1320549 ha) | Jessore                          | 2281          | HL                     | 43         |
|  | Jhenaidah                        | 1970          | MHL                    | 32         |
|  | Rajshahi                         | 1472          | MLL                    | 12         |
|  | Kushtia                          | 1285          | LL                     | 2          |
|  | Natore                           | 952           | HS+WB                  | 11         |
|  | Magura                           | 857           |                        |            |
|  | Meherpur                         | 705           |                        |            |
|  | Chapai                           | 669           |                        |            |
|  | Nawabganj                        | 638           |                        |            |
|  | Satkhira                         | 551           |                        |            |
|  | Chuadanga                        | 543           |                        |            |
|  | Pabna                            | 232           |                        |            |
|  | Khulna                           | 117           |                        |            |
|  | Naogaon                          | 54            |                        |            |
|  | Rajbari                          |               |                        |            |
| 12. Low Ganges River Floodplain<br>(796751 ha)   | Faridpur                         | 1534          | HL                     | 13         |
|  | Pabna                            | 1219          | MHL                    | 29         |
|  | Rajbari                          | 975           | MLL                    | 31         |
|  | Madaripur                        | 818           | LL                     | 14         |
|  | Narail                           | 714           | VLL                    | 2          |
|  | Gopalganj                        | 535           | HS+WB                  | 11         |
|  | Munikganj                        | 413           |                        |            |
|  | Natore                           | 581           |                        |            |
|  | Shariatpur                       | 370           |                        |            |
|  | Kushtia                          | 176           |                        |            |
|  | Bagerhat                         | 146           |                        |            |
|  | Dhaka                            | 126           |                        |            |
|  | Munshiganj                       | 97            |                        |            |
|  | Sirajganj                        | 79            |                        |            |
|  | Khulna                           | 68            |                        |            |
|  | Barishal                         | 60            |                        |            |
| 13. Ganges Tidal Floodplain<br>(1706573ha)       | Khulna                           | 3436          | HL                     | 2          |
|  | Bagerhat                         | 3131          | MHL                    | 78         |
|  | Satkhira                         | 3024          | MLL                    | 2          |
|  | Barishal                         | 2022          | HS+WB                  | 18         |
|  | Patuakhali                       | 1790          |                        |            |
|  | Borguna                          | 1496          |                        |            |
|  | Pirojpur                         | 1228          |                        |            |
|  | Jhalakati                        | 850           |                        |            |
|  | Sharitpur                        | 67            |                        |            |

Table 2, Cont'd.

| AEZ Number, Name and Area                               | Major districts, area & coverage |               | Land type and extent |            |
|---|----------------------------------|---------------|----------------------|------------|
|   | District                         | Area (*00 ha) | Land* type           | Extent (%) |
| 14. Gopalganj-Khulna Bil<br>(224700ha)                  | Gopalganj                        | 802           | HL                   | 3          |
|   | Khulna                           | 375           | MHL                  | 13         |
|   | Jessore                          | 339           | MLL                  | 41         |
|   | Bagerhat                         | 208           | LL                   | 28         |
|   | Narail                           | 198           | VLL                  | 11         |
|   | Madaripur                        | 163           | HS+WB                | 4          |
|   | Barishal                         | 80            |                      |            |
|   | Pirojpur                         | 77            |                      |            |
| 15. Arial Bil<br>(14436 ha)                             | Munshiganj                       | 103           | MLL                  | 13         |
|   | Dhaka                            | 41            | LL                   | 73         |
|   |                                  |               | HS+WB                | 14         |
| 16. Middle Meghna River<br>Floodplain<br>(155464 ha)    | Comilla                          | 331           | MHL                  | 8          |
|   | Narshingdi                       | 293           | MLL                  | 29         |
|   | B.Barua                          | 278           | LL                   | 25         |
|   | Chandpur                         | 233           | VLL                  | 11         |
|   | Munshiganj                       | 152           | HS+WB                | 27         |
|   | Kishorganj                       | 141           |                      |            |
|   | Narayanganj                      | 128           |                      |            |
| 17. Lower Meghna River<br>Floodplain<br>(90934 ha)      | Chandpur                         | 552           | HL                   | 14         |
|   | Laxmipur                         | 275           | MHL                  | 28         |
|   | Noakhali                         | 83            | MLL                  | 31         |
|   |                                  |               | HS+WB                | 27         |
| 18. Young Meghna Estuarine<br>Floodplain<br>(926885 ha) | Bhola                            | 3309          | HL                   | 1          |
|   | Noakhali                         | 2695          | MHL                  | 45         |
|   | Laxmipur                         | 1376          | MLL                  | 7          |
|   | Patuakhali                       | 855           | HS+WB                | 47         |
|   | Chittagong                       | 393           |                      |            |
|   | Barishal                         | 376           |                      |            |
|   | Feni                             | 175           |                      |            |
|   | Shariatpur                       | 50            |                      |            |
| 19. Old Meghna Estuarine<br>Floodplain<br>(774026 ha)   | Comilla                          | 2251          | HL                   | 2          |
|   | B.Barua                          | 1168          | MHL                  | 24         |
|   | Habiganj                         | 817           | MLL                  | 33         |
|   | Chandpur                         | 720           | LL                   | 21         |
|   | Noakhali                         | 627           | VLL                  | 3          |
|   | Kishorganj                       | 434           | HS+WB                | 17         |
|   | Feni                             | 307           |                      |            |
|   | Barishal                         | 288           |                      |            |
|   | Munshiganj                       | 275           |                      |            |
|   | Shariatpur                       | 221           |                      |            |
|   | Laxmipur                         | 201           |                      |            |
|   | Narayanganj                      | 170           |                      |            |
|   | Gopalganj                        | 147           |                      |            |
|   | Madaripur                        | 71            |                      |            |

Table 2, Cont'd.

| AEZ Number, Name and Area                           | Major districts, area & coverage |               | Land type and extent |            |
|---|----------------------------------|---------------|----------------------|------------|
|   | District                         | Area (*00 ha) | Land* type           | Extent (%) |
| 20. Eastern Surma Kushiara Floodplain (462159 ha)   | Sylhet                           | 2748          | HL                   | 5          |
|   | Moulvibazar                      | 1003          | MHL                  | 25         |
|   | Sunamganj                        | 473           | MLL                  | 20         |
|   | Habiganj                         | 398           | LL                   | 36         |
|   |                                  |               | HS+WB                | 14         |
| 21. Sylhet Basin (457345 ha)                        | Sunamganj                        | 2445          | MHL                  | 4          |
|   | Kishoreganj                      | 823           | MLL                  | 19         |
|   | Netrokona                        | 792           | LL                   | 43         |
|   | Habiganj                         | 367           | VLL                  | 23         |
|   | B. Baria                         | 145           | HS+WB                | 11         |
| 22. Northern and Eastern Piedmont Plains (403758ha) | Netrokona                        | 614           | HL                   | 33         |
|   | Sunamganj                        | 569           | MHL                  | 31         |
|   | Sherpur                          | 536           | MLL                  | 16         |
|   | Habiganj                         | 495           | LL                   | 9          |
|   | Mymensingh                       | 441           | VLL                  | 1          |
|   | Moulvibazar                      | 438           | HS+WB                | 10         |
|   | Sylhet                           | 433           |                      |            |
|   | Comilla                          | 374           |                      |            |
|   | B. Baria                         | 133           |                      |            |
| 23. Chittagong Coastal Plain (372007 ha)            | Chittagong                       | 2646          | HL                   | 17         |
|   | Cox' Bazar                       | 658           | MHL                  | 43         |
|   | Feni                             | 411           | MLL                  | 13         |
|   |                                  |               | HS+WB                | 27         |
| 24. St. Martin's Coral Island (804ha)               | St. Martin's Coral Island        | 804           | HL                   | 33         |
|   |                                  |               | MHL                  | 63         |
|   |                                  |               | MLL                  | 2          |
|   |                                  |               | HS+WB                | 2          |
| 25. Level Barind Tract (504851 ha)                  | Naogaon                          | 1408          | HL                   | 30         |
|   | Bogra                            | 1182          | MHL                  | 55         |
|   | Dinajpur                         | 1040          | MLL                  | 4          |
|   | Joypurhat                        | 729           | LL                   | 2          |
|   | Sirajgonj                        | 193           | HS+WB                | 9          |
|   | Natore                           | 186           |                      |            |
|   | Rajshahi                         | 158           |                      |            |
|   | Gaibandha                        | 94            |                      |            |
|   | Chapai                           | 50            |                      |            |
|   | Nawbganj                         |               |                      |            |
| 26 High Barind Tract (159964 ha)                    | Naogaon                          | 623           | HL                   | 93         |
|   | Chapai                           | 502           | MHL                  | 1          |
|   | Nawbganj                         | 475           | HS+WB                | 6          |
|   | Rajshahi                         |               |                      |            |
| 27. North Eastern Barind Tract (107926 ha)          | Rangpur                          | 466           | HL                   | 36         |
|   | Dinajpur                         | 374           | MHL                  | 56         |
|   | Bogra                            | 171           | MLL                  | 1          |
|   | Gaibandha                        | 72            | HS+WB                | 7          |

Table 2, Cont'd.

| AEZ Number, Name and Area                   | Major districts, area & coverage |               | Land type and extent |            |
|---|----------------------------------|---------------|----------------------|------------|
|   | District                         | Area (*00 ha) | Land* type           | Extent (%) |
| 28. Madhupur Tract (424359 ha)              | Gazipur                          | 1598          | HL                   | 56         |
|   | Tangail                          | 1033          | MHL                  | 18         |
|   | Mymensingh                       | 795           | MLL                  | 7          |
|   | Dhaka                            | 462           | LL                   | 9          |
|   | Narshingdi                       | 155           | HS+WB                | 10         |
|   | Narayanganj                      | 133           |                      |            |
|   | Jamalpur                         | 65            |                      |            |
| 29. Northern and Eastern Hills (1817172 ha) | Rangamati                        | 4565          | HL                   | 92         |
|   | Bandarban                        | 4423          | MHL                  | 2          |
|   | Khagrachhari                     | 3167          | MLL                  | 1          |
|   | Chittagong                       | 2328          | HS+WB                | 5          |
|   | Cox's Bazar                      | 1335          |                      |            |
|   | Moulvibazar                      | 1292          |                      |            |
|   | Habiganj                         | 495           |                      |            |
|   | Sylhet                           | 270           |                      |            |
|   | Comilla                          | 108           |                      |            |
|   | Sherpur                          | 82            |                      |            |
|   | Feni                             | 60            |                      |            |
|   | 30. Akhaura Terrace (11324 ha)   | B. Baria      | 113                  | HL         |
| MHL   |                                  |               |                      | 11         |
| MLL   |                                  |               |                      | 10         |
| LL  |                                  |               |                      | 15         |
| VLL   |                                  |               |                      | 3          |
| HS+WB                                       |                                  |               |                      | 6          |

HL = Highland, MHL =Medium Highland, MLL = Medium Lowland LL = Lowland and VLL =Very Lowland

### 3.2 Distribution of clay minerals

Soils of Bangladesh have been formed from different kinds of parent materials and are spread over three major physiographic units: hills, terraces and floodplains. Clay mineral data were scarce till 1980s, later, sporadically some works have been done. Summarization of available clay mineralogical data show that mica is the predominant clay mineral in almost all the soils. Other major minerals are smectite (mainly iron-rich high-charge beidellite), chlorite, vermiculite, kaolinite, and interstratified mica-chlorite, mica-vermiculite-smectite and kaolinite-smectite. The whole Bangladesh can be divided into eight units (or suites) namely, Me-Ch\*, Me-St, Me-Vt\*-Kt, Me-Ch-Vt\*, Me-Mx-Kt, Kt-Mc, Me-Kt-Vt\* and Me-Kt-Vt, where the symbols Me, Ch, St, Vt, Kt, and Mx indicate mica, chlorite, smectite, vermiculite, kaolinite, and mixed-layer minerals, respectively, and asterisk (\*) means partial chloritization of some vermiculite or partial degradation of some chlorite.

### Mineralogical distribution in different AEZs of Bangladesh

| Agroecological regions                     | Major minerals  |
|--|---|
| 1. Old Himalayan Piedmont Plain            | Mica, Chlorite*   |
| 2. Active Tista Floodplain                 | Mica, Chlorite*   |
| 3. Tista Meander Floodplain                | Mica, Chlorite*   |
| 4. Karatoya-Bangali Floodplain             | Mica, Chlorite*   |
| 5. Lower Atrai Basin                       | Mica, Chlorite*   |
| 6. Lower Purnabhaha Floodplain             | Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite |
| 7. Active Brahmaputra-Jamuna Floodplain    | Mica, Vermiculite*, Kaolinite   |
| 8. Young Brahmaputra and Jamuna Floodplain | Mica, Vermiculite*, Kaolinite   |
| 9. Old Brahmaputra Floodplain              | Mica, Chlorite, Vermiculite*  |
| 10. Active Ganges Floodplain               | Mica and smectite   |
| 11. Low Ganges River Floodplain            | Mica and smectite   |
| 12. High Ganges River Floodplain           | Mica and smectite   |
| 13. Ganges Tidal Floodplain                | Mica and smectite   |
| 14. Gopalganj-Khulna Bils                  | Mica and smectite   |
| 15. Arial Bil                              | Mica and smectite   |
| 16. Middle Meghna River Floodplain         | Mica-Chlorite-Vermiculite*  |
| 17. Lower Meghna River Floodplain          | Mica and smectite   |
| 18. Young Meghna Estuarine Floodplain      | Mica and smectite   |
| 19. Old Meghna Estuarine Floodplain        | Mica, Chlorite, Vermiculite*  |
| 20. Eastern Surma-Kushiyara Floodplain     | Mica, Kaolinite, Vermiculite  |
| 21. Sylhet Basin                           | Mica, Kaolinite, Vermiculite  |
| 22. Northern and Eastern Piedmont Plains   | Eastern part: Mica, Kaolinite, Vermiculite*<br>Northern part: Kaolinite, Mica     |
| 23. Chittagong Coastal Plain               | Mica, Kaolinite, Vermiculite*   |
| 24. St. Martin's Coral Island              | Mica, chlorite  |
| 25. Level Barind Tract                     | Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite |
| 26. High Barind Tract                      | Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite |
| 27. North-Eastern Barind Tract             | Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite |
| 28. Madhupur Tract                         | Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite |
| 29. Northern and Eastern Hills             | Easter part: Mica, Kaolinite, Vermiculite*<br>Northern part: Kaolinite, Mica      |
| 30. Akhaura Terrace                        | Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite |

[Source: Moslehuddin *et al.*, 1999, 2006, 2008]

### 3.3 Soil fertility status in different AEZs

Agro-ecological regions and sub-regions are very broad units. The fertility status of these regions varies considerably. Individual farmers have fragmented the land into smaller pieces causing wide variation in the management of each and every piece of land. This leads to a large variation in the fertility levels even between adjacent plots. Realizing the difficulties of generalization of fertility level, only an indicative status of the fertility levels of each of 30 AEZs is given as a ground for AEZ based fertilizer recommendations. Soil fertility status in different AEZs is updated taking information from SRDI.

#### AEZ 1: Old Himalayan Piedmont Plain (398154 ha)

This distinctive region is developed in Old Tista Alluvial fan extending out from the foot of the Himalayas. It has complex relief pattern comprising of broad and narrow floodplain ridge and linear depressions. Deep, Rapidly permeable sandy loams and sandy clay loams are predominant in this region. Its top soils are very strongly to strongly acidic and sub-soils are moderately acidic; rich in weatherable sand minerals. Seven General Soil Types occur in the region of which Non-calcareous Brown Floodplain soils, Black Terai soil and Non-calcareous Dark Grey Floodplain soils predominate. Organic matter contents are relatively higher (Piedmont area) than the other floodplain areas. The natural fertility of the soil, except the coarse textured, is moderate but well sustained. Soil fertility problems include rapid leaching of N, K, S, Ca, Mg and B. There is a significant loss of Ca through leaching mainly in highland and subsequently lowering of soil pH.

| Major land type       | Soil pH  | Soil OM | Nutrient status |      |     |      |      |     |       |      |     |
|-----------------------|----------|---------|-----------------|------|-----|------|------|-----|-------|------|-----|
|                       |          |         | N               | P    | K   | S    | Ca   | Mg  | Zn    | B    | Mo  |
| Highland (58 %)       | 3.8 -5.5 | VL-L    | VL-L            | L-M  | L-M | L-M  | VL-L | L-M | M-Opt | VL-L | L-M |
| Medium highland (34%) | 3.9-6.4  | VL-L    | VL-L            | VL-L | L-M | VL-L | VL-L | L-M | L-M   | VL-L | L-M |

OM = Organic matter      VL= Very low      Opt = Optimum      L = Low  
 H = High                      M=Medium      VH = Very high

The range of soil test values for each type of interpretation (e.g. VL) is given in Appendix 8.

#### AEZ 2: Active Tista Floodplain (83644 ha)

This region includes the active floodplains of the Tista, Dharla, and Dudkumar Rivers. It has complex patterns of low, generally smooth ridge, inter-depressions, river channels and cut-off channels. Most areas are shallowly flooded, but flooding is occasionally deep during flood peak.

The area has irregular patterns of grey stratified sands and silts. They are very strongly acidic to slightly acidic in the top soil and slightly acidic in rest of the profile and rich in weatherable minerals. Four General Soil Types occur in the region of which, Non-calcareous Alluvium predominates. Organic matter content is very low to low. Soil fertility level in general, including B status is low to medium. Calcium and Mg status has increased in the areas where dolomite lime has been used.

| Major Land type       | Soil pH | Soil OM | Nutrient status |     |     |     |     |     |     |     |     |     |
|-----------------------|---------|---------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                       |         |         | N               | P   | K   | S   | Ca  | Mg  | Zn  | B   | Mo  |     |
| Medium highland (72%) | 3.9-6.6 | VL-L    | VL-L            | L-M |

### AEZ 3. Tista Meander Floodplain (946803 ha)

The region occupies major part of the Tista Floodplain as well as the floodplains of the Atrai, Little Jamuna, Karatoya, Dharla and Dudkumar rivers. Most areas have broad floodplain ridge and almost level basins. Locally, relief is irregular alongside rivers with narrow ridges, depressions and in-filled channels. There is overall pattern of olive brown, rapidly permeable, loamy soils on the floodplain ridges and grey or dark grey, slowly permeable, heavy silt loam or silty clay loam soils on the lower land. Parent materials are rich in weatherable minerals. Eight General Soil Types occur in the region of which Non-calcareous Grey Floodplain soils and Non-calcareous Brown Floodplain soils predominate. They are very strongly to slightly acidic in the top soil and slightly acidic in the rest of whole profile, low in organic matter content on the higher parts, but moderate in the lower parts. Fertility level, in general, is low to medium but the status of K and CEC is medium in most of the places. Soils in general have a good moisture holding capacity. In the upper part of the region there is significant loss of Ca and Mg and subsequently lowering of soil pH.

| Major land type       | Soil pH | Soil OM | Nutrient status |     |     |     |     |     |     |     |     |     |
|-----------------------|---------|---------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                       |         |         | N               | P   | K   | S   | Ca  | Mg  | Zn  | B   | Mo  |     |
| Highland (35%)        | 3.6-6.8 | L-M     | VL-L            | L-M |
| Medium highland (51%) | 3.5-7.0 | L-M     | VL-L            | L-M |

### AEZ 4. Karatoya-Bangali Floodplain (257158 ha)

This floodplain apparently comprises a mixture of the Tista and Brahmaputra sediments. Most areas have smooth, broad, floodplain ridges and almost level basins. The soils are grey silt loams and silty clay loams on ridges and grey or dark grey clays in basins. Five General Soil Types occur in the region of which Non-calcareous Grey Floodplain and Non-calcareous Dark Grey Floodplain soils predominate. They are very strongly to slightly acidic in the top soil and slightly acidic in the rest of whole profile. Organic matter content is low in ridge soils and moderate in basins. General fertility level is medium. In the recent years there are significant loss of Ca and Mg and subsequently lowering of soil pH.

| Major land type       | Soil pH | Soil OM | Nutrient status |      |      |      |       |       |     |      |      |     |
|-----------------------|---------|---------|-----------------|------|------|------|-------|-------|-----|------|------|-----|
|                       |         |         | N               | P    | K    | S    | Ca    | Mg    | Zn  | B    | Mo   |     |
| Highland (23%)        | 4.1-6.5 | L-M     | VL-L            | VL-L | VL-M | L-M  | L-M   | L-M   | L-M | L-M  | VL-L | Opt |
| Medium highland (44%) | 4.1-6.5 | L-M     | VL-L            | VL-L | L-M  | L-M  | M-Opt | M-Opt | L-M | VL-L | Opt  |     |
| Medium lowland (14%)  | 4.3-6.5 | L-M     | VL-L            | VL-L | L-M  | VL-L | M-Opt | M-Opt | L-M | VL-L | Opt  |     |

### AEZ 5. Lower Atrai Basin (85105 ha)

This region comprises of low lying areas between the Barind Tract and the Ganges River Floodplain. The smooth, low lying, basin land occupies most of the region. Dark grey, heavy, acidic clay are predominating. Seven General Soil Types occur in the region, but Non-calcareous Dark Grey Floodplain soils cover most of the areas. Organic matter, CEC and status of essential nutrients are low to medium. In the recent years there is a lowering of organic matter, P, K, S and pH. Top soil pH ranges from very strongly acidic to slightly acidic.

| Major land type      | Soil pH | Soil OM | Nutrient status |      |     |      |       |       |     |       |     |
|----------------------|---------|---------|-----------------|------|-----|------|-------|-------|-----|-------|-----|
|                      |         |         | N               | P    | K   | S    | Ca    | Mg    | Zn  | B     | Mo  |
| Medium lowland (21%) | 4.0-6.5 | L-M     | VL-L            | L-M  | L-M | L-M  | Opt   | Opt   | L-M | M-Opt | Opt |
| Lowland (65%)        | 4.2-6.3 | L-M     | VL-L            | VL-L | L-M | VL-L | M-Opt | M-Opt | L-M | L-M   | Opt |

### AEZ 6. Lower Purnabhaha Floodplain (12896 ha)

This region occupies basins and bils separated by low floodplain ridges. Most of the region is moderately to deeply flooded in the rainy season. Soils are dark grey, mottled red, very strongly acid, heavy clays occupy both ridge and basin sites. Only one General soil type. Acid Basin Clays has been identified in the region. Organic matter status is low to medium with medium CEC. General fertility level is medium. The pH of the top soil ranges from very strongly acidic to slightly alkaline.

| Major land type | Soil pH | Soil OM | Nutrient status |     |       |       |     |     |       |       |     |
|-----------------|---------|---------|-----------------|-----|-------|-------|-----|-----|-------|-------|-----|
|                 |         |         | N               | P   | K     | S     | Ca  | Mg  | Zn    | B     | Mo  |
| Lowland (60%)   | 4.8-8.1 | L-M     | VL-L            | L-M | M-Opt | M-Opt | Opt | Opt | M-Opt | M-Opt | Opt |

### AEZ 7. Active Brahmaputra-Jamuna Floodplain (319001 ha)

This region comprises the belt of unstable alluvial land along the Brahmaputra-Jamuna rivers where land is constantly being formed and eroded by shifting river channels. It has an irregular relief of broad and narrow ridges and depressions. The area is occupied by sandy and silty alluvium, rich in weatherable minerals with strongly acidic to slightly alkaline in reaction. Six General Soil Types occupy the area of which, only Non-calcareous Alluvium predominates. Organic matter status and fertility status is low to medium. Nitrogen is limiting whereas K, S and Zn status is low to medium. Ca Mg and B status is medium to optimum.

| Major land type       | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |     |     |    |
|-----------------------|---------|---------|-----------------|------|-----|-----|-------|-------|-----|-----|----|
|                       |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn  | B   | Mo |
| Medium highland (37%) | 4.5-8.0 | L-M     | VL-L            | L-M  | L-M | L-M | M-Opt | M-Opt | L-M | L-M | M  |
| Medium lowland (20%)  | 4.5-8.0 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | M  |

### AEZ 8. Young Brahmaputra and Jamuna Floodplain (592394 ha)

The region comprises the area of Brahmaputra sediments. It has a complex relief of broad and narrow ridges, inter-ridge depressions, partially in-filled cut-off channels and basins. This area is occupied by permeable silt loam to silty clay loam soils on the ridges and impermeable clays in the basins; neutral to slightly acid in reaction. General Soil Types include predominantly Grey Floodplain soils. Organic matter contents are low to medium in ridges and basins. Soils are deficient in N, P, S, and B, but the status of K and Zn is low to medium. Top soil pH ranges from strongly acidic to neutral.

| Major Land type       | Soil pH | Soil OM | Nutrient status |      |     |      |       |       |     |      |    |
|-----------------------|---------|---------|-----------------|------|-----|------|-------|-------|-----|------|----|
|                       |         |         | N               | P    | K   | S    | Ca    | Mg    | Zn  | B    | Mo |
| Highland (18%)        | 4.5-6.5 | L-M     | VL-L            | L-M  | L-M | VL-L | M-Opt | M-Opt | L-M | VL-L | M  |
| Medium highland (42%) | 4.5-7.3 | L-M     | VL-L            | VL-L | L-M | L-M  | L-M   | L-M   | L-M | VL-L | M  |
| Medium lowland (19%)  | 4.5-7.2 | L-M     | VL-L            | VL-L | L-M | L-M  | L-M   | L-M   | L-M | VL-L | M  |

### AEZ 9: Old Brahmaputra Floodplain (723037 ha)

The region occupies a large area of Brahmaputra sediments before the river was diverted to its present Jamuna channel about 200 years ago. The region has broad ridges and basins. Soils of the area are predominantly silt loams to silt clay loams on the ridges and clay in the basins. General Soil Type predominantly includes Dark Grey Floodplain soil. Organic matter content is low on the ridges and moderate in the basins, top soils are very strongly acidic to neutral and sub-soils are neutral in reaction. There is lowering of soil pH in high land. General fertility level including N, P, K, S, and B is low. However, the status of CEC is medium.

| Major land type       | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |     |      |     |
|-----------------------|---------|---------|-----------------|------|-----|-----|-------|-------|-----|------|-----|
|                       |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn  | B    | Mo  |
| Highland (28%)        | 3.8-7.1 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M  | Opt |
| Medium highland (35%) | 4.5-7.2 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | VL-L | Opt |
| Medium lowland (20%)  | 4.5-7.2 | L-M     | VL-L            | VL-L | L   | L-M | M-Opt | M-Opt | L-M | VL-L | Opt |

### AEZ 10: Active Ganges Floodplain (333447 ha)

The region occupies unstable alluvial land within and adjoining Ganges river. It has irregular relief of broad and narrow ridges and depressions. The area has complex mixtures of calcareous sandy, silty and clayey alluvium. General soil types predominantly include Calcareous Alluvium and Calcareous Brown Floodplain soils. Soils are of low to medium in organic matter and neutral to slightly alkaline in reaction. General fertility level is medium with high CEC and deficient in N, P, B, and Zn contents.

| Major Land type       | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |     |      |    |
|-----------------------|---------|---------|-----------------|------|-----|-----|-------|-------|-----|------|----|
|                       |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn  | B    | Mo |
| Highland (12%)        | 6.7-8.1 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L   | VL-L | M  |
| Medium highland (33%) | 6.1-8.4 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L   | VL-L | M  |
| Medium lowland (18%)  | 5.4-8.0 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | VL-L | M  |

### AEZ 11. High Ganges River Floodplain (1320549 ha)

This region includes the western part of the Ganges River Floodplain, which is predominantly high land and medium highland. Most areas have a complex relief of broad and narrow ridges and basins. There is an overall pattern of olive-brown silt loams and silty clay loams on the upper parts of floodplain ridges and dark grey mottled brown, mainly clay soils on ridge sites and in basins. Most ridge soils are calcareous throughout the profile. General soil types predominantly include Dark Grey Floodplain soils and Calcareous Brown Floodplain soils. Organic matter content in the brown ridge soils is low, but higher in the dark grey soils. In general, top soils are slightly acidic to slightly alkaline in reaction; but there is a significant lowering of soil pH in high land in the recent years and in some places top soils become strongly acidic. Sub-soils are slightly alkaline in reaction. General fertility level is low including N, P, S, and B although CEC is medium. The K-bearing minerals are medium to high, but the Zn status is very low to medium.

| Major Land type       | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |      |     |    |
|-----------------------|---------|---------|-----------------|------|-----|-----|-------|-------|------|-----|----|
|                       |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn   | B   | Mo |
| Highland (43%)        | 4.5-9.1 | L-M     | VL-L            | VL-L | L-M | L-M | Opt-H | Opt-H | VL-L | L-M | M  |
| Medium highland (32%) | 5.0-8.4 | L-M     | VL-L            | VL-L | L-M | L-M | Opt-H | Opt-H | VL-L | L-M | M  |
| Medium lowland (12%)  | 6.0-8.3 | L-M     | VL-L            | VL-L | L-M | L-M | Opt-H | Opt-H | L-M  | L-M | M  |

### AEZ 12. Low Ganges River Floodplain (796751 ha)

The region comprises the eastern half of the Ganges River Floodplain, which is low-lying. The region has a typical meander floodplain landscape of broad ridges and basins. Soils of the region are silt loams and silty clay loams on the ridges and silty clay loam to heavy clays on lower sites. General soil types predominantly include Calcareous Dark Grey soils and Calcareous Brown Floodplain soils. Organic matter content is low in ridges and medium in the basins. Soils are calcareous in nature having neutral to alkaline in reaction. General fertility level is low to medium, CEC, K, and Zn status is low to medium.

| Major land type       | Soil pH | Soil OM | Nutrient status |      |     |       |       |       |     |     |     |
|-----------------------|---------|---------|-----------------|------|-----|-------|-------|-------|-----|-----|-----|
|                       |         |         | N               | P    | K   | S     | Ca    | Mg    | Zn  | B   | Mo  |
| Highland (13%)        | 6.6-8.4 | L-M     | VL-L            | VL-L | L-M | M-Opt | Opt-H | Opt-H | L-M | L-M | Opt |
| Medium highland (29%) | 4.8-8.2 | L-M     | VL-L            | VL-L | L-M | M-Opt | Opt-H | Opt-H | L-M | L-M | Opt |
| Medium lowland (31%)  | 5.8-8.1 | L-M     | VL-L            | VL-L | L-M | L-M   | Opt-H | Opt-H | L-M | L-M | Opt |
| Lowland (14%)         | 5.9-7.6 | M       | VL-L            | VL-L | L-M | L-M   | Opt-M | Opt-H | L-M | L-M | Opt |

### AEZ 13. Ganges Tidal Floodplain (1706573 ha)

This region occupies an extensive area of tidal floodplain land in the south-west of the country. The greater part of this region has smooth relief having large areas of salinity. There is a general pattern of grey, slightly calcareous, heavy soils on river banks and grey to dark grey, non-calcareous, heavy silty clays in the extensive basins. Non-calcareous Grey Floodplain soil is the major component of General Soil Types. Acid Sulphate soils also occupy significant part of the area where it is very strongly acidic during dry season. In general, most of the top soils are acidic and sub soils are neutral to slightly alkaline. Soils of the Sundarban area are alkaline. General fertility level is medium with low to medium organic matter content and medium K status. There are high exchangeable Na and low Ca / Mg ratio. The Zn and B status is low to medium and S status is medium to optimum.

| Major Land type       | Soil pH | Soil OM | Nutrient status |      |     |       |       |       |     |     |     |
|-----------------------|---------|---------|-----------------|------|-----|-------|-------|-------|-----|-----|-----|
|                       |         |         | N               | P    | K   | S     | Ca    | Mg    | Zn  | B   | Mo  |
| Medium Highland (78%) | 4.5-8.4 | L-M     | VL-L            | VL-L | L-M | M-Opt | Opt-H | Opt-H | L-M | L-M | Opt |

### AEZ 14. Gopalganj-Khulna Bils (224700 ha)

This region occupies extensive low-lying areas between Ganges River Floodplains and the Ganges Tidal Floodplains. Almost level, low-lying basins occupy most of the region, with low ridges along rivers and creeks. The region is seasonally moderately deep to deeply flooded by clear water. Basin centers stay wet through the dry season. Soils of the area are grey and dark grey and dark grey acidic heavy clays, peat or muck overlies at 25-100 cm. Soft peat and muck occupy perennially wet basin centers. General Soil Types include mainly peat and Non-calcareous Dark Grey Floodplain soils. Organic matter content is high. They have low bearing capacity when wet, very strongly acidic to neutral top soil reaction, medium in K and low in B and Zn status. The C:N ratio is very wide.

| Major land type       | Soil pH | Soil OM | Nutrient status |     |       |      |       |       |      |      |     |
|-----------------------|---------|---------|-----------------|-----|-------|------|-------|-------|------|------|-----|
|                       |         |         | N               | P   | K     | S    | Ca    | Mg    | Zn   | B    | Mo  |
| Medium highland (13%) | 4.8-7.5 | H       | L-M             | L-M | M-Opt | L-M  | Opt-H | Opt-H | L-M  | L-M  | Opt |
| Medium lowland (41%)  | 4.3-7.7 | H-VH    | L-M             | L-H | M-Opt | L-M  | Opt-H | Opt-H | L-M  | L-M  | Opt |
| Lowland (28%)         | 4.3-6.7 | H       | L-M             | L-M | L     | L-M  | Opt   | Opt   | VL-L | VL-L | Opt |
| Very lowland (11%)    | 4.0-6.4 | H       | L-M             | L-M | L-M   | VL-L | Opt   | Opt   | VL-L | VL-L | Opt |

#### AEZ 15. Arial Bil (14436 ha)

This region occupies low lying basin areas between the Ganges and Dhaleshwari rivers in the south of Dhaka and north-west of Munshiganj districts. The soils of this area are dark grey; acidic heavy clays predominate. Non-calcareous Dark Grey Floodplain soil is the major General Soil Type. Organic matter content generally exceeds 2%. Available moisture holding capacity is inherently low. They have high CEC and general fertility level is medium to high, N status is very low to low and B status is low to medium. Top soil pH ranges from slightly acidic to neutral.

| Major Land type      | Soil pH | Soil OM | Nutrient status |     |     |       |       |       |       |     |     |
|----------------------|---------|---------|-----------------|-----|-----|-------|-------|-------|-------|-----|-----|
|                      |         |         | N               | P   | K   | S     | Ca    | Mg    | Zn    | B   | Mo  |
| Medium lowland (13%) | 5.3-7.2 | M       | VL-L            | L-M | L-M | M-Opt | Opt-H | Opt-H | M-Opt | L-M | Opt |
| Lowland (73%)        | 4.7-6.6 | M       | VL-M            | L-M | L-M | M-Opt | Opt-H | Opt-H | M-Opt | L-M | Opt |

#### AEZ 16. Middle Meghna River Floodplain (155464 ha)

This region occupies abandoned channel of the Brahmaputra river on the border between the greater Dhaka and Comilla districts. This region includes islands-former Brahmaputra chars, within the Meghna river as well as adjoining parts of the mainland. Soils of the area are grey, loamy on the ridges and grey to dark grey clays in the basins. Grey sands to loamy sands with compact silty topsoil occupy areas of Old Brahmaputra char. Dominant General Soil Type is Non-calcareous Grey Floodplain soils. Top soils are very strongly acidic to neutral in medium low and low land soils and the sub-soils are slightly acidic to slightly alkaline. General fertility level is medium with very low to low in N and low to medium in organic matter contents. The P and Zn levels are low to medium and B level is very low to medium.

| Major Land type       | Soil pH | Soil OM | Nutrient status |     |     |     |       |       |     |     |     |
|-----------------------|---------|---------|-----------------|-----|-----|-----|-------|-------|-----|-----|-----|
|                       |         |         | N               | P   | K   | S   | Ca    | Mg    | Zn  | B   | Mo  |
| Medium low land (29%) | 4.8-6.9 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | L-M | L-M | Opt |
| Lowland (25%)         | 4.0-6.7 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | L-M | L   | Opt |
| Very lowland (11%)    | 4.5-5.4 | L-M     | VL-L            | L   | L-M | L-M | M-Opt | M-Opt | M   | VL  | Opt |

### AEZ 17. Lower Meghna River Floodplain (90934 ha)

This area occupies transitional area between Middle Meghna River Floodplain and the Young Meghna Estuarine Floodplain. The region has slightly irregular relief, but with little difference in elevation between the ridges and depressions. Soils of this area are relatively uniform, silt loams occupy relatively higher areas and silty clayloams occupy the depression. Non-calcareous Dark Grey Floodplain and Calcareous Grey Floodplain soils are major components of General Soil Types. Top soils are slightly acidic in high land and slightly acidic to slightly alkaline in medium high land and medium low land and the sub-soils are neutral in reaction. General fertility level is medium to high with very low to low in N and P, and low to medium in organic matter status and K bearing minerals.

| Major land type       | Soil pH | Soil OM | Nutrient Status |     |     |     |       |       |       |     |     |
|-----------------------|---------|---------|-----------------|-----|-----|-----|-------|-------|-------|-----|-----|
|                       |         |         | N               | P   | K   | S   | Ca    | Mg    | Zn    | B   | Mo  |
| Highland (14%)        | 5.5-6.5 | M       | VL-L            | L   | L-M | L-M | M-Opt | M-Opt | M-Opt | L   | Opt |
| Medium highland (28%) | 4.0-7.6 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | L-M   | L-M | Opt |
| Medium lowland (31%)  | 4.2-7.8 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | L-M   | L-M | Opt |

### AEZ 18. Young Meghna Estuarine Floodplain (926885 ha)

This region occupies young alluvial land in and adjoining the Meghna estuary. It is almost level with very low ridges and broad depressions. The major soils are grey to olive, deep, calcareous silt loam and silty clay loams and are stratified either throughout or at shallow depth. Calcareous Alluvium and Non-calcareous Grey Floodplain soils are the dominant General Soil Types. The soils in the south become saline in dry season. The soils in the south become saline in dry season. Top soils and subsoils of the area are mildly alkaline. General fertility level is low to medium, but N level is very low to low.

| Major land type        | Soil pH | Soil OM | Nutrient status |     |     |     |     |       |     |     |     |
|------------------------|---------|---------|-----------------|-----|-----|-----|-----|-------|-----|-----|-----|
|                        |         |         | N               | P   | K   | S   | Ca  | Mg    | Zn  | B   | Mo  |
| Medium high land (45%) | 4.3-8.4 | L-M     | VL-L            | L-M | L-M | L-M | L-M | M-Opt | L-M | L-M | Opt |

### AEZ 19. Old Meghna Estuarine Floodplain (774026 ha)

This region occupies a large area, mainly low lying between the south of the Surma-Kushiyara Floodplain and the northern edge of the Young Meghna Estuarine Floodplain. It comprises of smooth, almost level, floodplain ridges and shallow basins. Silt loam soils predominate in highlands and silty clay to clay in lowlands. Non-calcareous Dark Grey Floodplain soil is the only General Soil Type of the area. Organic matter content of the soils is low to medium. Moisture holding capacity is medium. Top soils are slightly acidic to slightly alkaline but sub-soils are neutral in reaction. General fertility level is medium. Status of K is low to medium. The level of P is very low to medium. S and B status is low to medium.

| Major land type        | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |     |     |     |
|------------------------|---------|---------|-----------------|------|-----|-----|-------|-------|-----|-----|-----|
|                        |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn  | B   | Mo  |
| Medium high land (24%) | 4.1-7.8 | L-M     | VL-L            | L-M  | L-M | L-M | M-Opt | M-Opt | L-M | L-M | Opt |
| Medium lowland (33%)   | 4.4-7.6 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | Opt |
| Low land (21%)         | 4.5-6.7 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | Opt |

### AEZ 20. Eastern Surma-Kushiyara Floodplain (462159 ha)

This region occupies the relatively higher parts of the Surma-Kushiyara Floodplain formed on sediments of the rivers draining into the Meghna catchment area from the hills. The area is mainly smooth, broad ridges and basins having grey, heavy silty clay loams on the ridges and clays in the basins. Non-calcareous Grey Floodplain soils are the only General Soil Types. Organic matter content of the soil is low to medium. Soil reaction ranges from very strongly acidic to neutral. Levels of CEC and Zn are medium. The status of N and P is very low to low; K and B are low to medium.

| Major Land Type        | Soil pH | Soil OM | Nutrient status |     |     |     |       |       |       |       |    |
|------------------------|---------|---------|-----------------|-----|-----|-----|-------|-------|-------|-------|----|
|                        |         |         | N               | P   | K   | S   | Ca    | Mg    | Zn    | B     | Mo |
| Medium high land (25%) | 3.8-7.1 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | M-Opt | L-M   | M  |
| Medium lowland (20%)   | 3.9-6.1 | L-M     | VL-L            | L-M | L-  | L-M | L-H   | M-Opt | M-Opt | L-M   | M  |
| Lowland (36%)          | 3.5-7.7 | VL-M    | L-M             | L-M | L-M | L-M | L-H   | M-Opt | L-M   | M-Opt | M  |

### AEZ 21. Sylhet Basin (457345 ha)

The region occupies the lower, western side of the Surma-Kushiyara Floodplain. The area is mainly smooth, broad basins with narrow rims of higher land along rivers. Relief is locally irregular near the rivers. The difference in elevation between river banks and adjoining basin centers is 1-2 meter or more. Soils of the area are grey silty clay loams and clay loam in the higher parts that dry out seasonally and grey clays in the wet basins. Non-calcareous Grey Floodplain soils and Acid Basin Clays are the major components of the General Soil Types. The soils have low to medium level of organic matter and soil reaction is mainly slightly acidic in top soil. Fertility level is medium to high with very low to low N and low to medium P content.

| Major land type       | Soil pH | Soil OM | Nutrient status |     |       |       |       |       |     |       |     |
|-----------------------|---------|---------|-----------------|-----|-------|-------|-------|-------|-----|-------|-----|
|                       |         |         | N               | P   | K     | S     | Ca    | Mg    | Zn  | B     | Mo  |
| Medium low land (19%) | 4.6-5.9 | L-M     | VL-L            | L-M | L-M   | M-Opt | M-Opt | M-Opt | L-M | M-Opt | Opt |
| Low land (43%)        | 4.7-6.1 | L-M     | VL-L            | L-M | M-Opt | M-Opt | M-Opt | M-Opt | L-M | M-Opt | Opt |
| very Low land (32%)   | 4.9-6.2 | L-M     | VL-L            | L-M | M-Opt | M-Opt | M-H   | M-H   | L-M | M-Opt | Opt |

### AEZ 22. Northern and Eastern Piedmont Plains (403758 ha)

This is a discontinuous region occurring as a narrow strip of land at the foot of the Northern and eastern hills. The area comprises merging alluvial fans which slope gently outward from the foot of the hills, into smooth, low lying basin. Grey Piedmont soils and Non-calcareous Grey Floodplain soils are the major General Soil Types. Soils of the area are loams to clays in texture having very strongly acidic to slightly acidic in reaction. General fertility level is low to medium with very low to low N and P, and low to medium S and B status.

| Major land type       | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |     |     |    |
|-----------------------|---------|---------|-----------------|------|-----|-----|-------|-------|-----|-----|----|
|                       |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn  | B   | Mo |
| Highland (33%)        | 4.1-6.2 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | L  |
| Medium highland (31%) | 3.9-6.0 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | L  |
| Medium lowland (16%)  | 3.6-6.0 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | L  |

### AEZ 23. Chittagong Coastal Plains (372007 ha)

This region occupies the plain land in greater Chittagong district and the eastern part of Feni District. It is a compound unit of piedmont, river, tidal and estuarine floodplain landscapes. The major problem in these soils is high salinity during dry season (October to May). Grey silt loams and silty clay loam soils are predominant. Acid sulphate soils which are potentially strongly acidic occur in mangrove tidal floodplains. Non-calcareous Grey Floodplain soils, Non-calcareous alluvium and acid sulphate soils are the major components of the General Soil Types of the area. General fertility level of the soils is medium and N, P and K are Limiting. Status of S is low to optimum. Organic matter content is low to medium. The status of Zn and B is low to medium and that of N and P is very low to low.

| Major Land P <sup>h</sup> | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |     |     |    |
|---------------------------|---------|---------|-----------------|------|-----|-----|-------|-------|-----|-----|----|
|                           |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn  | B   | Mo |
| High land (17%)           | 3.9-6.2 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | M  |
| Medium highland (43%)     | 4.4-6.2 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | M  |
| Medium Lowland (13%)      | 4.5-6.2 | L-M     | VL-L            | VL-L | L-M | L-M | M-Opt | M-Opt | L-M | L-M | M  |

#### AEZ 24. St. Martin's Coral Island (804 ha)

This small but distinctive region occupies the whole of St. Martin's Island in the extreme south of the country. The area has very gently undulating old beach ridges and inter-ridge depressions, surrounded by sandy beaches. The soils are developed entirely on old and young coral beach sands. Calcareous Alluvium is the only General Soil Types of the area. General fertility level is low with poor moisture holding capacity but rich in Ca, Mg and B Contents.

| Major land type       | Soil pH | Soil OM | Nutrient status |      |     |     |       |       |    |   |    |
|-----------------------|---------|---------|-----------------|------|-----|-----|-------|-------|----|---|----|
|                       |         |         | N               | P    | K   | S   | Ca    | Mg    | Zn | B | Mo |
| High land (33%)       | 4.6-7.8 | VL-L    | VL-L            | VL-L | L-M | L-M | Opt-H | Opt-H | L  | H | M  |
| Medium highland (63%) | 4.6-7.8 | VL-L    | VL-L            | VL-L | L-M | L-M | Opt-H | Opt-H | L  | H | M  |

#### AEZ 25. Level Barind Tract (504851 ha)

This region is developed over Madhupur Clay. The landscape is almost level, locally irregular along river channels. The predominant soils have a grey, silty, puddled top soil with ploughpan, which either directly overlies grey, heavy, little weathered Madhupur Clay or merges with the porous, silt loam or silty clay loam subsoils which overlies strongly acid clay at greater depth. Shallow Grey Terrace soils and Deep Grey Terrace soils are the major components of General Soil Types of the area. The soils are low in available moisture holding capacity and top soils are very strongly acidic to neutral in reaction. Organic matter status is mainly low and most of the nutrients are low to medium.

| Major land type       | Soil pH | Soil OM | Nutrient status |      |     |     |     |     |     |     |     |
|-----------------------|---------|---------|-----------------|------|-----|-----|-----|-----|-----|-----|-----|
|                       |         |         | N               | P    | K   | S   | Ca  | Mg  | Zn  | B   | Mo  |
| High land (30%)       | 4.3-6.1 | VL-L    | VL-L            | VL-L | L-M |
| Medium highland (55%) | 4.4-7.2 | L       | VL-L            | VL-L | L-M |

### AEZ 26. High Barind Tract (159964 ha)

It includes the south-western part of the Barind Tract where the underlying Madhupur clay has been uplifted and cut into by deep valleys. The top soil is grey silt loam to silty clay loam, is strongly puddled and has a compact ploughpan at the base. The sub soil is grey, brightly mottled yellow-brown, silt loam to silty clay and is very porous. Deep Grey Terrace soils and Grey Valley soil are the major components of the General Soil Types of the area. General fertility status is low with low to medium status of organic matter, very low to low status of N, P and K and low to medium status of Zn and B. Top soil reaction ranges from very strongly acidic to slightly alkaline.

| Major land type | Soil pH | Soil OM | Nutrient status |      |      |     |     |     |     |     |     |
|-----------------|---------|---------|-----------------|------|------|-----|-----|-----|-----|-----|-----|
|                 |         |         | N               | P    | K    | S   | Ca  | Mg  | Zn  | B   | Mo  |
| Highland (93%)  | 4.0-7.5 | L-M     | VL-L            | VL-L | VL-L | L-M | L-M | L-M | L-M | L-M | L-M |

### AEZ 27. North Eastern Barind Tract (107926 ha)

This region occupies several discontinuous areas on the north-eastern margins of the Barind Tract. It stands slightly higher than adjoining floodplain land. The region has silty or loamy top soil and clay loams to clay subsoil and grades into strongly mottled clay. The Madhupur Clay underlying this region is deeply weathered. Deep Red Brown Terrace soils and Deep Grey Terrace soils are the major components of the General Soil Types of the area. The soils are mainly very strongly acidic in reaction. Organic matter of the soils is low to medium. General fertility level is low with low to medium status of Zn and B.

| Major land type       | Soil pH | Soil OM | Nutrient status |     |     |     |       |       |     |     |     |
|-----------------------|---------|---------|-----------------|-----|-----|-----|-------|-------|-----|-----|-----|
|                       |         |         | N               | P   | K   | S   | Ca    | Mg    | Zn  | B   | Mo  |
| Highland (36%)        | 4.2-6.5 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | L-M | L-M | L-M |
| Medium highland (56%) | 4.4-7.0 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | L-M | L-M | L-M |

### AEZ 28. Madhupur Tract (424329 ha)

This is a region of complex relief and soils are developed over the Madhupur Clay. The landscape comprises of level upland, closely or broadly dissected terraces associated with shallow or broad deep valleys. Eleven General Soil Types exist in the area of which Deep Red Brown Terrace, Shallow Red Brown Terrace soils and Acid Basin Clays are the major ones. The soils on the terrace are better drained, friable clay loams to clays overlying friable clay substratum at varying depths. Soils in the valleys are dark grey heavy clays. The top soils are mainly very strongly acidic in reaction but ranges up to slightly acidic with low to medium status of organic matter, low moisture holding capacity and low fertility level. The soils are mainly phosphate fixing, low to medium in P, B and K; and medium to optimum in S contents.

| Major land type       | Soil pH | Soil OM | Nutrient status |     |     |       |       |       |     |     |     |
|-----------------------|---------|---------|-----------------|-----|-----|-------|-------|-------|-----|-----|-----|
|                       |         |         | N               | P   | K   | S     | Ca    | Mg    | Zn  | B   | Mo  |
| Highland (56%)        | 3.9-6.4 | L-M     | VL-L            | L-M | L-M | M-Opt | M-Opt | M-Opt | L-M | L-M | L-M |
| Medium highland (18%) | 4.3-6.5 | L-M     | VL-L            | L-M | L-M | M-Opt | M-Opt | M-Opt | L-M | L-M | L-M |

### AEZ 29. Northern and Eastern Hills (1817172 ha)

This region includes the country's hill areas. Relief is complex. Hills have been dissected to different degrees over different rocks. In general, slopes are very steep and few low hills have flat summits. The major hill soils are yellow-brown to strong brown, permeable, friable, loamy; mainly very strongly acidic and low in moisture holding capacity. However, soil patterns are generally complex due to local difference in sand, silt and clay contents of the underlying sedimentary rocks and in the amount of erosion that has occurred. Brown Hill soils are the predominant General Soil Types of the area. Organic matter content and general fertility level are low to medium with very low to low status of N and low to medium in P.

| Major land type | Soil pH | Soil OM | Nutrient status |     |     |     |       |       |     |     |     |
|-----------------|---------|---------|-----------------|-----|-----|-----|-------|-------|-----|-----|-----|
|                 |         |         | N               | P   | K   | S   | Ca    | Mg    | Zn  | B   | Mo  |
| Highland (92%)  | 3.8-7.2 | L-M     | VL-L            | L-M | L-M | L-M | M-Opt | M-Opt | L-M | L-M | L-M |

### AEZ 30. Akhaura Terrace (11324 ha)

This small region occupies the eastern border of Brahmanbaria and southwest corner of Habiganj district. In appearance theregion resembles Madhupur Tract with level upland, dissected by mainly deep, broad valleys.

The main soils on the upland have strong brown clay which grades into red mottled clay substratum. The valley soils range from silty clay loams to clays. Deep Red Brown Terrace Soil, Grey piedmont soils and Acid Basin Clays are the major components of the General Soil Types of the area. The general fertility is low. The soils are strongly acidic to slightly acidic in reaction. Organic matter content is low to medium and the N content is very low to low. Zinc and B contents are low to medium and P, K, and S contents are low.

| Major Land type        | Soil pH | Soil OM | Nutrient status |    |   |   |    |    |     |     |     |
|------------------------|---------|---------|-----------------|----|---|---|----|----|-----|-----|-----|
|                        |         |         | N               | P  | K | S | Ca | Mg | Zn  | B   | Mo  |
| High land (55%)        | 5.4-6.5 | L-M     | VL-L            | VL | L | L | L  | L  | L-M | L-M | L-M |
| Medium high land (11%) | 5.5-6.5 | L-M     | VL-L            | L  | L | L | L  | L  | L-M | L-M | L-M |
| Medium lowland (10%)   | 5.4-6.5 | L-M     | VL-L            | L  | L | L | L  | L  | L-M | L-M | L-M |
| Lowland (15%)          | 5.3-6.5 | L-M     | VL-L            | L  | L | L | L  | L  | L-M | L-M | L-M |

## 4. SOIL FERTILITY EVALUATION

Optimum productivity (yield) of a crop depends on adequate supply of plant nutrients. The quantity of nutrients required by plants depends on several factors: (a) crops and crop varieties, (b) yield level, (c) soil properties, (d) environment, and (e) management.

Continued removal of nutrients, with little or no replacement, will increase the nutrient deficiency and yield loss. The role of a plant nutrient can be determined by knowing the nutrient requirement of the crop and the nutrient-supplying capacity of the soil. When soil does not supply sufficient amount of a nutrient for optimum crop productivity, that nutrient must be applied. The nutrient rate is determined by knowing the nutrient requirement of the crop and the potential nutrient supply of the soil. Several techniques are used to assess the nutrient status of a soil, such as:

- Soil analysis
- Plant analysis
- Diagnosis of nutrient deficiency symptoms

### 4.1 Soil analysis

Soil test refers to chemical extraction of a soil sample to estimate nutrient availability. Soil tests extract part of the total nutrient content is related to the quantity of plant available nutrient. Compared with plant analysis, soil tests determine relative nutrient status before planting.

#### Objectives of soil tests

- To provide an index of nutrient availability in soil
- To predict the probability of obtaining a profitable response to fertilizer application
- To provide a basis for development of fertilizer recommendation

#### Advantages of soil tests

- Soil analysis provides a good basis for fertilizer recommendation.
- It indicates fertility condition of a field (low, medium, optimum and high) as to determine different fertilizers' requirement of crops and cropping patterns.
- Soil testing is an advantage over biological methods which are relatively elaborate and time consuming.
- It is better than nutrient deficiency diagnosis and plant tissue analysis since the nutrient need can be ascertained before the crop is grown. When nutrient deficiency is observed in a crop, generally it becomes difficult to correct this deficiency through fertilizer application.

#### Steps of soil analysis

- Collection of soil samples
- Preparation of soil samples
- Analysis of soil samples
- Interpretation of soil test results
- Nutrient rate recommendation based on soil test values and crop response correlation.

Soil sampling is very important since soil test values and its interpretation are based on this sample. Thus, the spots which do not represent the field should be avoided. A composite sample at 0-15 cm soil depth over 5-10 spots should be taken from each field. After collection, the unwanted materials, e.g. stones, gravels, pebbles etc. need to be removed and the sample be dried in a shade (up to 3% soil moisture) before it is stored into a polythene bag or plastic bottle. Every soil sample should be analyzed for some basic properties such as soil texture, pH and organic matter. For saline areas, soils should also be analyzed for total soluble salts (i.e. electrical conductivity). Except nitrogen, all other nutrients are evaluated for their available status. Soil tests for micronutrients are not strong indicators of responses to added fertilizer, since soil test values are often found inaccurate as it is expressed in ppm, more difficult situation for heavy metals (cd, Pb, As, Cr) which are measured in terms of ppb.

A soil test, even if every reliable or accurate, is only one factor in making decisions about the need for fertilization. There are many other factors affecting crop growth and yield, such as soil type and environmental conditions, e.g. moisture, temperature). Because of varying and different forms of nutrients in soils, e.g. calcareous vs. acid soils, soil tests are equally varied, particularly for available P and micronutrients, and to a lesser extent for N. Being mobile in soils and subject to mineralization-immobilization, N poses particular problems to establish a reliable test.

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#### 4.2 Critical limit of nutrients

Critical limit (C.L.) of a nutrient refers to a value below which an economic crop response to the added nutrient is highly expected. It is the level of a nutrient below which the crop will suffer from its deficiency and thus, the crop will show economic response to the added fertilizer. The critical limit may be useful for delineating responsive sites from non-responsive ones but are not suited for making quantitative recommendations for a range of soil test values. The critical levels depend on soils, crops and extraction methods.

**Table 3. Interpretation of soil test values in relation to critical limit**

| Soil test value | % C.L.    | Expected crop response  |
|-----------------|-----------|---|
| Very low        | $\leq 75$ | 25-50% of maximum expected yield predicted without fertilization. High rate of fertilization is required.             |
| Low             | 75.1-150  | 50-75% of maximum expected yield predicted without fertilization. Modest to high rate of fertilization may be needed. |
| Medium          | 150.1-225 | 75-100% of maximum expected yield predicted without fertilization. Low to medium rate of fertilization may be needed. |
| Optimum         | 225.1-300 | Crop response to fertilization less expected.   |
| High            | 300.1-375 | Crop response to fertilization not predicted  |
| Very high       | $> 375$   | Crop response to fertilization not predicted, rather crop may be adversely affected by fertilization.                 |

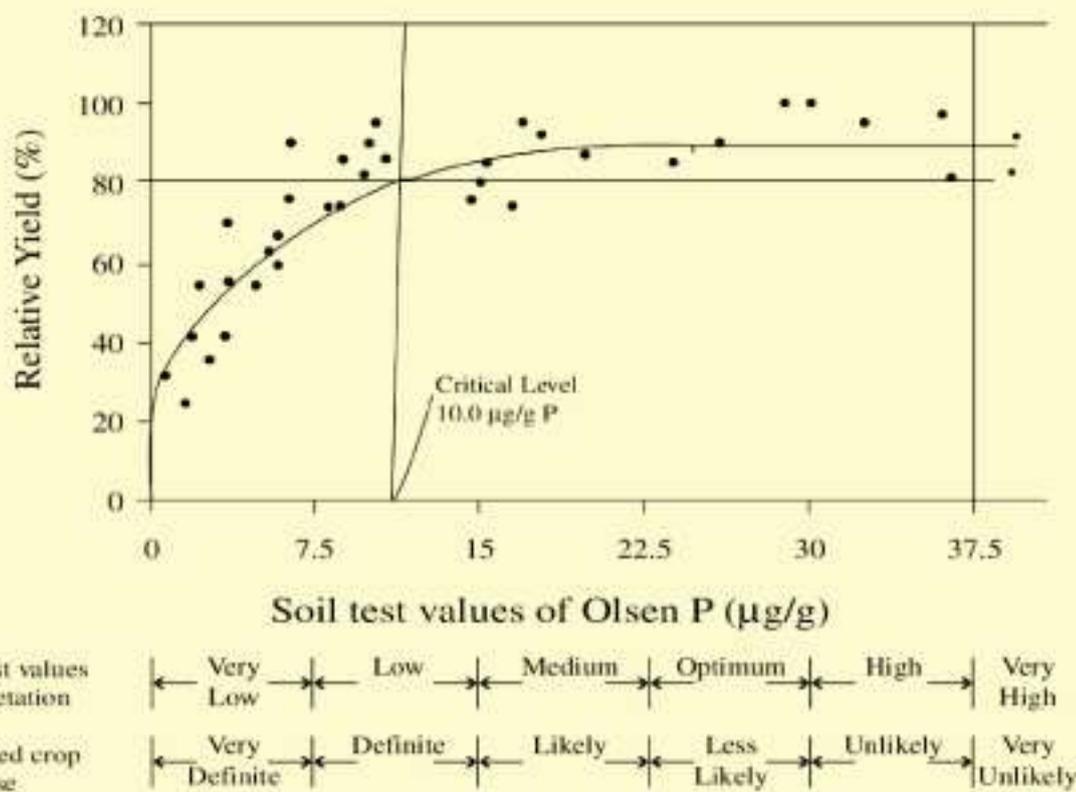


Fig. 7 Soil test interpretation and expected crop response based on critical limit (example for Phosphorus).

#### 4.3 Crop response to added fertilizers

Based on soil test result, nutrient content can be classified into five categories- very low, low, medium, high and very high. The probability of crop response to applied nutrients increases with decreasing soil test value. There is a good possibility of obtaining profitable crop response from the use of fertilizers on soils showing "low to medium" status of a nutrient. There is a greater possibility of obtaining a response from a given nutrient with a low soil test result.

Soil test values would be of no value unless they are positively correlated with crop response. Yield responses from applied nutrients can be more closely related to the quantity of available nutrients in the soil as found by soil analysis. A soil test measures part of the total nutrient supply in the soil and represent only an index of nutrient availability. Soil tests do not measure the exact quantity of a nutrient potentially taken up by a crop. To predict the nutrient needs of crops, the soil test values must be calibrated against nutrient rate used in the field experiments.

##### Crop growth response curve

The response of a crop to added nutrients shows a well-defined pattern. When any growth parameter or yield of a crop is plotted as a function of increasing amounts of applied nutrients, successive increments of nutrients give successively smaller increases in crop growth or yield. Such curves are known as growth response curves. From the response function equation the value of an added nutrient that maximizes yield is estimated as follows:

$$Y = a + bx + cx^2$$

where Y is the maximum crop growth or yield

a, b and c are co-efficients and

X is added nutrient

The optimum nutrient rate ( $N_y$ ) can be computed from the above equation as

$$N_y = \frac{-b}{2c}$$

Now, the nutrient rate that maximizes profit:

$$N_p = \frac{1}{2c} \left( \frac{P_f}{P_y} - b \right)$$

Where,  $P_f$  = Price of nutrient and  $P_y$  = price of crop product

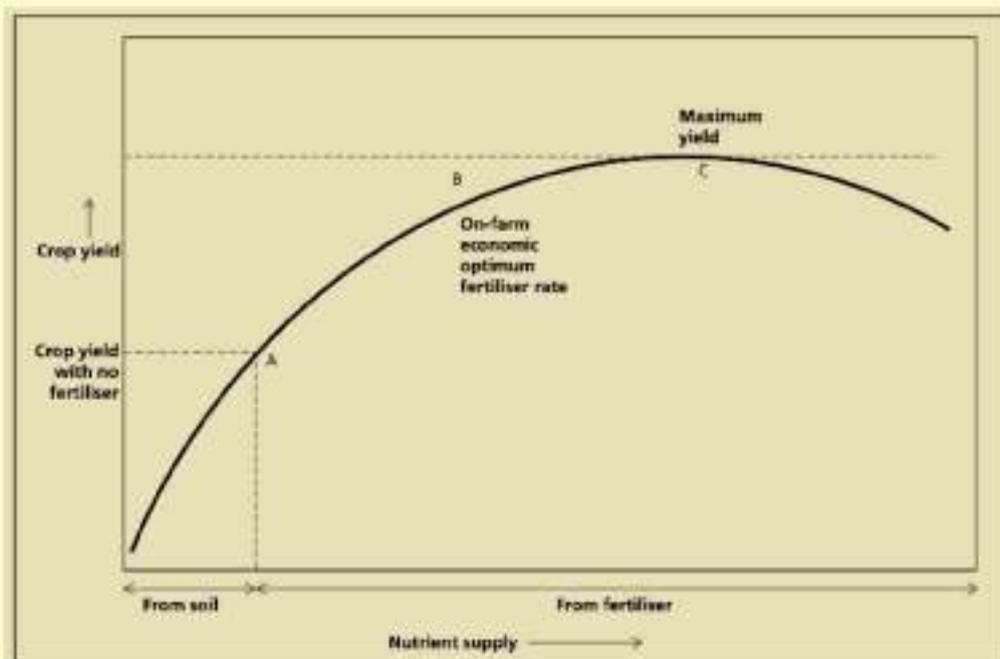


Fig. 8 Crop yield as influenced by nutrient supply from soil and fertilizer sources

Response of a crop to added nutrients depends on soil-crop-climatic variables and production practices. In general, most of the crops are responsive to N fertilizers. Upland and rabi crops grown under strongly acidic and alkaline soil conditions are more responsive to P fertilizers. Oil seed crops and wetland rice are responsive to S fertilizers. Sugarcane and tuber crops are more responsive to K fertilizers. Crops grown on light textured soils respond more to K fertilizers. Crops grown on the calcareous and saline soils respond more to Zn fertilizers. Fertilizer response is more pronounced under irrigated than under rainfed ecosystems. Crops may differ markedly in their requirements of different nutrients. Again soil moisture content may affect the response of a crop to fertilizers. Furthermore, fertilizer response of a crop depends on the kinds of fertilizers used, and also on the time and methods of their application.

- For example, without applied N, yield typically is low (A) (Fig. 9)
- As N use increases from very small amounts, there is a large increase in yield up to the 'on-farm economic optimum' N rate (B).

- Maximum yield (C) is reached at a N rate greater than the on-farm economic optimum and this is never a target if farm profits are to be maximized. Application of N above point C does not increase yield, and with further applications yield falls.

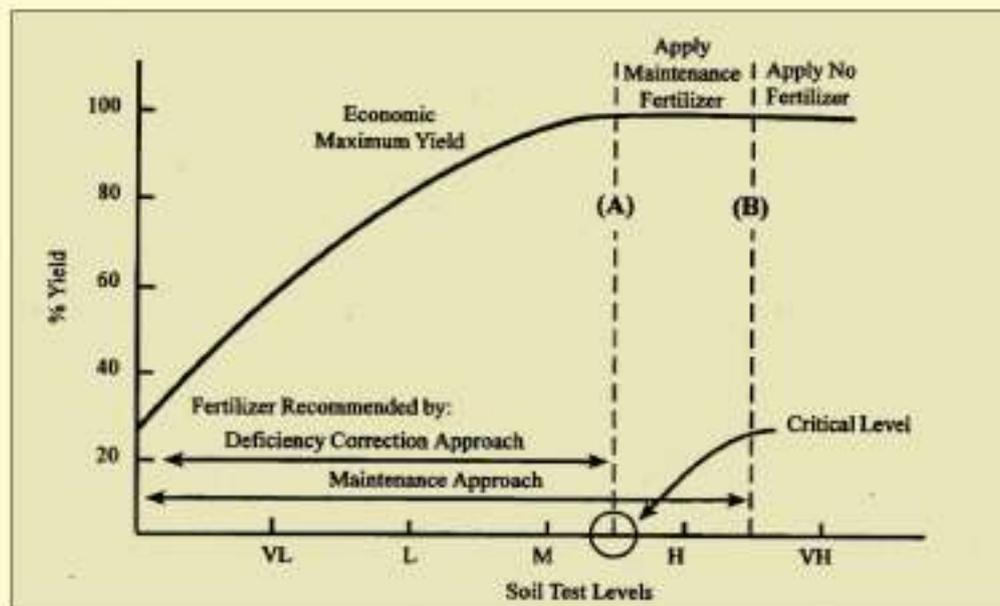


Fig. 9: Yield response as influenced by soil test level and soil test recommendation approach (Hergert, 1997)

#### 4.4 Plant analysis

Plant analysis refers to plant tissue test either in the field or in the laboratory. Plant analysis is based on the relationship between nutrients in a plant and nutrient availability in the soil. This analysis is done with the following objectives:

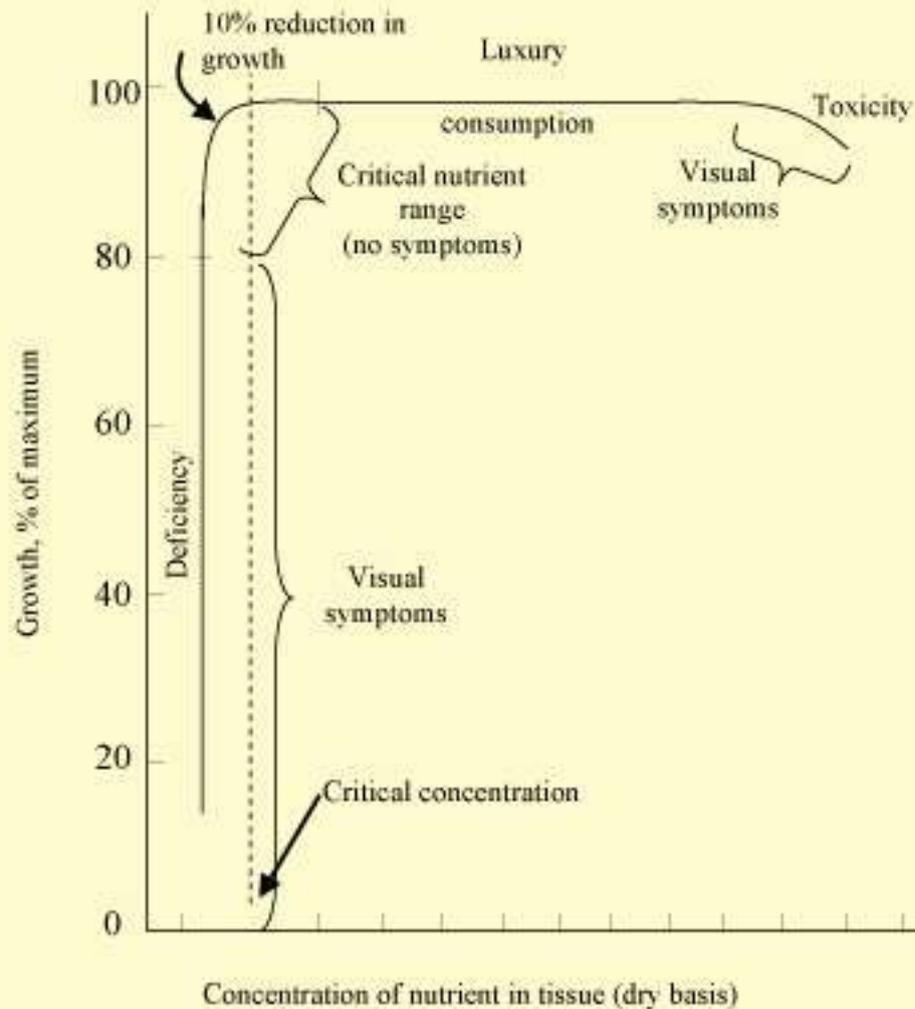
- to determine shortage of a nutrient before it shows deficiency symptoms
- to identify hidden hunger or verify the nutrient stress suspected from the visual deficiency symptom
- to predict the nutrient supplying capacity of a soil
- to study the relationship between plant nutrient status and crop performance

Fresh tissue test directly in the field is important in diagnosing the nutrient needs of growing plants. The nutrient concentration in the cell sap can be a good indication of nutrient supply at the time of testing. Tissue tests are rapid and easy to conduct and interpret. Plant tissue test kits are inexpensive. The result of this testing kit is categorized into low, medium and high nutrient content. However, application of a nutrient to correct its deficiency with a tissue test may not be feasible as because (i) the deficiency has already caused yield loss, (ii) the crop may not respond to the applied nutrient at a specific growth stage, (iii) climatic conditions may be unfavorable for the crop to get benefit from nutrient addition.

Plant analysis in the laboratory is performed on the whole plant or specific plant parts (e.g. roots, stems, leaves). After sampling, the plant material is dried, ground, and the nutrient content is determined following wet digestion with conc. acid or dry ashing in a high-temperature oven.

Growth stage is important in plant analysis because nutrient status and demand varies during the season. Nutrient concentration in vegetative parts usually decreases with maturity. In most crops the two best sampling times coincide with peak periods of dry matter and plant nutrient accumulation. The first peak occurs during the maximum vegetative growth period and the second peak during the reproductive stage. Generally, the latest mature leaf is used for testing. Time of day can affect tissue N concentrations. To

reduce variability, samples should be collected in the morning. Sampling should be avoided if plants have been affected by insect or disease. Border row plants and shaded leaves should be avoided during sampling.



**Fig. 10: Relationship between plant nutrient concentration and crop yield. Critical nutrient range (CNR) represents an economic yield loss without visual deficiency symptoms.**

Plants that are severely deficient in an essential nutrient exhibit a visual deficiency symptom (Fig. 10). Plants that are moderately deficient usually exhibit no visual symptoms, although yield potential is reduced. Luxury consumption represents nutrient absorption in excess of that required for optimum growth. Nutrient toxicity occurs when plant growth and yield decrease with increasing plant nutrient concentration. The critical nutrient concentration (CNC) is the nutrient level below which crop yield or quality is unsatisfactory.

**Table 4. Generalized nutrient concentration in plants**

| Macronutrient |                   | Micronutrient |                     |
|---------------|-------------------|---------------|---------------------|
| Element       | Concentration (%) | Element       | Concentration (ppm) |
| Nitrogen      | 1.0-5.0           | Iron          | 70-150              |
| Phosphorus    | 0.1-0.4           | Manganese     | 30-100              |
| Potassium     | 1.0-2.5           | Copper        | 5-15                |
| Calcium       | 0.2-1.0           | Zinc          | 20-50               |
| Magnesium     | 0.1-0.4           | Molybdenum    | 0.1-1.0             |
| Sulphur       | 0.1-0.4           | Boron         | 10-50               |

#### 4.5 Diagnosis of nutrient deficiency and excess or toxic symptoms

When a plant is deficient of a particular element, some characteristic symptom appears. Nutrient deficiency symptom is related to some nutrient function in the plant. A nutrient may have several functions which makes it difficult to identify the reason for a particular deficiency symptom. For example, when N is limiting, chlorophyll production and leaf greenness is reduced, allowing yellow pigments (carotene and xanthophyll) to prevail. Deficiency symptoms of a nutrient may vary with crop species. Generally, deficiency symptoms are similar within a plant family since they have similar nutrient requirement. However, nutrient deficiencies are generally observed in the whole plot, but sporadic or few plants are affected in case of insect or disease damage.

Nutrient deficiencies are relative and a deficiency of one element implies adequate or excessive quantities of another. Thus, plants exhibit external symptoms of starvation as a result of nutrient deficiency or imbalance. For example, Mn deficiency may be induced by excessive Fe in soils. Plants poorly supplied with P may have lower N needs compared to those with adequate P. Hence, the same supply of P may become sufficient or deficient depending on the level of N supply. It is difficult to distinguish among the deficiency symptoms in the field, because disease, insect, or herbicide damage may resemble certain micronutrient deficiencies.

Nutrient deficiency symptoms appear when nutrient supply is so low that the plant can not function properly. In such cases, supplemental nutrients are needed before the symptoms appear. If the symptom is observed early, it is possible to correct it during the growing season with foliar spray or side-dressing. Nutrient deficiency symptoms appearing during early growth stage may disappear as the growing season progresses which is especially true for micronutrients.

Recently leaf color chart has been developed for efficient N management of irrigated rice. Crop N status is periodically assessed by comparing rice leaf color with four panels of critical colors in the chart. Farmers would be able to determine the best time of urea top dressing by using the leaf color chart.

### Deficiency symptoms of nutrients in plants

| Nutrient   | Deficiency symptoms   |
|------------|---|
| Nitrogen   | Yellowing of older leaves; slow growth, early maturity.   |
| Phosphorus | Purple coloration of older leaves, reduced tillering in cereals, delayed flowering  |
| Potassium  | Chlorosis and necrosis of the leaf edges; weakening of straw; susceptibility to diseases.   |
| Calcium    | Burning of leaf tips and margins (called die back or tip burn); white or grayish green nodules in legumes; discolored and softer fruits.      |
| Magnesium  | Interveinal chlorosis of older leaves; reddish-purple cast of lower leaves in cotton.   |
| Sulphur    | Yellowing of younger leaves; reddish color on the lower surfaces of leaves in cruciferous crops (e.g. cabbage).                               |
| Iron       | Interveinal chlorosis of younger leaves; whole leaf becomes white in case of severity   |
| Manganese  | Like Fe, interveinal chlorosis of younger leaves; necrosis develops at advanced stage instead of white colour                                 |
| Zinc       | Rusty brown spotted leaves in rice; clustering of small leaves (rosetting) at the top of fruit plants; white bud in corn; fern leaf in potato |
| Copper     | Chlorosis of younger leaves, leaf curling; susceptibility to diseases (e.g. wilt), growing points die.  |
| Boron      | Grain set failure; reduced seedling vigor in pulses; hollow-heart in cauliflower; de-shape of papaya  |
| Molybdenum | Interveinal chlorosis of younger leaves; poor nodulation in legumes   |
| Chlorine   | Wilting of plants; chlorosis of younger leaves  |

### Excess or toxic symptoms of nutrients in plants

| Nutrient   | Excess or toxic symptoms  |
|------------|---|
| Nitrogen   | Very dark green, succulent, susceptible to disease & insect infestation, lodging, blossom abortion. |
| Phosphorus | Looks like Ca, Zn, Fe or Mn deficiency symptoms of leaves   |
| Potassium  | Exhibits Ca or Mg deficiency symptoms of leaves.  |
| Calcium    | Shows Mg or K deficiency symptoms of leaves.  |
| Magnesium  | Possible Ca or K deficiency symptoms of leaves  |
| Sulphur    | Premature senescence of leaves  |
| Iron       | Bronzing of leaves with tiny brown spots, blackish rice root  |
| Manganese  | Older leaves show brown spots surrounded by chlorotic zones and circles.                            |
| Copper     | Very slow growth, shows Fe deficiency.  |
| Boron      | Leaf margins and tips turn brown and die.   |
| Molybdenum | Not yet known.  |
| Chlorine   | Yellowing of lower leaves, burning of leaf margins and tips, bronzing and abscission of leaves.     |

**PHOTOGRAPHS**  
**on**  
**Deficiency Symptoms in Crop Plants**



**N deficient rice field**



**N deficient wheat field (Middle)**



**Normal tomato leaf (left) and N deficient tomato leaf (right)**



**N deficient maize field**



**N deficiency in potato plant**



**N deficient soybean leaf (right)**



**N deficient cucumber  
(misshaped and chlorotic)**



**P deficiency in rice**



**P deficient maize plants**



**P deficient cabbage seedling**



**P deficient tomato leaf**



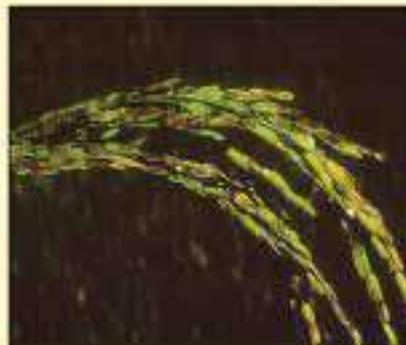
**P deficient potato leaves**



**P deficient guava leaves (left)**



**P deficient banana plant**



**K deficiency in rice**



**K deficiency in wheat**



**K deficiency in maize leaves**



**K deficient tomato leaves**



**K deficiency in potato**





**K deficiency in cotton**



**K deficiency in soybean**



**S deficiency in rice**



**S deficiency in wheat**



**S deficiency in maize**



**S deficiency in potato**



**S deficiency in mustard**



**S deficiency in banana**



**S deficiency in tomato**



**Mg deficiency in potato**



**Mg deficiency in tomato**



**Mg deficiency in banana**



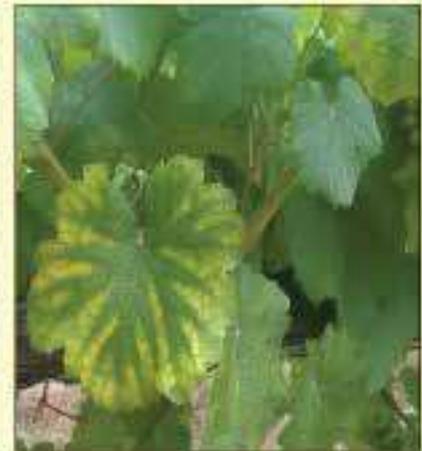
**Mg deficiency in maize**



**Mg deficiency in wheat**



**Mg deficiency in sweet gourd**



**Mg deficiency in grape**



**Mg deficiency in soybean**



**Mg deficiency in straw berry**



**Zn deficiency in rice**



**Zn deficiency in maize**



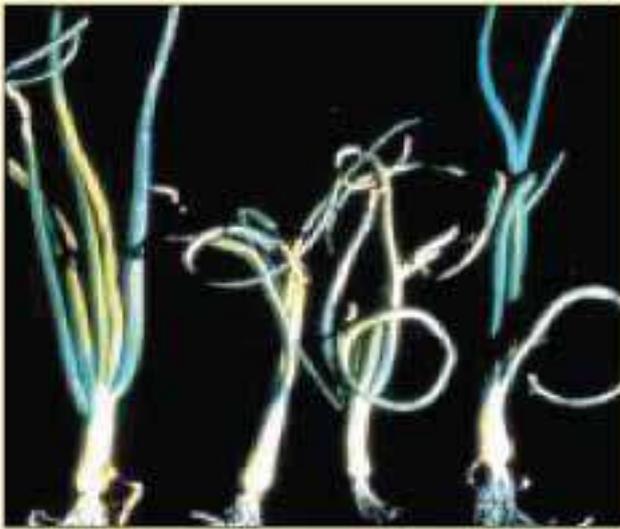
**Zn deficient tomato leaf**



**Zn deficiency in orange**



**Zn deficient cotton leaf**



**Zn deficient onion seedlings**



**B deficiency in cabbage**



**B deficiency in potato**



**B deficiency in tomato**



**B deficiency in mustard**



**B deficiency in papaya**



**B deficient straw berry**



**B deficient wheat (left)**

## 5. FERTILIZERS AND THEIR USE

Broadly a fertilizer may be defined as any substance (chemical, organic and microbial) that is added to soil to supply element(s) required for the nutrition of plants. Specifically, fertilizers are chemical, organic or microbial materials that occur naturally or are produced in a factory and when added to the soil, they supply nutrient elements required for normal plant growth.

### 5.1 Types of fertilizer

**Inorganic (Mineral) fertilizer-** Fertilizer which contains nutrients in the form of inorganic salts obtained by extraction and/or by physical and/or chemical industrial processes, e.g. TSP, MoP, gypsum, etc.

**Organic fertilizer-** Carbonaceous materials mainly of plant and/or animal origin added to the soil specifically for the nutrition of crops, e.g. cowdung, poultry manure, compost, etc.

**Straight fertilizer-** Fertilizer which contains only one primary nutrient (N, P or K), e.g. urea, TSP and MoP.

**Micronutrient fertilizer-** Fertilizer which contains any micronutrient (Zn, B, Fe, Mn, Cu, Mo, Cl or Ni), which is required by plants relatively in a smaller amount but essential for plant growth, e.g. zinc sulphate, boric acid, coppersulphate, etc.

**Complete fertilizer-** Fertilizer which contains all three primary nutrients (N, P & K).

**Compound fertilizer-** Fertilizer which contains two or more plant nutrients, e.g. DAP.

**Granular fertilizer-** Solid material that is formed into a definite sized granule, e.g. USG, UMG.

**Coated fertilizer-** Granular fertilizer that is coated with a thin layer of different materials in order to improve the behavior and/or modify the characteristics of the fertilizer, e.g. S coated urea. Coated fertilizers are slow release fertilizers.

**Biofertilizer-** Fertilizer that contain an active culture of beneficial microorganism which benefit the plants by providing N or P or rapid mineralization of organic material, e.g. *Rhizobium*, *Azotobacter*, *Azospirillum*, etc.

**Liquid fertilizer-** Fertilizer that is in suspension or solution, e.g. liquefied ammonia.

Apart from fertilizers, some materials are used in soil as amendments:

**Soil conditioner-** Material added to soils for improvement of their physical and/or chemical properties and/or biological activity.

**Liming material-** An inorganic soil conditioner containing Ca or Ca and Mg, generally in the form of oxide, hydroxide, or carbonate, principally intended to raise the soil pH. Dololime [ $\text{CaMg}(\text{CO}_3)_2$ ] is now commonly used in Bangladesh.

The reactivity of fertilizers with soil is determined by fertilizer and soil characteristics. Fertilizer characteristics include physical form (solid, liquid and gas), solubility, composition, chemical reactivity and time and methods of application. Soil characteristics are pH, texture, organic matter and concerned elemental status.

### 5.2 Fertilizer use in Bangladesh

Inorganic fertilizers have been introduced in this country during early 1950's as a supplemental source of plant nutrients. But their use steadily increased from the mid 1960's along with the introduction and expansion of modern varieties accompanied by the development of irrigation facilities. The increasing trend of

fertilizer use, particularly urea-N, still continues (Appendix-1). Until 1980, three primary major plant nutrients (N, P & K) along with one secondary major nutrient (Ca) were supplied from fertilizer to our soils. The importance of S and Zn for rice culture in particular was recognized during early 1980's. Gypsum, zinc sulphate and zinc oxy-sulphate were then introduced to supply these nutrients. Very recently, the deficiencies of Mg, B and Mo have been reported for some soils and crops. Of the total nutrients used in the country, N alone constitutes about 80 percent, which may lead to nutrient imbalance in soil-plant systems. If this trend of fertilizer use continues along with intensive cultivation of high yielding crop varieties, the productivity of our soils is likely to be seriously affected. Factor productivity of nutrients has already been declined. To avert this potential danger, the limiting nutrients must be identified and the soils should be enriched with the addition of these nutrients in properly balanced fertilization programmes. Prior to 1990, only TSP was used by our farmers as a source of P because it was the only P containing fertilizer available in the market at that time. After 1990, DAP, another source of P, has been made available in the market. Since these materials vary in their P content, variable amounts of these materials would be required to meet a specific P fertilizer recommendation. It is to be noted that SSP contains S and DAP contains N in addition to P. Therefore, there is a need to adjust for S and N fertilizer application if either SSP or DAP is used as a P source instead of TSP. A list of commonly used fertilizer with their nutrient contents is given in Appendix-2.

Looking at the fertilizer consumption over the years from 1980-81 to 2015-16, use of every nutrient (N, P & K) has increased as the time has advanced, except during 2006-2008 in which time cost of fertilizer became too high which the farmers could not afford (Fig. 11). The N consumption in 1980-81 was 365881 ton which in 2015-16 increased to 1183024 ton. Between P and K, the trend of K use is higher than that of P use. Fertilizer consumption has much increased since the Govt. had given subsidy on fertilizer price.

### Fertilizer use in other countries

The use of fertilizer nutrients in the Asian region has increased considerably in recent years (Appendix-3). Application of fertilizers per unit area is the maximum in Korea followed by China and the minimum in Myanmar. During the past few years, total fertilizer nutrient use in Bangladesh has increased significantly. A further increase in fertilizer use needs to occur in those countries where more production has to be realized from the limited areas of land.

### 5.3 Balanced use of fertilizers

Fertilizers are applied to soil to enhance the ability of a soil to supply nutrients to plants adequately as well as proportionately in order to overcome nutrient deficiency and to ensure higher crop yield. Generally,

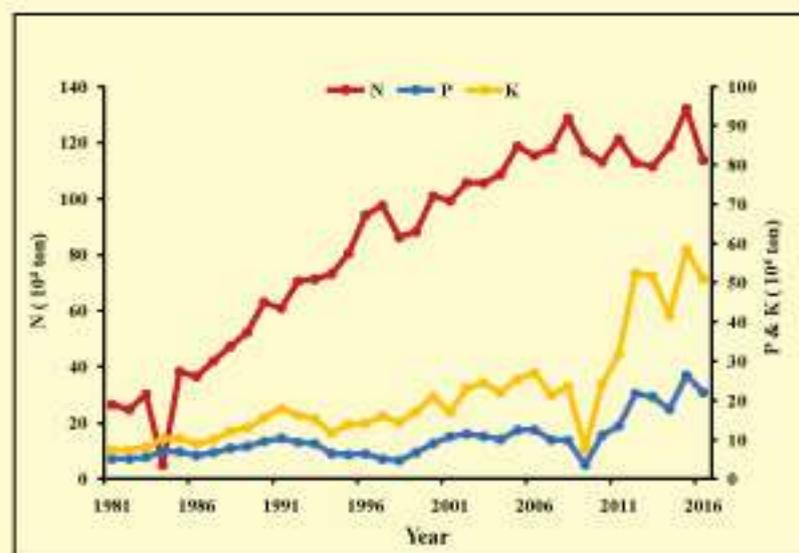


Fig. 11: Consumption of N, P and K fertilizers in Bangladesh during 1981 to 2016.

the farmers of our country are not using balanced dose of fertilizers. Balanced application of fertilizers has many fold advantages: correction of inherent soil nutrient deficiencies, restoring soil fertility, avoiding damage to the environment, increasing crop yields and increasing crop quality.

In principle, balanced fertilization is indispensable to avoid crop yield decline on cultivated land and to supplement nutrient loss from the soil ecosystem. Balanced fertilization ensures high productivity in accordance with nutrient demand by individual crops and for individual nutrient elements without causing harm to the environment.

Imbalanced fertilizer use at the expense of inherent soil fertility practices represent 'soil mining' as against 'soil building' that results from balanced fertilization. Only 'soil building' leads to a sustainable land use system in a world where most grains in food production must continue to come from existing agricultural land.

#### 5.4 Nutrient use efficiency

Farmers are mostly concerned with the total profit and the marginal benefit-cost ratio from investment in fertilizers and soil conservation measures. The most relevant measure of nutrient use efficiency is, therefore, the partial factor productivity from investment in applied nutrients. The partial factor productivity from applied nutrients (PFP) is the ratio of grain yield to the quantity of applied nutrients.

##### Agronomic efficiency (AE)

It represents the marginal benefit from investment in nutrient inputs.

The formula for AE is:

$$\text{where, } AE = (GY_{NA} - GY_{NO}) / N_R$$

AE = Agronomic efficiency  
GY<sub>NA</sub> = Grain yield (kg/ha) with addition of nutrient  
GY<sub>NO</sub> = Grain yield (kg/ha) without addition of nutrient  
N<sub>R</sub> = Rate of added nutrient (kg/ha)

##### Recovery efficiency (RE)

Crop management practices in general and nutrient management practices in particular have the greatest impact on the RE from applied nutrients. For example, competition from weeds, poor control of water, plant disease or insect damage can reduce the uptake of applied nutrients. Thus, improved crop management per se, including use of the best adapted variety, helps to maximize the RE from applied nutrients.

##### Physiological efficiency (PE)

Physiological efficiency (PE) represents the ability of a plant to transform a given amount of acquired nutrient into economic yield. For cereals, economic yield is grain yield. There are significant differences in PEs among genotypes. Most of the variations are associated with differences in harvest index (HI) which is the ratio of grain yield to total plant biomass, for example, traditional rice varieties typically have an HI of 0.33 while modern high yielding semi-dwarf rice varieties (MV) have an HI of about 0.5. Therefore, with an equivalent quantity of N uptake and total biomass production MV will have greater PE than the traditional variety.

#### 5.5 Deep placement of urea

Urea Super Granules (USG) and Urea Mega Granules (UMG) are used to increase N use efficiency. Urea Super Granules (USG) are small sized granules, each weighing 0.9g and Urea Mega Granules (UMG) are large sized granules, each 1.8g or 2.7g pellets made of ordinary prilled/granular urea by compressing. The amount of USG or UMG should be adjusted to the recommended dose of N for different crops and soils.

The granules (USG/UMG) need to be placed after 5-7 days of transplanting at 8-10 cm soil depth at the centre of every four hills between alternate rows.

With USG, recovery of deep placed N in wetland rice is greater than the N recovery from surface applied and/or incorporated ordinary urea. Fertilizer recovery in the wetland rice plant tops was found significantly higher for deep placed N as USG/UMG (50-60%) than for split-applied Urea (25-34%). About 35% N can be saved by using USG or UMG in rice and 20% in vegetable and fruit crops (viz. cabbage, cauliflower, tomato, potato and papaya).

The main benefit of USG/UMG placement is that the N loss through NH<sub>3</sub> volatilization, denitrification, leaching and surface runoff are significantly minimized. Deep-placed N as USG/UMG is less subject to algal immobilization and uptake by aquatic weeds than broadcast and/or incorporated urea. These two factors contribute to the improved nitrogen use efficiency.

### 5.6 Use of biofertilizers

Biofertilizers are microbial inoculants consisting of living and active strains of specific bacteria, algae, fungi, alone or in combination, used for application to seed, soil or composting areas with the objective of increasing crop productivity. They help in the biological nitrogen fixation, solubilization of insoluble phosphate, stimulating plant growth or in decomposition of organic substances.

#### Rhizobial biofertilizer

Rhizobial biofertilizer/inoculants are made with bacterial strains that can fix atmospheric N<sub>2</sub> in symbiosis with legumes. They are the members of five bacterial genera: Rhizobium, Mesorhizobium, Bradyrhizobium, Sinorhizobium and Azorhizobium. The beneficial effect of these organisms in increasing yield of leguminous crops (lentil, chickpea, cowpea, mungbean, blackgram, pigeonpea, grasspea, pea, groundnut and soybean) from fixation of atmospheric nitrogen is well established.

#### Procedure for application of rhizobial biofertilizers

- i) Take an amount of seed in a container/bowl.
- ii) Add sugarcane molasses (2-3% for large seeds viz. groundnut, soybean etc. and 3-5% for small seeds viz. lentil, mungbean, etc.) and mix with seeds to make them sticky.
- iii) Add peat based inoculant (2-3% for large seeds and 3-5% for small seeds) to sticky seeds.
- iv) Mix seeds with inoculum until they are coated and appear uniformly black.
- v) Dry seeds under shade on a paper. Do not dry in direct sunlight.
- vi) There should be a minimum 24-hour gap between seed treatment with fungicide and biofertilizer application.
- vii) Use double quantity of biofertilizer in case of pesticide treated seeds.
- viii) Sow the inoculated seeds and cover the seeds with soil immediately.

#### Azolla biofertilizer

Azolla is a floating fern and it fixes atmospheric N<sub>2</sub> in symbiosis with *Anabaena azollae*. In wet land rice, the average N contribution by Azolla is equivalent to 25-40 kg N/ha. Azolla should be applied to standing water @ 3-4 t/ha at 1-2 weeks after transplanting of rice. After 2-3 weeks of its application, water needs to be drained out and Azolla should be incorporated into the soil. Azolla can be grown into the rice field more than once.

### 5.7 Rationale of fertilizer use

Except nitrogenous fertilizers, all fertilizers would have residual effect on the next crops. Thus, application of those fertilizers at a full rate is not economical. Considering nutrient uptake, fertilizer types, crop types and soil characteristics the following points need to be considered while making fertilizer recommendations for cropping patterns.

- i) More than 60% of added N is lost from soil in different ways (denitrification, volatilization and leaching) and very little or no residue is left into the soil for use by the next crops. Thus, urea fertilizer should be applied at a full rate to every crop. The N rate for T. Aman rice could be reduced by 25-30 kg ha<sup>-1</sup> if 12-15 tons green biomass of dhaincha (*Sesbania*) is incorporated. This reduction could be 8-10 kg ha<sup>-1</sup> when stover of grain legumes (e.g. mungbean) is incorporated to soil.
- ii) Phosphorus availability is low in both acid and calcareous soils. Plant uptake of this element is usually 15-25% of the added amount, thus it produces residual effect on the subsequent crops. Hence, the P rate for the second and third crops could be reduced by 40-50% for rice and jute, and by 30-40% for vegetables.
- iii) Potassium availability is low in light textured, terrace and piedmont soils. The K requirement for rice, tuber, jute, sugarcane, fruit and vegetable crops is high. Potassium application should be considered as a maintenance dose even at optimum level of soil K. Potassium application could be reduced by 30-40% in the subsequent crops after potato, sugarcane and vegetables when recommended dose of K fertilizer was used. The K does could be reduced by 20-40% in subsequent crops if 2-4 tons of crop residues per hectare are incorporated to soils.
- iv) Sulphur availability is low under wetland condition. The S fertilizer (e.g. gypsum) has substantial residual effect on the next crops. So, wetland rice should receive full dose of S. Cultivation of rabi crops after harvest of T. Aman rice should receive 50% of the recommended S dose except for oil seed, maize, potato and vegetable crops, which should receive full dose of S. For 3-rice and 3-vegetables cropping patterns, the 2nd and 3rd crops would receive 50% dose.
- v) Magnesium availability is generally low in piedmont and Tista floodplain soils. Magnesium fertilizer should be applied to rabi crops and also to kharif crops e.g. jute. For wet land rice cultivation, magnesium application is not needed. If dolomite ( $\text{CaCO}_3 \cdot \text{MgCO}_3$ ) is used to raise soil pH, application of Mg fertilizer is not needed within three years.
- vi) Zinc availability is low in calcareous and wetland rice soils. Zinc fertilizers should be applied to both rabi and kharif crops when grown in calcareous soils (AEZs 10, 11, 12, and 13). For the rice-rice cropping pattern, full dose of Zn should be applied to the 1st crop and 50% dose to the 2nd crop. There is no need to apply Zn fertilizer to the rabi crops when the preceding T. Aman rice has received Zn at a full rate. Maize, potato, vegetables and spices as the 2nd or 3rd crop should receive 50% Zn dose.
- vii) Boron availability is low under dry land condition. Rabi crops should receive boron once a year. In the cropping pattern where rabi is the fallow period then full recommended dose of boron should be applied to the kharif-1 crop.
- viii) If organic manure such as cowdung, poultry manure, bioslurry and compost are used, the amount of nutrients from manure should be adjusted with the rates of chemical fertilizers, taking into account of 50% mineralization.
- ix) Under rainfed condition, the yield reduction would be 15% for rice and jute, 20% for potato and sugarcane, and 35% reduction for wheat, oilseed, vegetables and spices, for which all the recommended fertilizer nutrients (N, P, K, S, Mg, Zn, and B) should be reduced by 25% compared to that with irrigated condition.
- x) For an intercropping system, fertilizer dose for the companion crop should be 20-50% of the recommended dose for the crop depending on population and the main crop should receive 100% recommended dose of fertilizers.

## 5.8 Time and methods of fertilizer application

Fertilizer efficiency depends to a great extent on the time and methods of application. This is particularly important for nitrogenous fertilizers like urea, which is highly water soluble and easily lost from soil in various ways. As much as 70% of the applied urea might be lost from soil under wet land rice culture.

In fertilizer application, the following principles should be taken into account.

- Fertilizers should not be applied too close to seeds, young roots and stems of plants
- Fertilizers should not be applied to plant leaves when they are young and wet.
- Manures and fertilizers should be mixed thoroughly with the soil.
- Urea should not be applied to soil with standing water.
- Manure should be applied 7-10 days before sowing/planting.

For efficient use of fertilizers, an appropriate method of fertilizer application is very important. There are three methods of fertilizer application: broadcast, localized application and foliar spray. Broadcast method is most commonly used in field crops and the localized method is widely followed in horticultural crops. Foliar application could be effective for correcting deficiency of micronutrients (Fe, Mn, Zn and B), not for that of any macronutrient. Maximum absorption of foliar applied nutrient occurs when (i) the nutrient element is in low concentration, (ii) applied solution contains a wetting agent, (iii) plant tissue is fully turgid and at the mature stage, (iv) applied in the late afternoon or in the morning when dew dries up, and (v) air temperature is cool, has a high relative humidity, and there is no wind.

In order to increase the efficiency of fertilizers, the following guidelines need to be followed.

- i) During rabi season, if there is no facility for irrigation, the full dose of urea should be applied and mixed with the soil during final land preparation. If irrigation facility is available, urea should be applied in three equal splits, during final land preparation, rapid vegetative growth stage, and 5-7 days before primordial initiation.
- ii) In case of rice (except B. Aman rice), urea should be applied in three equal splits, the first split at final land preparation or immediately after seedling establishment, the second split at rapid tillering stage and the third split at 5-7 days before panicle initiation (PI) stage. In case of broadcast rice culture, nitrogen fertilizer should be applied in two equal splits, the first one as basal and the second one at maximum tillering stage.
- iii) For vegetables, 2-3 split applications of urea should be adjusted with the growth periods of the crop. For short duration crops the full dose of urea may be applied during final land preparation.
- iv) For most spices crops, urea application may be made in 2-3 splits.
- v) Phosphate fertilizer should be applied 1-2 days prior to final land preparation and zinc fertilizer should be applied during final land preparation. Zn can also be topdressed if required.
- vi) The full doses of potassium, sulphur, magnesium and boron fertilizers should be applied as basal during final land preparation. In coarse-textured soils, the potassium fertilizer may be applied in two splits, the one-half at final land preparation and the rest half at rapid tillering stage. Sulphur and zinc fertilizers may be top dressed if necessary, especially if the recommended doses of these fertilizers have not been applied basally. Zinc and P fertilizers should not be mixed for storage.
- vii) Topdressing should be done under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.
- viii) For onion, potassium should be applied as  $K_2SO_4$  instead of KCl (MoP).

- ix) Micronutrient fertilizers can be applied as foliar spray since these are required by crops relatively in a smaller amount. Foliar spray has some advantages: (i) Application rates are much lower than soil application rates, (ii) Uniform application is possible, (iii) Response to the applied nutrient is almost immediate. Nevertheless, it has some disadvantages: (i) Leaf burn may result if salt concentration is too high, (ii) Nutrient demand may not be fulfilled when the plants are small and leaf surface is insufficient for foliar absorption, (iii) There is no residual effect.

The sources and solution concentration of different micronutrients could be as follows:

| Micronutrient | Source             | Concentration (g 100 litre <sup>-1</sup> ) |
|---------------|--------------------|--|
| Iron          | Ferrous sulphate   | 250-350                                    |
| Manganese     | Manganese sulphate | 250-500                                    |
| Zinc          | Zinc sulphate      | 250-600                                    |
| Copper        | Copper sulphate    | 250-600                                    |
| Boron         | Solubor            | 250-600                                    |
| Molybdenum    | Ammonium molybdate | 30-60                                      |

4R Nutrient Stewardship of IPNI (International Plant Nutrition Institute) is the foundation of best management practices for fertilizer management. The 4R represents Right source (types of fertilizer), right rate (rate of application), right time (basal & stage of crop growth) and right place (method of application)

## 6. SOIL ORGANIC MATTER MANAGEMENT

Soil organic matter comes from plant and animal remains. It influences the physical, chemical and biological properties of soil. It improves soil physical conditions viz soil structure, water holding capacity, aeration, soil erosion etc. It's a storehouse of plant nutrients, chiefly N, P & S. It serves as a food and energy for beneficial organisms viz. N<sub>2</sub> fixing bacteria (e.g. *Rhizobium*, *Azotobacter*), earthworms. It is the 'life force of a soil'.

### 6.1 Status of soil organic matter in Bangladesh

A good soil should have at least 2.5% organic matter, but in Bangladesh most of the soils have less than 1.5%, and some soils have even less than 1% organic matter. As the time advances, organic matter content in soil declines. This is particularly true under high land and medium high land conditions. The long-term fertilizer trials indicate that in the rice-rice (anaerobic-anaerobic) cropping system, the soil organic matter has slightly increased (BRRRI and BAU reports) and in the wheat-rice (aerobic-anaerobic) system the soil organic matter has rather decreased (BARI report). Hence, depletion of soil organic matter can not be generalized across the country.

#### Organic matter mineralization

Soil organic matter undergoes mineralization and releases substantial quantities of N, P, S and smaller amount of micronutrients. Application of organic residues returns mineral nutrients to the soil. The conversion of organic N, P and S to available forms occurs through the activity of microorganisms and is influenced by temperature, moisture, pH etc. The rate and extent of mineralization determine crop availability of nutrients from added organic materials. All the bio-forms use soil as their home or they live on organic matter and decompose it to simple products. These products are responsible for sustaining soil productivity and performing environmental regulatory function.

## 6.2 Management of soil organic matter

Soil organic matter is continuously undergoing changes and needs to be replenished regularly to maintain soil productivity. The major sources of soil organic matter include animal manure, farmyard wastes, domestic wastes, industrial wastes, sewage sludge, green manure etc. A large variety of organic wastes are available in the country that can be used as potential source of manure to improve soil. These are domestic wastes (non-edible vegetables, food and fruit parts, after-meal wastes etc.), farmyard wastes (cattle dung and urine, feed/fodder refuse, harvested crop residues, poultry excreta etc.), agro-industrial wastes (sugarcane trash, oil cakes, bagasse, molasses, bone meal, blood meal, fish meal, rice husk, brans, saw dust etc.), farm wastes (crop residues, weeds, dead animals, water hyacinth etc.) and city wastes (solid wastes and sewage sludge).

### Crops residues

Leftover parts of various crops after harvest are called crop residues. Substantial quantities of crop residues are produced in the country every year. But little or no care is taken for its use. In most cases, crop residues are burnt or removed away to clean the land causing huge loss of this potential resource. Plant roots, straw & stalks and vegetable tops are valuable as a source of organic matter and plant nutrients. Crop residues can be recycled either by composting or by way of mulch or by direct incorporation in the soil.

### Animal manure

It includes the excreta (dung and urine) of the domestic animals. Stubbles used as bedding of animals also become part of the manure. In Bangladesh, cowdung is the most common animal manure, although a big portion of the cowdung produced in the country is used as fuel. Next to cowdung, poultry manure is a potential source of organic matter.

Fresh animal manure should not be applied to standing crops, because the heat and CO<sub>2</sub> generated during vigorous decomposition is harmful for the young roots. Substantial quantities of animal manure and their nutrient content are lost due to careless handling. Animal manure should be stored in pits under a shade. The cattle urine is rich in N and should be preserved with the dung. The manure in the pit should be kept moist in order to reduce the volatilization of N. Animal manure generally takes 2-3 months time for its decomposition.

### Compost

The organic fertilizer that is produced by decomposing different waste materials of plant and animal origin is called compost. Ingredients that are used to make compost include dead leaves, straw, weeds, water hyacinth, household wastes like non-edible food, fruit and vegetable parts, after-meal wastes, municipal garbage, saw dust, wastes of leather factory, sugar mill bagasse, rice husk etc. Municipal and leather wastes should be treated to make them free from heavy metals and other toxic substances. The materials should be placed in layers, one above another. Each layer may be 25-30 cm thick. Heaps should preferably be 1.5 - 2.0 meter wide and not more than 1.5 meter in height. In order to promote microbial activities, thin (4-5 cm) layers of soil or fresh cowdung should be placed in between the layers of materials in the heap. Top of the heap should also be covered with soil. The heap should be kept moist, by spraying water at regular intervals. After 1.5- 2 months the layers should be reversed in a new heap to allow uniform decomposition. Depending on the condition of the weather and the type of raw materials used, preparation of compost takes 4 - 6 months. High temperature and high humidity favour rapid decomposition. Addition of small quantities of urea and triple superphosphate hastens the rotting of raw materials like straw, sugarcane trash, rice husk etc. which decomposes very slowly. Microbial accelerator (e.g. *Trichoderma*), if available, may also be used for rapid composting.

In composting, earthworms can play a good role. Earthworms convert organic wastes such as manure or household refuse to valuable compost. This is known as vermicompost. Earthworm inhabits organic matter lying on soil surface; eat fallen leaves and other non-decomposed litter. It has also been found to be especially efficient in breaking down the toughest organic wastes like sugarcane trash.

### Bio-slurry

Bio-slurry is an anaerobically decomposition product of animal manure. Commonly used cowdung or poultry manure is an aerobically decomposition product. After extraction of biogas (chiefly CH<sub>4</sub>), bio-slurry comes out of digester. Bio-slurry can be a potential source of organic matter. Fertilizer value of original manure (cowdung, poultry manure) is not hampered when it is turned to bio-slurry. Bio-slurry pit should be shaded to protect it from scorching sunshine and rains. A major limitation of the utilization of bio-slurry is to carry it from the pit to the distant crop field.

### Green manure

Green manure (GM) refers to crops that are grown and ploughed down at the appropriate stage of growth. In some countries, farmers collect fresh leaves from the forests and apply to the soil. This is called green leaf manure. Green manure adds substantial quantities of organic matter and N to soils.

Any herbaceous plant may be used for green manuring, but plants of the family leguminosae are preferred because of the added advantage of getting fixed N. The common GM plants include dhaincha (*Sesbania aculeata*), African dhaincha (*S. rostrata*), sunhemp (*Crotalaria juncea*), cowpea, grasspea, soybean, mungbean, blackgram etc. The crops should be ploughed down when the plants are 40-50 days old. Rhizobial inoculation would be useful to obtain higher biomass in a given period over uninoculated legumes. Dhaincha needs to be incorporated to soil within a week before T. Aman rice planting. A green manure crop may add 10 - 15 ton biomass (fresh weight) per hectare and 60-120 kg of N/ha to the soil. Azolla (water fern) can also be used as a green manure in Boro rice field.

### 6.3 Integrated Nutrient Management

The basic concept of Integrated Nutrient Management (INM) is 'the management of all available plant nutrient sources, organic and inorganic, to provide optimum and sustainable crop production conditions within the prevailing farming system'. Therefore the INM approach refers to an appropriate combination of mineral fertilizers, organic manures, crop residues, compost, N-fixing crops and bio-fertilizers taking into account of the local ecological conditions, land use systems and the individual farmer's social and economical conditions. In the INM practice it is important to consider the cropping pattern, not the single crop. Manure or fertilizer alone can not sustain soil fertility and crop yield over time, their combination (i.e. INM) is essential for it.

The INM based fertilizer requirement can be calculated as follows:

$$A = B - C$$

A = Amount of nutrient needed from fertilizer source

B = Total need of a nutrient for a crop on soil test or AEZ basis

C = Amount of nutrient supply from manure application

Example: Nutrient recommendation in kg/ha (AEZ basis) for Potato-T. Aus -T. Aman rice cropping pattern

AEZ: 19      Land type: Medium high land      Rainfed/Irrigated: Irrigated

**a) Recommended rate of nutrients**

| Season   | Crop         | Yield level (t/ha) | N   | P  | K  | S  | Mg | Zn | B |
|----------|--------------|--------------------|-----|----|----|----|----|----|---|
| Rabi     | Potato       | 30.0               | 135 | 30 | 90 | 10 | -  | 2  | 1 |
| Kharif-1 | T. Aus rice  | 4.0                | 75  | 10 | 20 | 6  | -  | 1  | - |
| Kharif-2 | T. Aman rice | 5.0                | 90  | 10 | 30 | 8  | -  | 1  | - |

**b) Nutrient addition from manure and fertilizers for potato**

|                          |                | N   | P  | K  | S  | Mg | Zn | B |
|--------------------------|----------------|-----|----|----|----|----|----|---|
| Recommended dose (kg/ha) |                | 135 | 30 | 90 | 10 | -  | 2  | 1 |
| Supply from manure       | Cowdung 5 t/ha | 30  | 10 | 20 | -  | -  | -  |   |
| Supply from fertilizer   |                | 105 | 20 | 70 | 10 | -  | 2  | 1 |

**c) Nutrient addition from manure and fertilizers for T. Aus rice**

|                          |      | N  | P  | K  | S | Mg | Zn | B |
|--------------------------|------|----|----|----|---|----|----|---|
| Recommended dose (kg/ha) |      | 75 | 10 | 20 | 6 | -  | 1  | - |
| Supply from manure       | None |    |    |    |   |    |    |   |
| Supply from fertilizer   |      | 75 | 10 | 20 | 6 | -  | 1  | - |

**d) Nutrient addition from manure and fertilizers for T. Aman rice**

|                          |      | N  | P  | K  | S | Mg | Zn | B |
|--------------------------|------|----|----|----|---|----|----|---|
| Recommended dose (kg/ha) |      | 90 | 10 | 30 | 8 | -  | 1  | - |
| Supply from manure       | None |    |    |    |   |    |    |   |
| Supply from fertilizer   |      | 90 | 10 | 30 | 8 | -  | 1  | - |

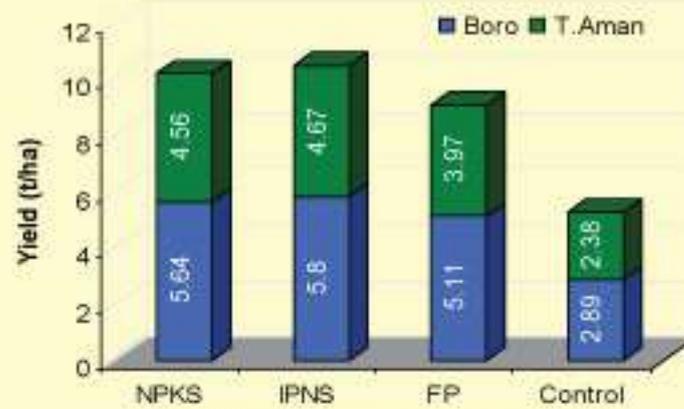
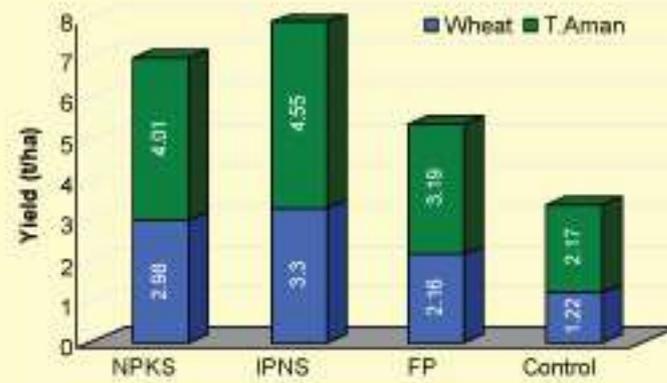


Fig. 9.1 Effects of different nutrient management packages on the yield of crops grown in sequence

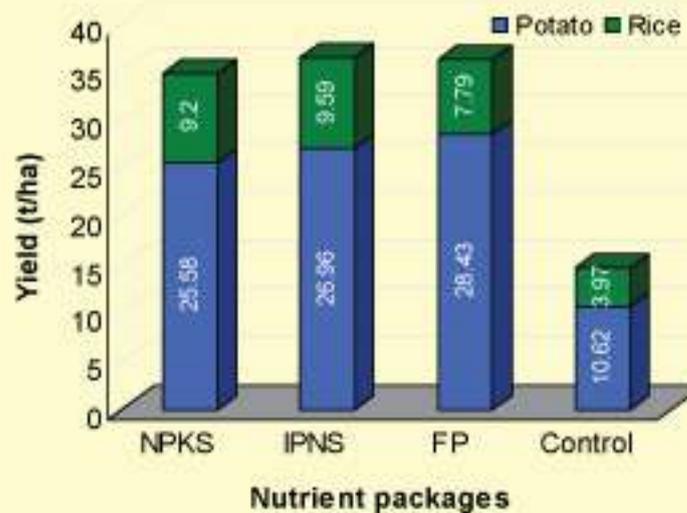


Fig. 12 Effects of different nutrient management packages on the yield of crops grown in sequence

## 6.4 Carbon sequestration

Carbon sequestration (carbon sink) is a biochemical process by which atmospheric carbon is absorbed by living organisms including trees, soil microorganisms and crops and involving the storage of carbon in soils with the potential to reduce atmospheric CO<sub>2</sub> levels. Carbon sequestration is capturing and securely storing carbon dioxide emitted from the global energy system. A large amount of carbon is stored in soils and vegetation, which is our natural carbon sink. Increasing carbon fixation through photosynthesis, slowing down or reducing decomposition of organic matter, and changing land use practices can enhance carbon uptake in these natural sinks. Terrestrial carbon sequestration is the process through which carbon dioxide (CO<sub>2</sub>) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils. Therefore, a carbon sink occurs when carbon sequestration is greater than carbon releases over some time period.

Soils of Bangladesh have low reserves of organic carbon due to increasing cropping intensity, higher rate of organic matter decomposition under sub-tropical humid climate, low use of organic manure and little or no use of green manures. The highest depletion of soil carbon has been reported in soils of Meghna river floodplain (35%), followed by Madhupur tracts (29%), Brahmaputra floodplain (21%), Old Himalayan piedmontplain (18%) and Gangetic floodplain (15%). The sequestration of atmospheric C in the soil and biomass reduces greenhouse effect. Carbon sequestration is essential to improve soil quality, increase agronomic productivity and use efficiency of inputs like fertilizers and water and thus helps maintain or restore the capacity of soil to perform its production and environmental functions on a sustainable basis.

Carbon sequestration reflects the long-term balance between additions of organic C from different sources and its losses from soil. Following the adoption of large-scale intensive cropping, with the introduction of modern varieties and increased use of chemical fertilizers, the long-term balance would be modified. Intensive cropping encourages oxidative losses of C due to continued soil disturbance, while it also leads to a large-scale addition of C to the soil through crop residues. This may result in a buildup or depletion of soil carbon stock.

## 7. SOIL ACIDITY AND LIMING

### 7.1 Soil acidity

Acid soils are an important issue because of its adverse effect on soil fertility and crop productivity. Geomorphologically acid sulphate soils, peat soils, acid basin clays, terrace soils and hill soils are moderately to strongly acidic in reaction. Apart from soil formation, leaching of basic cations (Ca<sup>2+</sup>, Mg<sup>2+</sup>, K<sup>+</sup> and Na<sup>+</sup>) and continuous use of urea application are the principal causes of soil acidity in this country. Urea acidifies soils through the process of nitrification (NH<sub>4</sub><sup>+</sup> + 2O<sub>2</sub> = NO<sub>3</sub><sup>-</sup> + 2H<sup>+</sup> + H<sub>2</sub>O). Inputs of S as elemental S or as SO<sub>2</sub> from the atmosphere can also produce acidity when they are oxidized: (i) 2S + 3O<sub>2</sub> + 2H<sub>2</sub>O = 2H<sub>2</sub>SO<sub>4</sub>, (ii) 2SO<sub>2</sub> + O<sub>2</sub> + 2H<sub>2</sub>O = 2H<sub>2</sub>SO<sub>4</sub>. When microorganisms decompose soil organic matter they produce CO<sub>2</sub> which dissolves in soil water to form H<sub>2</sub>CO<sub>3</sub> in the same way as in rain. However, soil pH is not easily altered because of inherent buffering capacity which depends on clay and organic matter contents.

It is estimated that soils of 0.108 mha lands across the country are very strongly acidic (pH <4.5), 3.383 mha lands are strongly acidic (pH 4.5-5.5), and 1.114 mha lands are moderately acidic (pH 5.6-6.5) in reaction. Soil acidity is increasing with time. Between 1998 and 2010, the very strongly acid plus strongly acid soils area has increased by 13% (SRDI, 1998 and SRDI, 2010). Acid soils may constraint crop production in more than 30% of lands in this country.

Soil acidity affects crop growth in two ways: directly by acidity effect and indirectly by affecting nutrient availability. Acid soils possess toxic concentration of Al<sup>3+</sup>, Fe<sup>3+</sup> and Mn<sup>2+</sup>, deficient concentrations of P and Mo, and low availability of bases (Ca<sup>2+</sup>, Mg<sup>2+</sup>) which together cause reduction in crop yield. Legumes are highly affected due to soil acidity. Acidity limits both survival and persistence of nodule forming bacteria in soil, and the process of nodulation itself. Soil acidification may intensify and affect crop production if effective management strategies for amelioration are not implemented.

## 7.2 Liming

Liming is done to correct soil acidity. Liming eliminates the toxic effect of Al, Fe and Mn, and increases the availability of P, Mo, Ca and Mg. Liming stimulates mineralization of organic N and fixation of atmospheric N. It improves soil physical conditions e.g. soil structure. Liming is generally practiced for dry land crops e.g. maize, wheat, grain legumes, oil seeds etc. This practice also reduces  $N_2O$  emissions, but this is more than offset by  $CO_2$  emissions from the lime as it neutralizes acidity. Because crop plants vary in their tolerance to acidity and plant nutrients have different optimal pH ranges, target soil pH values could be set at 6.5 -7.0.

Liming materials are calcium carbonate ( $CaCO_3$ ), calcium oxide ( $CaO$ ), calcium hydroxide [ $Ca(OH)_2$ ], magnesium carbonate ( $MgCO_3$ ) and dolomite (dololime). Dololime ( $CaCO_3, MgCO_3$ ) is now commonly used in this country. Wood ash, press mud from sugar mills, lime sludge from paper mills and sludge from water treatment plants can also be used as liming materials.

Liming reactions begin with the neutralization of  $H^+$  in the soil solution by either  $OH^-$  or  $HCO_3^-$  producing from liming materials. The continued removal of  $H^+$  from the soil solution will ultimately result in the precipitation of free aluminium and iron into insoluble hydroxide forms and their replacement on soil exchange sites with basic cations. Consequently, the soil pH increases with increasing percent base saturation. In Bangladesh dolomitic lime,  $CaMg(CO_3)_2$  (called dolochun, imported from Bhutan) is commonly used. Liming increases  $Ca^{2+}$  concentrations in the soil solution and thus increases soil pH through the reaction:

$CaCO_3 + H^+ = Ca^{2+} + CO_2 + H_2O$ . The amount of liming necessary to neutralize soil acidity depends on the soil pH, organic matter and clay contents. Liming should be done for soils having pH below 5.5, the rate could be 1-2 t/ha as dololime. Further liming may not be required within three years.

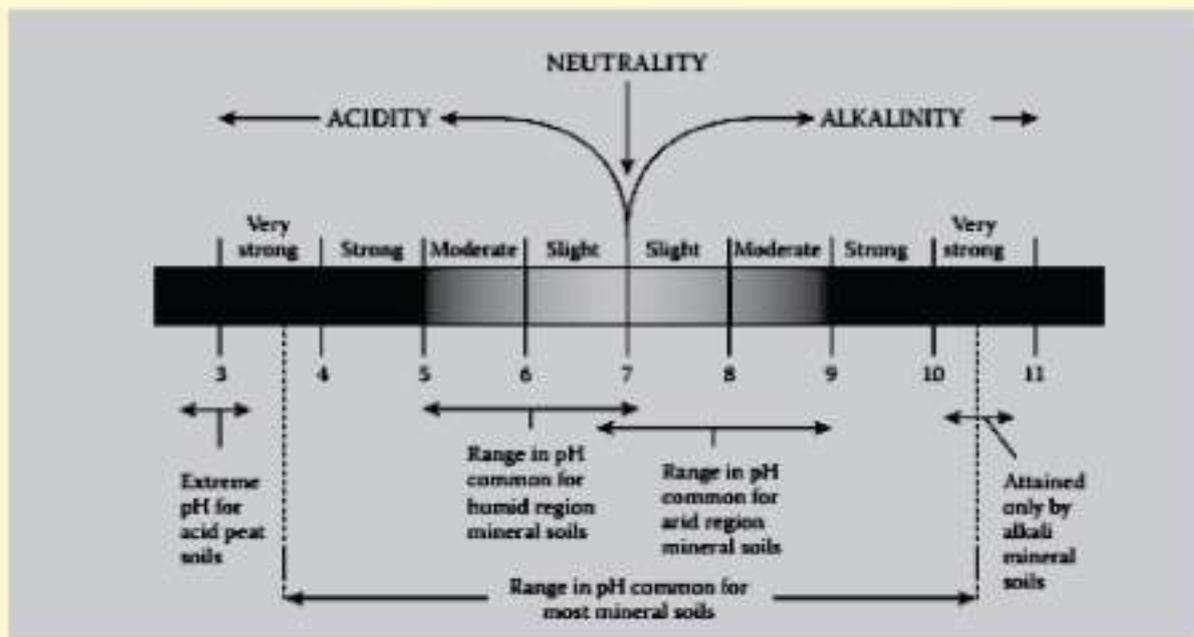


Fig. .... Soil pH interpretation scale for agricultural soils

## 8. FERTILIZER MANAGEMENT FOR DIFFERENT FARMING SYSTEMS

### 8.1 Fertilizer management for multiple cropping system

Multiple cropping is an important practice to minimize risks and increase crop production. The philosophy of multiple cropping is maximizing crop production per unit area with the minimum soil deterioration. As an approach towards planning of resources, multiple cropping is a time dimension land use effort within a calendar year through repeated cropping. It's a labour intensive and highly productive cropping practice which can lead not only to an increased crop production and greater income but also to a more equitable distribution of income and an opportunity for diversified agriculture. Small land holders especially with limited land but high available labour resources can be benefited from multiple cropping.

For intercrops fertilizer recommendations are made on the basis of the intercrop plant population in the field. Usually half or one-third of the recommended rates of fertilizers for a particular crop is recommended depending on the plant population. Examples of fertilizer recommendations for different mixed and intercropping systems are given in section 11.3 of this Guide.

### 8.2 Fertilizer management for conservation agriculture

Conservation agriculture (CA) involves minimum tillage accompanied with crop residue retention and crop rotations. It's an emerging practice in Bangladesh. The CA may bring about following changes in relation to fertilizer management:

- There would be stratification of nutrients in soils
- Soil organic matter may increase due to less decomposition
- Soil moisture retention is increased due to residue cover
- Requirement of N addition may be increased
- Requirement of other nutrients addition may be decreased
- Salt injury of crops may arise due to fertilizer placement in close proximity to seed

A decline in soil disturbance and increase in crop residue retention may favour the accumulation of soil organic matter. The rate of such changes is probably dependent on the amounts of organic matter addition from crop residues.

Nutrient requirement of crops with CA would vary from conventional agriculture. This variation would arise from the less disturbance of the soil under CA. The extent of variation is determined by the degree of reduction in tillage, amount of residue returned to the soil surface and the crops in sequence.

Nitrogen mineralization rate tends to be lower because the soil is not greatly disturbed and the organic residues remain on the surface where decomposition is slower. Hence, there is usually less nitrate in no-tillage unfertilized soil as compared to conventionally tilled soil. Requirement of N addition would be higher for the first few crops since N in the systems tends to be less available under no tillage.

Phosphorus requirement of crops grown under minimum tillage might be lower compared to conventional tillage. The CA helps maintain soil temperature and conserve soil moisture. The amount of P uptake depends mainly on the diffusion of this element. Diffusion of P increases with the soil water content. Therefore, it would be expected that under no-tillage P diffusion rate would be higher than in the conventional tillage.

### 8.3 Fertilizer management in homestead gardening

Homestead gardening is done on a small scale in the backyard or front yard of a house. The basic purpose of homestead gardening is to grow fresh and safe food in a healthy environment for family consumption. Traditionally homestead gardening in Bangladesh is the activity of rural households. The gardening activities are mainly seasonal, where about 70% of vegetables and fruits are produced in the winter, less than 10% of homestead gardens grow vegetables year-round. Helen Keller International initiated a nationwide homestead

gardening program which aimed at encouraging poor households with very limited land to grow vegetables year-round. Home gardening activities are centered on women, thus it creates impact on women empowerment. Home gardening is especially important in overcoming seasonal availability of foods and promoting household self-sufficiency. Home gardening can be a good source of family income and good source of minerals, especially micronutrients (e.g. Zn, Fe) and vitamins (e.g. A & C). Homestead gardens can play a good role to reduce malnutrition as well as poverty.

The OFRD (BARI) has developed nine vegetables production models based on farmers' choice and agro-ecological suitability. The models are known as Goyeshpur model (Pushpopara, Pabna), Syedpur model (Lahirirhat, Rangpur), Palima model (Elenga, Tangail), Ishan Gopalpur model (Hatgobindapur, Faridpur), Narekeli model (Kusumhati, Sherpur), High Barind model (Kadamshahar, Barind, Rajshahi), Golapgonj model (Jalalpur, Sylhet), Lebukhali Model (Rajakhali, Patuakhali) and Atkapalia model (Hazarhat, Noakhali). Fertilizer management is much varied depending on the locations, crops and cropping patterns. Some examples are given below.

### Syedpur model (Lahirirhat, Rangpur)

| Niche/space              |       | Year-round homestead vegetable pattern |                         |                 |
|--------------------------|-------|--|-------------------------|-----------------|
|                          |       | Rabi                                   | Kharif-I                | Kharif-II       |
| 1. Open sunny space      | Bed 1 | Radish                                 | Red amaranth            | Kangkong        |
|                          | Bed 2 | Cabbage                                | Stem amaranth           | Leafy coriander |
|                          | Bed 3 | Brinjal + Red amaranth                 | Indian spinach          | Spinach         |
|                          | Bed 4 | Tomato + Napashak                      | Okra                    | Red amaranth    |
|                          | Bed 5 | Garlic                                 | Leafy jute              | Okra            |
| 2. Roof                  |       | Bottle gourd                           | Ash gourd               | Ash gourd       |
| 3. Trelli                |       | Country bean                           | Sweet gourd/snake gourd | Sweet gourd     |
| 4. Fence                 |       | Bitter gourd/country bean              | Ribbed gourd            | Bitter gourd    |
| 5. Slightly Marshy land  |       | Aroid (Latiraj)                        |                         |                 |
| 6. Marshy land           |       | Water taro (Kalakachu)                 |                         |                 |
| 7. Backyard              |       | Papaya, Banana, Guava, Lemon           |                         |                 |
| 8. Partially shady place |       | Ginger, Turmeric, Moulavi kachu        |                         |                 |

### Lebukhali Model (Rajakhali, Patuakhali)

| Niche/space         |       | Cropping pattern         |                         |                         |
|---------------------|-------|--------------------------|-------------------------|-------------------------|
|                     |       | Rabi                     | Kharif I                | Kharif II               |
| 1. Open sunny space | Bed-1 | Red amaranth + Radish    | Brinjal                 | Brinjal                 |
|                     | Bed-2 | Red amaranth + Nolkhol   | Okra                    | Indian spinach          |
|                     | Bed-3 | Coriander leaf + cabbage | Stem amaranth           | Kangkong                |
|                     | Bed-4 | Red amaranth + Brinjal   | Kangkong                | Kangkong                |
|                     | Bed-5 | Red amaranth + Tomato    | Indian spinach          | Indian spinach          |
| 2. Fence            |       | Bitter gourd             | Yard long bean          | -                       |
| 3. Trellis          |       | Cucumber, Bitter gourd   | Ribbed gourd            | -                       |
| 4. Non-fruit trees  |       | -                        | Sponge gourd/Potato yam | Sponge gourd/Potato yam |
| 5. Pond/ditch slope |       | Bottle gourd             | Bitter gourd            | -                       |
| 6. Shady Place      |       |                          | Turmeric/Mukhikachu     | Turmeric/Mukhikachu     |
| 7. Marshy Land      |       |                          | Aroid (Latiraj)         | Aroid (Latiraj)         |

**Table 5. Fertilizer management for vegetables and fruits in homestead gardens (per dcM or 40 m<sup>2</sup>)**

| Vegetables                | Fertilizer rate (g) and time of application (day) |                 |               |                    |            |               |               |               |       |               |                 |                |
|---------------------------|---|-----------------|---------------|--------------------|------------|---------------|---------------|---------------|-------|---------------|-----------------|----------------|
|                           | Cow dung (kg)                                     | TSP             | Gypsum        | ZnS O <sub>4</sub> | Boric acid | MoP           |               |               | Urea  |               |                 |                |
|                           |   |                 |               |                    |            | Basal         | TD-1*         | TD-2*         | Basal | TD-1*         | TD-2*           | TD-3*          |
| Raddish                   | 30  | 2250            | 400           | 30                 | 50         | 500           | 200           | 200           | 600   | 450           | 450             | -              |
| Tomato                    | 40  | 2000            | 400           | 30                 | 50         | 400           | 300           | 300           | -     | 800           | 700(25)         | 700(40)        |
| Brinjal                   | 40  | 2500            | 400           | 30                 | 50         | 600           | 300           | 300           | -     | 500           | 600 (flowering) | 600 (fruiting) |
| Cabbage                   | 40  | 1500            | 400           | 30                 | 50         | 600           | -             | 400           | -     | 500           | 500(25)         | 600(40)        |
| Bottle gourd              | 60 (pit)  | 1000/ pit       | 200/ pit      | 25/ pit            | 20/ pit    | 200/ pit      | 125/ pit (40) | 125/ pit (70) | -     | 100/ pit (25) | 500(25)         | 600(40)        |
| Bitter gourd              | 40 (4/pit)  | 1250 (125/ pit) | 200 (20/ pit) | 20 (pit 2)         | 10 (pit 1) | 300 (30/ pit) | 12/ pit (30)  | -             | -     | 220 (15)      | 220 (30)        | 220 (55)       |
| Indian spinach            | 20  | 600             | 200           | -                  | -          | 240           | -             | -             | -     | 30(15)        | 250(25)         | 250(35)        |
| Ash gourd and sweet gourd | 60 (pit 10)                                       | 270/ pit        | 40/ pit       | 3/ pit             | -          | 30/ pit       | 45/ pit       | 45/ pit       | -     | 50/ pit (15)  | 70/ pit (35)    | 70/ pit (50)   |
| Red amaranth              | 40  | 600             | 200           | -                  | -          | 240           | -             | -             | 120   | 120 (15)      | -               | -              |
| Stem amaranth             | 60  | 1000            | 250           | 20                 | -          | 600           | -             | -             | 400   | 400           | -               | -              |
| Sponge gourd              | 10/ pit   | 400/ pit        | 200           | 20                 | -          | 40/ pit       | 30/ pit (25)  | 30/ pit (40)  | -     | 50/ pit (15)  | 100/ pit (35)   | 100/ pit (55)  |

TD-1\* = First top dressing; TD-2\* = Second top dressing; TD-3\* = Third top dressing

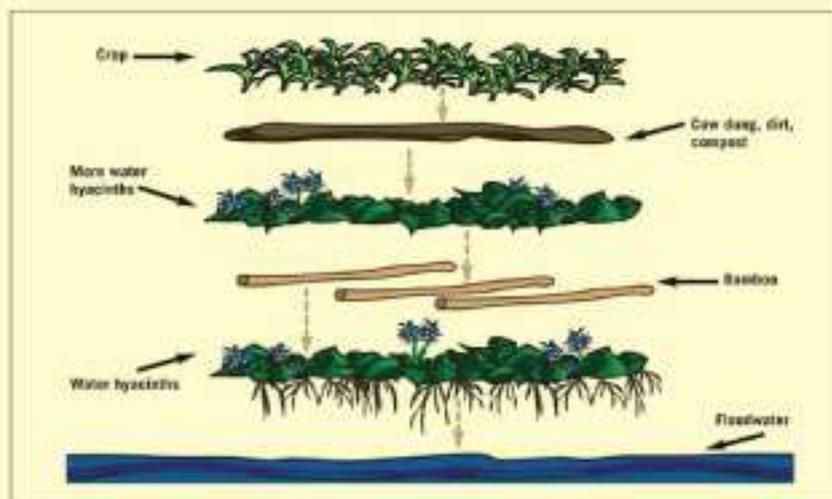
#### 8.4 Fertilizer management for roof top gardening

A roof top garden is a garden on the roof of a building. The practice of cultivating crop on the rooftop of buildings is sometimes referred to as rooftop farming. Hydroponic systems and plantings in containers are used extensively in roof top gardens. In the hydroponic system the plants are grown without soil, using mineral nutrientsolutions. Terrestrial plants may be grown with their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as gravel. The nutrients in hydroponics can come from an array of different sources; these can include but are not limited to byproduct from fish waste, duck manure, or normal nutrients. Some shades are required for some delicate plants like orchids and green leaves. Source of water and clear drainage system are a must. Regular irrigation *i.e.* daily watering is a must in the hot summer days. Shallow-rooted edibles like lettuce, radishes, tomatoes, peppers, straw barriers, herbs, okras, egg plants, beets, carrots and beans are easily produced in different sized containers. Fruit trees like mangoes, litchis, guavas, lemons etc can also be grown in pots, but need large containers. Rooftop gardening is becoming popular day by day with the introduction of the multi-storied building, as in Dhaka city. There are many benefits of rooftop gardening. Apart from food supply, roof plants are beneficial for control of carbon emission and supply of oxygen to the atmosphere and filtering out harmful carbon dioxide from the atmosphere.

### 8.5 Fertilizer management for floating bed

A floating bed is built using aquatic weeds as a bed on which vegetables can be grown. This approach is cheap and sustainable. The base of the raft is often made from water hyacinth where it clogs up water systems and damages the ecosystems and aquaculture within ponds. If water hyacinth is not available other materials can be used such as paddy straw, nalkhagra (a freshwater wetland tree), and any available organic materials such as azolla, coconut straw, bamboo, and old rope. Commonly, the rafts are around 8m long and 2m wide and are around 0.6 to 1m deep. Soil, compost and cowdung are added to cover the base of the raft to a depth of around 25cm. Crops of floating bed include Kang Kong (leafy vegetables), okra (lady's finger), gourd, brinjal (aubergine), pumpkin, and onions. Eventually the raft will decay and cannot be used any longer. The rafts are then broken up and used as compost, usually at the end of the growing season and a new raft is prepared for the next crop.

Floating agriculture can be used in areas where agricultural land is submerged for long periods; the approach is getting widespread in Bangladesh where agricultural land is inundated for extended periods during the monsoon season. In the wetlands of southern Bangladesh, the farmers have developed a floating agricultural practice to cultivate crops in floating bed, made of usually water hyacinth (*Eichhornia crassipes*). They have developed a method similar to hydroponic culture. They construct reasonably sized floating platforms or rafts covered with soil and cowdung on which vegetables and other crops are cultivated. A new raft needs to be built every year, but the old one can be used as fertilizer during dry season. Vegetables, spices and flowers are grown sustainably over the years on floating substratum. Floating platforms are very good for growing vegetables during rainy season and in the winter farmers carry the floating beds on higher grounds; they break it and mix it with soil as a source of organic matter for growing crops. The crops obtain nutrients from floating beds, so fertilizer requirement for crops becomes the minimum. The vegetables grow comparatively faster on floating beds than on normal beds. It is an eco-friendly agriculture system enhancing the environmental value of wetlands.



BARI has suggested the following fertilizer requirement for floating bed (water hyacinth based)

Bed size: 9.15m x 1.3m x 1.2m

**Sweet Gourd (pumpkin);** Var.: BARI Misti Kumra-1, BARI Misti Kumra-2 and others

Yield: 40.0 ± 4.0 t/ha

Nutrient recommendation:

65-36-20-7-1-1 g/10 m<sup>2</sup> of NPKSZnB applied as side dressing at 15, 30, 45, 60, 75, and 90 days after planting.

## **Cucumber**

Yield: 19.6 ± 1.96 t/ha

Nutrient recommendation:

10-4-8-3-0.25-0.125 kg/ha of NPKSZnB applied as basal.

### **8.6 Organic farming**

Conventional agriculture focuses merely on yield benefits with an intensive use of agro-chemical inputs. The global concern over the excessive use of agro-chemicals influences the organic methods of agricultural production. Organic farming is an emerging practice of crop production that concerns not to use pesticides, fertilizers, genetically modified organisms and growth hormones. Among the pesticides, insecticides account for about 80%, and are largely used for vegetables farming. Organic farming system relies on crop rotations, crop residues, animal manures, legumes, green manures, safe off-farm organic wastes and aspects of biological pest control. Advantages of organic farming include recycling of nutrients, sequestration of carbon, reducing chemical pollution of soil & water, promotion of biological diversity and providing safe & healthy food. Nevertheless, it has some disadvantages which could be yield loss, higher price of produce and limited size of market.

Organic farming is quite applicable to homestead gardening which covers a small area. Cereal and forage crops can be grown organically easily due to relatively less pest infestation and also low nutrient requirement. Fruit and vegetable crops present greater challenges. Some pest and disease problems are difficult to manage by organic methods. It is well agreed that neither fertilizer nor manure alone can sustain soil fertility and crop productivity, their integration is essential to achieve sustainable crop yield without incurring loss to soil fertility. Organic farming is a holistic production management system which promotes healthy agro-ecosystem, including biodiversity, biological cycles, and soil biological activity, as opposed to using synthetic materials. To promote organic farming wider participation of policy makers, growers, extension personnel and business people is imperative.

## 9. FERTILIZER MANAGEMENT IN DEGRADED LAND FARMING

Agroecologically there are some disadvantageous areas in this country which include hills, coasts, haors, charlands, peat and piedmonts. The soils in these areas are not productive due to some constraints and the cropping intensity is low. To improve crop yield as well as cropping intensity, an efficient management of soils and crops is essential.

### 9.1 Fertilizer management in hill farming

Hills are mainly concentrated in the Chittagong Hill Tracts (76% of the total hills) which covers three districts: Khagrachari, Rangamati and Bandarban. The major constraints are soil erosion (by heavy downpours in July-August), inadequate irrigation facility, soil acidity, limited volume of soil for root anchorage and low soil organic matter content. Soil erosion causes due to sloppy land and jhum cultivation. Jhum cultivation (shifting cultivation after slash and burning) and deforestation are the predominant form of land degradation. Soil erosion can be reduced by some practices like terracing, contour planting and stubble mulching. Steep slopes should be better left under perennial plants and permanent cover.

Hilly areas fall under the AEZ 29 (Northern and Eastern Hills). Brown Hill soils are the predominant General Soil Types. Fertility levels including soil organic matter are generally low to medium. Field crops are grown in the foot of hills; the crops are mainly cowpea, vegetables (sweet gourd, bitter gourd & cucumber), sugarcane, and rice (T. Aus, T. Aman and Boro). Fertilizer recommendation for crops/cropping patterns is shown in section 11.2 under the AEZ 29.

### 9.2 Fertilizer management in coastal farming

Salinization is the most dominant form of land degradation. The major saline affected districts are Satkhira, Khulna, Pirojpur, Barguna, Patuakhali, Noakhali and Cox's Bazar. This area is relatively flat and suffers from saline soil-water to different degrees. Other environmental challenges include tidal surge, cyclone, acid sulphate soils (located at Sundarbans and Chakaria), water-logging in polder areas, river erosion and unstable atolls.

The coastal and offshore areas include tidal, estuarine and meander floodplains. The tidal floodplain occurs mainly in the south of the Ganges floodplain (49%) and also on large parts of Chittagong coastal plains (6%). Estuarine floodplain occupies about 18% of the coastal area located in greater Noakhali, Barisal, Patuakhali and a smaller area of Chittagong districts.

Both magnitude and extent of soil salinity are increasing with time. The soils of Jessore, Magura, Narail, Faridpur, Gopalganj, Barisal, Jhalakhati and Patuakhali have been newly salinized over 36 years (1973–2009). As estimated by SRDI, the salinity area in 1973 was 0.83 mha, in 2000 was 1.02 mha and in 2009 it became 1.06 mha.

Saline soils have a high content of soluble salts. The EC value of saturated extract is more than 4 dS/m at 25°C, ESP value is less than 15 and the pH value is below 8.5. It is also called white alkali soils. The soluble salts are mostly chlorides and sulphates of Na, Ca and Mg. Bicarbonate and sulphate is dominant in Southern belt and chlorite is dominant in Chittagong belt.

The agricultural production constraints include soil and water (irrigation) salinity, high flooding depth in monsoon season, late draining, heavy soil consistency, poor soil fertility status, high osmotic pressure (causing reduction in absorption of water and nutrients), poor soil structure and cyclonic storm surges. The salinity increases in dry months showing a peak in March-April and decreases in wet months with the minimum in July-August. Growing of salt tolerant crops and varieties, improving drainage system, green manuring and use of mulches could be good options for crop production in this soil. Additional use of 20 kg K/ha and 5 t/ha ash is beneficial for rice crop.

Coastal areas belong to the AEZ 13 (Ganges Tidal Floodplain). Non-calcareous Grey Floodplain soils are the predominant General Soil Types. Fertility level such as the N & P status is very low to low and the K, Zn & B status is low to medium. Field crops viz. rice (Boro & T. Aman), vegetables (brinjal, cabbage, cauliflower, tomato), sunflower, sesame, water melon, mungbean, etc. are grown in the areas. Fertilizer recommendation for cropping patterns is presented in section 11.2 under the AEZ 13.

### 9.3 Fertilizer management in haor farming

About 2.6 mha area is affected by water-logging. It includes bils, jhils, haors and baors. Some examples of bils are Chalan bil, Gopalganj-Khulna bil, Arial bil and Bil Dakatia (located at Khulna-Jessore). Jhils are seen in the southwestern Ganges deltaic parts, for example Bhabadah (Avaynagar, Monirampur and Keshabpur upazilas under Jessore district).

Haors occupy Surma-Kushiyara floodplain and Sylhet basin areas under the two AEZs – Eastern Surma-Kushiyara Floodplain (AEZ 20) and Sylhet Basin (AEZ 21). It extends in Sylhet, Moulavi Bazar, Sunamganj, Habiganj, Netrakona, Kishoreganj and Bhahmanbaria districts (AEZ 21). Some important haors are Hakaluki haor, Tangua haor, Kawadighi haor, Hail Haor and Balai haor.

The major problems related to crop production in these areas are strong soil acidity, heavy soil texture, nutrient deficiency and difficult communication. Soil fertility status such as N, P, K, S & Zn and also organic matter are commonly low to medium. Water-logging restricts aeration of the soil creating an oxygen-free environment in the root zone. Activities of aerobic organisms are ceased and the availability of N, S and Zn is reduced. It is predominantly a single cropped (Boro rice) area; however in many areas T. Aman rice, mustard and some vegetable crops are grown. Fertilizer requirement for cropping patterns is depicted in section 11.2 under the AEZs 20 and 21.

### 9.4 Fertilizer management in char land farming

Char lands occur along the major river systems which have a complex topography. Land instability is a great problem. Other problems include coarse textured soils, low water holding capacity, low nutrient capacity, river bank erosion and flooding. Crops are often lost through active changes in river alignment and complete alteration of landscape at a local level. Char land may emerge either as islands within the river channel or as char attached to the riverbanks. The active floodplain and char land soils occur in the 11 districts: Kurigram, Lalmonirhat, Sirajganj, Pabna, Jamalpur, Manikganj, Faridpur, Shariatpur, Madaripur, Chandpur and Bhola. Burial of standing crops and good agricultural lands pose serious constraints to crop production by fresh sediment of sandy deposits. Coarse textured soils, low water holding capacity and low soil fertility are the major constraints for achieving satisfactory crop yield. It is estimated that around 0.72 mha is char lands; however, it varies depending on the situation (erosion and accretion). Major crops grown in the char lands are maize, groundnut, mustard, sesame, vegetables (brinjal, sweetgourd).

## 10. QUALITY CONTROL OF FERTILIZERS

### 10.1 Fertilizer (Management) Act, 2006 and Fertilizer (Management) Regulation, 2007

The Government of Bangladesh has promulgated the "Fertilizer (Management) Act, 2006". The Government has also promulgated a regulation entitled "Fertilizer (Management) Regulation, 2007" under the Fertilizer (Management) Act, 2006 by a Gazette Notification (SRO No. 92-Law/2007) during May 2007. Regulatory frameworks for commercial production, procurement, import, distribution, storage and marketing of organic and inorganic fertilizers and fertilizer materials have been included in the Act as well as in the Regulation. Penalties and punishment for illegal activities and violation of the rules and regulations in import, distribution, storage and marketing of fertilizers have also been incorporated in the Act.

Heavy/toxic metals in fertilizers are known to deteriorate the quality of fertilizers and may create health hazards of human beings through food chain. Therefore, quality control of fertilizers in respect of heavy/toxic metal content is important. Standards for maximum allowable limits of different heavy/toxic metals for both of organic and inorganic fertilizers have been fixed in the country. Maximum allowable limits of different heavy/toxic metals for the inorganic fertilizers and their raw materials have been fixed and incorporated in the Fertilizer (Management) Regulation, 2007 (Appendix 3). To ensure the quality of organic fertilizers, standard for physical and chemical properties have been fixed along with the maximum allowable limits of different heavy/toxic metals, which have been published as Gazette Notification by MoA during April 2008.

### 10.2 Registration of Fertilizers

The Department of Agriculture Extension (DAE) has been authorized for registration of fertilizers and fertilizer materials in the country. The entrepreneurs, producers and importers must have to take registration of their products for commercial production, import, distribution and marking in the country through certain procedures as described in the Fertilizer (Management) Act, 2006. The National Fertilizer Standardization Committee, headed by the Secretary, Ministry of Agriculture is the authority for standardization of fertilizers and fertilizer materials. The National Fertilizer Standardization Committee performs technical evaluation of fertilizers and fertilizer materials through a technical sub-committee namely "Fertilizer Technical Sub-Committee", in which the Member-Director (NRM), BARC works as the Convenor and the Additional Director (Implementation), Field Service Wing, DAE as the Member Secretary.

Technical evaluation of fertilizers and fertilizer materials, applied for standardization, is done through 'Lab Analysis' in the Govt. notified laboratories and 'Field Trials' in the agricultural research institutes (BARI, BRRI, BINA etc.). The results of lab analysis and field trials are evaluated in the Fertilizer Technical Sub-Committee meetings, and if found satisfactory, are forwarded to the National Fertilizer Standardization Committee with recommendation for approval. The National Committee overviews the results in the meeting and if the committee is satisfied, the product is then approved through Gazette Notification. After approval of the product the entrepreneurs, producers and importers have to take registration for the product for commercial production, import, marketing and distribution in the country from the Department of Agriculture (DAE) through certain procedures as stated in the Fertilizer (Management) Regulation, 2007.

### 10.3 Fertilizer Monitoring

Regular monitoring of fertilizer marketing and fertilizer inspection is essential to ensure the availability of standard and quality fertilizers in the market. The DAE is assigned for monitoring of fertilizers and fertilizer materials in the country. The department is authorized to take legal actions against any illegal activities related to commercial production, import, storage, distribution and marking of fertilizers and fertilizer materials in the country. Post landing inspection of the imported fertilizers and fertilizer materials is done on mandatory basis at different ports (sea port, air port and land ports) before giving entrance of the products in the country. There are altogether 11 ports in the country, in which 11 'Post Landing Inspection Com

mittees' are working. The 'Post Landing Inspection Committees' are headed by the Deputy Directors of DAE of the respective districts. Samples are collected randomly from the imported fertilizers and fertilizer materials and analyzed in the Government notified laboratories. The sub-standard and adulterated products, if found in the laboratory analysis, are prohibited to enter in the country. The DAE also regularly monitors the fertilizers and fertilizer materials that are being produced, stored, distributed, marketed and used in the country. The Inspectors of DAE (UAO/AAO/AEOs etc.) remain vigilant throughout the country round the year, especially during the peak marketing periods. As per the 'Regulation', the Inspectors collect samples, send to the Government notified laboratories for analysis and take regulatory measures for the sub-standard and adulterated products. The Inspectors can issue order to stop selling of any fertilizer for a certain period if found doubtful/adulterated.

The Government notified laboratories play significant role in the quality control of fertilizers and fertilizer materials in the country. There are six Government notified laboratories for fertilizer analysis. The laboratories are Soil Science laboratories of BARI, BRRI, BINA, Department of Soil, Water and Environment, Dhaka University and the laboratories of SRDI and BSTI. In addition, there are three Government notified laboratories particularly for analysis of plant growth regulator (PGR). These are the laboratories of Biochemistry Department of Dhaka University, Biochemistry laboratory of Khulna University of Engineering and Technology (KUET) and the laboratory of Bangladesh Council for Scientific and Industrial Research (BCSIR). As a service laboratory, the laboratories of SRDI play a major role in analyzing fertilizer samples. On an average, the SRDI analyzes about 5000 fertilizer samples every year, received from the field levels mainly through DAE and report annually to the Ministry of Agriculture (MoA) regarding the quality fertilizers used in the country.

#### **10.4 Identification of Adulterated Fertilizers at Field Level**

The most important thing in quality control is the identification of adulterated fertilizers. Simple methods of identification of adulterated fertilizers practicable at the field level have been developed by the SRDI. Through long experience, the SRDI has identified various materials used in adulteration of fertilizers. These materials can easily be identified through qualitative analysis of fertilizer samples using some locally available materials. Following these methods a preliminary idea can be obtained about the quality of fertilizers. To know the degree of adulteration, quantitative analysis must be done in the well-equipped laboratories.

##### **10.4.1 Identification of adulterated Urea**

Adulteration of urea is very rare. In few cases misbranding *i.e.* packaging of other fertilizer in the bag of urea is observed. Urea fertilizer never exists in crystalline form.

For quality testing, pour one teaspoonful of urea into two teaspoonful (10 ml) of water and stir them. Urea will be dissolved quickly and a clear solution will be developed. The solution will be felt cool as urea is hygroscopic. If other materials like lime are mixed with urea it will produce a pungent odour of ammonia gas when dissolved in water.

##### **10.4.2 Identification of adulterated Triple Super Phosphate (TSP)**

Triple Super Phosphate is a widely used phosphatic fertilizer in Bangladesh. It is granular, grey to dark grey in color and contains 20% total P and 17.4% water soluble P with acidic taste. A good quality TSP is strong acidic in taste with pungent smell but adulterated TSP has no acidic taste and pungent smell.

Good quality TSP is little bit hard and cannot be broken by pressing with two thumb nails. On the other hand, adulterated TSP can be broken easily by pressing between the thumb nails. Colour of good quality TSP is found homogenous when broken into pieces, while the colour of adulterated TSP is not homogenous when broken.



**Solution of good quality (left) and adulterated (right) TSP**

To know about the quality, pour one teaspoonful of TSP in 100 ml of water in a beaker or glass and stir them for a few minutes. All the granules of TSP will be dissolved and a clear solution like green coconut water will be developed. On the other hand, a hazy/turbid/muddy solution is developed when adulterated TSP is dissolved in water.

#### **10.4.3 Identification of adulterated Diammonium Phosphate (DAP)**

DAP is a widely used chemical fertilizer in the country, which contains 18% N and 20% total P and 17.8% water soluble P. The DAP is highly soluble in water, having pungent smell and acidic in taste. It is granular and dark grey to white in color. The DAP becomes wet when exposed to air.

Place one to two teaspoonful of DAP fertilizer on a dry paper and keep it open for one to two hours. If it becomes wet, the fertilizer is of good quality but if it does not wet the DAP is adulterated.



For quality testing, pour one teaspoonful of DAP into 100 ml of water in a beaker or glass. The good quality DAP will be dissolved quickly. After dissolution, add half teaspoonful of barium chloride ( $BaCl_2$ ) into the solution. In case of good quality DAP,  $BaCl_2$  will be settled down at the bottom of the beaker or glass. On the other hand, adulterated DAP will produce turbid/muddy/hazy precipitate in the solution due to presence of sulphur.

#### **10.4.4 Identification of adulterated Muriate of Potash (MOP)**

The MOP is one of the most widely used potash fertilizers in Bangladesh. It is light to deep red in colour, crystalline in nature and contains 50% K. It does not have pungent smell or taste.

To know about the quality, pour half teaspoonful of MoP fertilizer into 100 ml of water in a beaker or glass and stir for a few minutes. The good quality MoP will be dissolved totally and almost a clear solution will be produced. But if MoP contains sand, powder of broken glasses, finely ground white rocks/stones or brick chips, these materials will not dissolve and will be settled at the bottom of the container or beaker. This indicates that the fertilizer is adulterated.



**Good quality (left) and adulterated (right) MOP fertilizer**



**Solution of good quality and adulterated MOP fertilizer**

If MoP is mixed with synthetic dye (red or any other color), there will be a layer of colour at the upper surface of the solution when dissolved in water. In such cases, undoubtedly, the MoP is adulterated. The colour will stick on to the finger when dipped into the solution. The good quality MoP will produce light homogenous red colour solution. The colour will not stick on to the finger if deep into the solution.

#### 10.4.5 Identification of adulterated Potassium Sulphate (Sulphate of Potash)

Use of Sulphate of potash (SoP) is increasing progressively in Bangladesh. Sulphate of potash is of large crystalline or powder in form and white in color. It contains 50% K and 17% S. It is less hygroscopic compared to other fertilizers and absorbs less water, for which it has very good shelf life. Usually, SoP is adulterated by mixing it with lime, starch or gypsum.

To know the quality of SoP, pour two teaspoonful of the fertilizer into a small beaker or glass container and add few drops of 10% HCl. Adulterated SoP may produce  $\text{CO}_2$  if it contains lime, but the good quality SoP will not produce any gas.

Pure SoP is comparatively heavier in weight compared to the adulterated SoP.



**Good quality SoP fertilizer**

#### 10.4.6 Identification of adulterated NPKS (Mixed fertilizer)

NPKS is a mixed fertilizer containing N, P, K and S. It is manufactured locally through physical mixing of different fertilizers like DAP, MAP, Ammonium sulphate, TSP, MOP, Gypsum etc. The Government of Bangladesh has approved six grades of NPKS ( $\text{N:P}_2\text{O}_5:\text{K}_2\text{O}:\text{S}$ ) fertilizers for different crops, but only two grades, 8-20-14-5 for rice and 12-15-20-6.5 for wheat are available in the market. Most of the available NPKS mixed fertilizers are highly adulterated. Adulteration is noticed in respect of proportion of different nutrients and mixing of undesirable materials like soil, dolomite or both, synthetic dye etc.

There are wide variations in the nature and degree of adulteration of NPKS mixed fertilizers. So it is difficult to identify adulterated NPKS fertilizer at the field level.

Good quality NPKS fertilizers are heavier than the adulterated NPKS fertilizers.

If adulteration is done by mixing with soil or gypsum along with black coating, the material will be broken down into powder by little pressing between two fingers. The color of outside and inside the granules will not be same or uniform in case of adulterated fertilizers.



NPKS mixed fertilizer

If adulteration is done by mixing with soil or gypsum along with black coating, the material will be broken down into powder by little pressing between two fingers. The color of outside and inside the granules will not be same or uniform in case of adulterated fertilizers.

#### 10.4.7 Identification of adulterated Gypsum

Gypsum is used as a source of S in Bangladesh. It comes out as by-product during production of TSP. Gypsum is amorphous/powder, grey to white in color, contains 16% S and 20% Ca. Gypsum contains comparatively high moisture and for that reason it cannot be preserved for a long time in open place. Gypsum fertilizer is soft and glitters when exposed to sunlight. Usually in rare cases adulteration is observed in gypsum, because of its lower price compared to other fertilizers.

To check its quality, pour one teaspoonful of gypsum into a small beaker or glass or ceramic pot and add 10-15 drops of dilute (10%) HCl. If there is effervescence of  $\text{CO}_2$ , then undoubtedly the gypsum is adulterated. Good quality gypsum will not produce gas or effervescence.

Good quality gypsum is heavier than the adulterated one.



Good quality Gypsum

#### 10.4.8 Identification of adulterated Zinc Sulphate, heptahydrate ( $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ )

Zinc sulphate, heptahydrate is crystalline like sugar. It contains 21% Zn and 10.5% S. The Government of Bangladesh has also approved granular zinc sulphate, heptahydrate for marketing and use in Bangladesh.

Good quality zinc sulphate, heptahydrate must be in crystalline form and friable.

To know about the quality, pour one teaspoonful of zinc sulphate, heptahydrate in 100 ml water in a glass container or beaker and stir. The good quality zinc sulphate will be



Zinc sulphate, heptahydrate



Good quality Zinc sulphate, heptahydrate solution

totally dissolved and no sediment will be found at the bottom of the beaker or glass container. But in case of adulterated zinc sulphate, heptahydrate there will be sediment at the bottom of the beaker or glass container.

Zinc sulphate, heptahydrate is lighter than zinc sulphate, monohydrate in weight.

#### 10.4.9 Identification of adulterated Zinc Sulphate, monohydrate ( $ZnSO_4 \cdot H_2O$ )

Zinc Sulphate, monohydrate must be granular and contains 36% Zn and 17.5% S. Good quality Zinc Sulphate, monohydrate is pale white in color but adulterated zinc sulphate may be milk white in colour.

To know the quality of zinc sulphate, monohydrate, pour one to two teaspoonful of the fertilizer into 100 ml cool water in a glass container or beaker and stir. The fertilizer will not be dissolved fully and will produce turbid solution.

For quality testing, dissolve one to two teaspoonful of zinc sulphate, monohydrate into 100 ml of water in a beaker or glass container, at first some cotton like materials (sediment) will be seen in the whole solution. Allow it for 5-10 minutes, layer of sediment/precipitate will be seen at the surface of the solution. Now add small amount (2g) of sodium carbonate or sodium bicarbonate. A dark turbid solution will be produced. After 5-10 minutes the dark turbid solution will become clear starting from the bottom to the top in case of good quality zinc sulphate, monohydrate and a white layer will be seen at the surface. But in case of adulterated fertilizer, precipitation of  $MgCO_3$  will be seen at the bottom of the beaker or glass container.



Good quality and adulterated Zinc sulphate, mono hydrate solution

#### 10.4.10 Identification of adulterated Chelated Zinc

Chelated zinc is a high quality zinc fertilizer. It is a compound of zinc and organic salt containing 10% Zn. Good quality chelated zinc is yellowish powder or fine crystalline in form and very light in weight. For quality testing, pour one teaspoonful of chelated zinc into 200 ml of cool water in a beaker or glass and stir it. The fertilizer will be dissolved quickly and will produce a clear solution. Add little amount of barium chloride to the clear solution. There will be no precipitation or sedimentation since there is no sulphur. In case of adulterated chelated zinc, when it is poured into cool water, it will not be dissolved quickly. Upon addition of barium chloride white precipitate or sediment will be produced.



Chelated Zinc solution

#### 10.4.11 Identification of adulterated Boron fertilizers

Boric acid and Solubor are used as boron fertilizers in Bangladesh.

**Boric acid** is white, fine crystalline, contains 17% B, dissolves fully in cold water and leaves no sediment in solution at the bottom.

**Solubor** is white, fine powder, light weight, contains 20% B, dissolves fully in cold water and leaves no sediment in solution at the bottom.

For quality testing of 'Boric acid' and 'Solubor', pour one teaspoonful of boric acid or solubor into a beaker or glass containing 100 ml clear cold water and stir. Both the fertilizers will be dissolved quickly and will produce clear solution with no precipitation. Add small amount (2 g) of barium chloride into the solution. If the fertilizers are adulterated with 'sodium sulphate' (usually used), a white turbid/sediment like milk will be produced.

Boric acid is heavier in weight than solubor.



Adulterated and good quality  
Boric acid solution



Adulterated and good quality  
Solubor solution

#### 10.4.12 Identification of adulterated Organic fertilizer

Organic fertilizers are produced through decomposition of organic materials of plant and animal origin. The government of Bangladesh has approved the standard specification of organic fertilizer with certain physical and chemical properties through a Gazette Notification by the Ministry of Agriculture on 02 April 2008. As per notification the organic fertilizer should be-

- non-granular in form
- dark grey to black in colour
- odorless
- devoid of bad smell

A good quality organic fertilizer does not form clod when press in hand. These are the qualitative/physical properties of a standard organic fertilizer. By checking these properties preliminary idea about the quality of an organic fertilizer can be obtained. But it is not possible to be sure about the quality without chemical analysis in the laboratory.

## 11. FERTILIZER RECOMMENDATION FOR CROPS

### 11.1 Fertilizer Recommendation for Different Crops

Soil analysis, if properly done and rightly interpreted in relation to crop response, can be used as an effective tool for location specific and yield goal basis fertilizer recommendation. Like previous two guides, the soil test values are also interpreted into 6 categories in this guide based on critical limit (C.L.) along with their corresponding expected crop yield response for making more realistic fertilizer recommendation (Table 3 & Fig. 7). In this guide, fertilizer recommendations are suggested for the high yield goal of a crop from very low to optimum level of soil test values. Fertilizer recommendation is not suggested when soil test value goes beyond optimum level i.e. ranges between high and very high categories. Example of making location specific fertilizer recommendation for crops (e.g. wheat) and cropping patterns on the basis of soil test value, yield goal and rationales are given in Appendix 10.

In compliance with the Govt. policy of achieving self sufficiency in food, fertilizer recommendations have been provided in this guide targeting high yield goal. However, if a farmer is unable to afford the cost of fertilizers required for achieving high yield, he can be advised to reduce the rate of each required fertilizer by 30% so that balanced fertilization is made to achieve a moderate yield, which is assumed to be around 80% of the high yield goal.

This section of Fertilizer Recommendation Guide provides guidelines for achieving high yield goal based fertilizer recommendation for different crops like cereals, fibres, pulses, oil seeds, roots and tubers, vegetables, spices, fruits, flowers and plantation crops. If soil test values of a field are available, specific fertilizer dose for that particular field can be calculated using the formula and procedures described in Appendix 9.

## II FERTILIZER RECOMMENDATION FOR CROPS

### 11.1 Fertilizer Recommendation For Different Crops

#### 11.1.1 Cereal Crops

#### RICE (*Oryza sativa* L.)

##### Boro rice

(Var: BRRI dhan29, BRRI dhan58, BRRI dhan59, BRRI dhan60, BRRI dhan68, BRRI dhan69, BRRI dhan74, Binadhan-6, Binadhan-18 and BRRI hybrid dhan2, BRRI hybrid dhan3 and BRRI hybrid dhan5)

Yield Goal:  $7.5 \pm 0.75$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |
|------------------------------|---------------------------------|-------|---------|-------|---------|
|                              | N                               | P     | K       | S     | Zn      |
| Optimum                      | 0-60                            | 0-8   | 0-38    | 0-6   | -       |
| Medium                       | 61-120                          | 9-16  | 39-76   | 7-12  | 0.0-1.3 |
| Low                          | 121-180                         | 17-24 | 77-114  | 13-18 | 1.4-2.6 |
| Very low                     | 181-240                         | 25-32 | 115-152 | 19-24 | 2.7-3.9 |

(Var: BR14, BR16, BR17, BR18, BR19, BR26, BRRI dhan28, BRRI dhan45, BRRI dhan47, BRRI dhan50, BRRI dhan61, BRRI dhan63, BRRI dhan64, BRRI dhan67, Binadhan-5, Binadhan-6, and Binadhan-8, Binadhan-10, Binadhan-14)

Yield Goal:  $6.0 \pm 0.6$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |
|------------------------------|---------------------------------|-------|--------|-------|---------|
|                              | N                               | P     | K      | S     | Zn      |
| Optimum                      | 0-48                            | 0-7   | 0-30   | 0-4   | -       |
| Medium                       | 49-96                           | 8-14  | 31-60  | 5-8   | 0.0-1.0 |
| Low                          | 97-144                          | 15-21 | 61-90  | 9-12  | 1.1-2.0 |
| Very low                     | 145-192                         | 22-28 | 91-120 | 13-16 | 2.1-3.0 |

(Var: BR1, BR2, BR7, BR15, and BRRI dhan36, Binadhan-8 and Binadhan-10)

Yield Goal:  $5.0 \pm 0.50$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |
|------------------------------|---------------------------------|-------|--------|-------|---------|
|                              | N                               | P     | K      | S     | Zn      |
| Optimum                      | 0-40                            | 0-6   | 0-25   | 0-4   | -       |
| Medium                       | 41-80                           | 7-12  | 26-50  | 5-8   | 0.0-0.8 |
| Low                          | 81-120                          | 13-18 | 51-75  | 9-12  | 0.9-1.6 |
| Very low                     | 121-160                         | 19-24 | 76-100 | 13-16 | 1.7-2.4 |

### Method of fertilizer application:

- In general, all of P, K, S and Zn fertilizers should be applied as basal during final land preparation. S and Zn can be topdressed if needed (depending on symptom).
- For light textured soils, half of K should be applied as basal and the rest half should be applied with last N topdressing.
- N should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.
- Under direct seeded culture fertilizer should be applied in two equal splits, the first one as basal and the second one at maximum tillering stage; and should be mixed thoroughly with the soil as soon as possible for better utilization.

For use of urea super granules (USG) or urea mega granules (UMG) as the source of N, the method of application should be properly followed as described in page 51.

## Aus rice

(Var. BR1, BR2, BR14, BR16, BR26, BRRI dhan27, BRRI dhan48 and Binadhan-19)

Yield Goal:  $4.0 \pm 0.4$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0–32                            | 0–4   | 0–20  | 0–3   | –       |
| Medium                       | 33–64                           | 5–8   | 21–40 | 4–6   | 0.0–0.7 |
| Low                          | 65–96                           | 9–12  | 41–60 | 7–9   | 0.8–1.4 |
| Very low                     | 97–128                          | 13–16 | 61–80 | 10–12 | 1.5–2.1 |

(Transplant Var. BR6, BR7 and BR24, BRRI dhan65)

(Direct Seeded Var. BRRI dhan42 and BRRI dhan43)

Yield Goal:  $3.5 \pm 0.35$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0–22                            | 0–4   | 0–15  | 0–3   | –       |
| Medium                       | 23–44                           | 5–8   | 16–30 | 4–6   | 0.0–0.6 |
| Low                          | 45–66                           | 9–12  | 31–45 | 7–9   | 0.7–1.2 |
| Very low                     | 67–88                           | 13–16 | 46–60 | 10–12 | 1.3–1.8 |

Method of fertilizer application: As described above

## B. Aman rice

(Var. LIV under Broadcast Culture)

Yield Goal:  $2.5 \pm 0.25$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |     |         |
|------------------------------|---------------------------------|-------|-------|-----|---------|
|                              | N                               | P     | K     | S   | Zn      |
| Optimum                      | 0-12                            | 0-3   | 0-10  | 0-2 | -       |
| Medium                       | 13-24                           | 4-6   | 11-20 | 3-4 | 0.0-0.5 |
| Low                          | 25-36                           | 7-9   | 21-30 | 5-6 | 0.6-1.0 |
| Very low                     | 37-48                           | 10-12 | 31-40 | 7-8 | 1.1-1.5 |

## T. Aman rice

(Var: BR 11, BR 22, BR 23, BRR I dhan40, BRR I dhan41, BRR I dhan44, BRR I dhan46, BRR I dhan49, BRR I dhan51, BRR I dhan52, BRR I dhan53, BRR I dhan54, BRR I dhan56, BRR I dhan62, BRR I dhan66, BRR I dhan70, BRR I dhan71, BRR I dhan72, BRR I dhan73, BRR I dhan75, BRR I dhan76, BRR I dhan78, BRR I dhan79, BRR I dhan80, BRR I hybrid dhan4, BRR I hybrid dhan6 and Binadhan-4, Binadhan-7, Binadhan-11, Binadhan-12, Binadhan-15, Binadhan-16, Binadhan-17, Binadhan-20 )

Table 1. Yield Goal:  $5.0 \pm 0.5$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |
|------------------------------|---------------------------------|-------|--------|-------|---------|
|                              | N                               | P     | K      | S     | Zn      |
| Optimum                      | 0-30                            | 0-5   | 0-25   | 0-4   | -       |
| Medium                       | 31-60                           | 6-10  | 26-50  | 5-8   | 0.0-0.8 |
| Low                          | 61-90                           | 11-15 | 51-75  | 9-12  | 0.9-1.6 |
| Very low                     | 91-120                          | 16-20 | 76-100 | 13-16 | 1.7-2.4 |

(Var: BR25, BRR I dhan33, BRR I dhan34, BRR I dhan37, BRR I dhan38, BRR I dhan39, BRR I dhan56, BRR I dhan57 and Binadhan-12, Binadhan-13

Table 1. Yield Goal:  $4.0 \pm 0.4$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0-24                            | 0-4   | 0-20  | 0-3   | -       |
| Medium                       | 25-48                           | 5-8   | 21-40 | 4-6   | 0.0-0.7 |
| Low                          | 49-72                           | 9-12  | 41-60 | 7-9   | 0.8-1.4 |
| Very low                     | 73-96                           | 13-16 | 61-80 | 10-12 | 1.5-2.1 |

Method of fertilizer application: Please follow the methods as described in page – 76

(Variety: BR5, Binadhan-9;  
LIV: Kataribhog, Kalijira, Chinigura etc.

Table 1. Yield Goal:  $3.0 \pm 0.3$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0-18                            | 0-3   | 0-15  | 0-3   | -       |
| Medium                       | 19-36                           | 4-6   | 16-30 | 4-6   | 0.0-0.6 |
| Low                          | 37-54                           | 7-9   | 31-45 | 7-9   | 0.7-1.2 |
| Very low                     | 55-72                           | 10-12 | 46-60 | 10-12 | 1.3-1.8 |

Method of fertilizer application: As described in page 75

#### Fertilizer Recommendation for Seedbed

Usually, fertilizer application is not required for rice seedbed. For low fertile soils, manure at the rate of 2 kg/m<sup>2</sup> can be applied. In case of Sulphur deficiency gypsum should be applied at the rate of 10 g/m<sup>2</sup> as topdress. Yellow colored seedlings due to cold injury in boro season cannot be recovered by N or S topdressing, rather the seedbed should be covered with transparent polythene.

## WHEAT (*Triticum aestivum*)

[Var: BARI Gom-25, BARI Gom-27, BARI Gom-28, BARI Gom-29, BARI Gom-30, BARI Gom-31, BARI Gom-32, BARI Gom-33, BARI Tritically-1, BARI Tritically-2 and Binagom-1]

**Yield Goal: 4.5 ± 0.45 t/ha (Irrigated culture)**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |      |         |         |
|------------------------------|---------------------------------|-------|--------|-------|------|---------|---------|
|                              | N                               | P     | K      | S     | Mg   | Zn      | B       |
| Optimum                      | 0-40                            | 0-8   | 0-30   | 0-5   | -    | -       | -       |
| Medium                       | 41-80                           | 9-16  | 31-60  | 6-10  | 0-4  | 0.0-1.3 | 0.0-0.7 |
| Low                          | 81-120                          | 17-24 | 61-90  | 11-15 | 4-8  | 1.4-2.6 | 0.8-1.4 |
| Very low                     | 121-160                         | 25-32 | 91-120 | 16-20 | 7-12 | 2.7-3.9 | 1.5-2.1 |

**Yield Goal: 2.5 ± 0.25 t/ha (Rainfed culture)**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |          |     |         |         |
|------------------------------|---------------------------------|-------|-------|----------|-----|---------|---------|
|                              | N                               | P     | K     | S        | Mg  | Zn      | B       |
| Optimum                      | 0-15                            | 0-5   | 0-12  | 0-2.5    | -   | -       | -       |
| Medium                       | 16-30                           | 6-10  | 13-24 | 2.6-5.0  | -   | -       | 0.0-0.5 |
| Low                          | 31-45                           | 11-15 | 25-36 | 5.1-7.5  | 0-4 | 0.0-1.5 | 0.6-1.0 |
| Very low                     | 46-60                           | 16-20 | 37-48 | 7.6-10.0 | 4-8 | 1.6-3.0 | 1.1-1.5 |

### Method of application (Irrigated culture):

- a) Two-third of the N and all of P, K, S, Mg, Zn, B and organic manure (if used) should be applied as basal during final land preparation.
- b) Remaining one-third of N should be applied at 17-21 days after sowing (DAS) after first irrigation.
- c) Application of organic fertilizer (OF) at the rate of 3 t/ha is recommended; if applied the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

### Method of application (Rainfed culture):

- a) All fertilizers should be applied as basal during final land preparation.
- b) One-third N (additional to basal) of the recommended rate for wheat cultivation under irrigated condition should be applied once if the crop gets a rain in between 17-40 DAS.
- c) Application of OF at the rate of 2.5 t/ha is recommended; if applied the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

## MAIZE (*Zea mays*)

(Hybrid Varieties: BARI Hybrid Bhutta-3, BARI Hybrid Bhutta-5, BARI Hybrid Bhutta-6, BARI Hybrid Bhutta-7, BARI Hybrid Bhutta-8, BARI Hybrid Bhutta-9, BARI Hybrid Bhutta-10 and BARI Hybrid Bhutta-11, BARI Hybrid Bhutta-12, BARI Hybrid Bhutta-13, BARI Mistibhutta-1)

**Yield Goal: 10.0 ± 1.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |       |         |         |
|------------------------------|---------------------------------|-------|---------|-------|-------|---------|---------|
|                              | N                               | P     | K       | S     | Mg    | Zn      | B       |
| Optimum                      | 0-75                            | 0-20  | 0-40    | 0-15  | 0-5   | -       | -       |
| Medium                       | 76-150                          | 21-40 | 41-80   | 16-30 | 6-10  | 0.0-2.0 | 0.0-0.8 |
| Low                          | 151-225                         | 41-60 | 81-120  | 31-45 | 11-15 | 2.1-4.0 | 0.9-1.6 |
| Very low                     | 226-300                         | 61-80 | 121-160 | 46-60 | 16-20 | 4.1-6.0 | 1.7-2.4 |

(OP Varieties, BARI Bhutta-5, BARI Bhutta-6 and BARI Bhutta-7, Khaibhutta, Moharbhutta)

**Yield Goal: 6.0 ± 0.6 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |       |         |         |
|------------------------------|---------------------------------|-------|-------|-------|-------|---------|---------|
|                              | N                               | P     | K     | S     | Mg    | Zn      | B       |
| Optimum                      | 0-45                            | 0-12  | 0-24  | 0-9   | -     | -       | -       |
| Medium                       | 46-90                           | 13-24 | 25-48 | 10-18 | 0-5   | 0.0-1.4 | 0.0-0.7 |
| Low                          | 91-135                          | 25-36 | 49-72 | 19-27 | 6-10  | 1.5-2.8 | 0.8-1.4 |
| Very low                     | 136-180                         | 37-48 | 73-96 | 28-36 | 11-15 | 2.9-4.2 | 1.5-2.1 |

### Method of application:

- a) The above doses of nutrients are applicable to maize grown in rabi season. The doses may be reduced by 30% when the crop is grown in kharif season.
- b) One-third of N and all of P, K, S, Mg, Zn and B should be applied during sowing in 7-10 cm deep furrows (5-8 cm apart from the maize rows) and covered with the soil.
- c) In rabi season, remaining N should be applied in two equal splits as side dressing in maize rows at 8-10 leaf stage (30-35 DAS) and at tasselling stage (50-60 DAS) and mixed thoroughly with the soil as soon as possible for better utilization.
- d) In kharif season, N should also be applied in two equal splits as side dressing in maize rows at 8-10 leaf stage (20-25 DAS) and at tasselling stage (45-50 DAS) and mixed thoroughly with the soil as soon as possible for better utilization.
- e) Application of OFat the rate of 3 t/ha is recommended; if applied the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

## BARLEY (*Hordeum vulgare*)

(Var. BARI Barley-1, BARI Barley-2, BARI Barley-3, BARI Barley-4, BARI Barley-5, BARI Barley-6, and BARI Barley-7)

Yield Goal:  $3.0 \pm 0.3$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0-20                            | 0-7   | 0-15  | 0-3   | -       |
| Medium                       | 21-40                           | 8-14  | 16-30 | 4-6   | 0.0-1.0 |
| Low                          | 41-60                           | 15-21 | 31-45 | 7-9   | 1.1-2.0 |
| Very low                     | 61-80                           | 22-28 | 46-60 | 10-12 | 2.1-3.0 |

## PROSO MILLET (*Panicum miliaceum*)

[Var. BARI Cheena-1(Tushar)]

Yield Goal:  $2.5 \pm 0.25$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0-20                            | 0-7   | 0-15  | 0-3   | -       |
| Medium                       | 21-40                           | 8-14  | 16-30 | 4-6   | 0.0-1.0 |
| Low                          | 41-60                           | 15-21 | 31-45 | 7-9   | 1.1-2.0 |
| Very low                     | 61-80                           | 22-28 | 46-60 | 10-12 | 2.1-3.0 |

## FOXTAIL MILLET (*Setaria italica*)

(Var. Titas, BARI Kaon-2, and BARI Kaon-3)

Yield Goal:  $3.0 \pm 0.3$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0-20                            | 0-8   | 0-14  | 0-3   | -       |
| Medium                       | 21-40                           | 9-16  | 15-28 | 4-6   | 0.0-1.0 |
| Low                          | 41-60                           | 17-24 | 29-42 | 7-9   | 1.1-2.0 |
| Very low                     | 61-80                           | 25-32 | 43-56 | 10-12 | 2.1-3.0 |

### Method of application

- Half of N and all of P, K, S, and Zn should be applied as basal during final land preparation.
- Remaining N should be applied as topdress in two equal splits after irrigation at 55-60 DAS for barley and foxtail millet and 30-35 DAS for proso millet.
- Under rainfed culture all fertilizers should be applied as broadcast during final land preparation.

## 11.1.2 Fibre Crops

### JUTE (*Corchorus capsularis*)

[Var. CVL-1, CVE-3, CC-45, BJRI Deshi-5 (BJC-7370), BJRI Deshi-6 (BJC-83), BJRI Deshi-7 (BJC-2142, only for Faridpur region), Binadeshi pat-2 & Atompat-38]

Yield Goal (Yield:  $3.5 \pm 0.35$  t/ha)

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|
|                              | N                               | P     | K     | S     | Zn      |
| Optimum                      | 0-25                            | 0-4   | 0-20  | 0-5   | -       |
| Medium                       | 26-50                           | 5-8   | 21-40 | 6-10  | 0.0-1.5 |
| Low                          | 51-75                           | 9-12  | 41-60 | 11-15 | 1.6-3.0 |
| Very low                     | 76-100                          | 13-16 | 61-80 | 16-20 | 3.1-4.5 |

### JUTE (*Corchorus olitorius*)

[Var. O-9897, OM-1 and BJRI Tossa-4 (O-72)]

Yield Goal:  $4.5 \pm 0.45$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |
|------------------------------|---------------------------------|-------|--------|-------|---------|
|                              | N                               | P     | K      | S     | Zn      |
| Optimum                      | 0-30                            | 0-5   | 0-25   | 0-8   | -       |
| Medium                       | 31-60                           | 6-10  | 26-50  | 9-16  | 0.0-2.0 |
| Low                          | 61-90                           | 11-15 | 51-75  | 17-24 | 2.1-4.0 |
| Very low                     | 91-120                          | 16-20 | 76-100 | 25-32 | 4.1-6.0 |

#### Method of application

- Half of N and all of P, K, S, Zn and organic fertilizer (if used) should be applied as basal during final land preparation.
- Remaining N should be top dressed at 40-45 DAS under moist soil condition.
- Application of 3 t/ha organic fertilizer is recommended; if applied the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

**KENAF (*Hibiscus cannabinus*)**  
(Var. HC-2, HC-95 and BJRI Kenaf-3) and

**MESTA (*Hibiscus sabdariffa*)**  
(Var. HS-24)

Yield Goal: 4.5 ± 0.45 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |
|------------------------------|---------------------------------|-------|-------|-------|
|                              | N                               | P     | K     | S     |
| Optimum                      | 0-30                            | 0-5   | 0-20  | 0-8   |
| Medium                       | 31-60                           | 6-10  | 21-40 | 17-16 |
| Low                          | 61-90                           | 11-15 | 41-60 | 17-24 |
| Very low                     | 91-120                          | 16-20 | 61-80 | 25-32 |

Method of application: Same as for jute

**LATE JUTE SEED PRODUCTION**

**JUTE (*Corchorus capsularis*)**

Var. CVL-1, CVE-3, CC-45, BJRI Deshi Pat-5 (BJC-7370), BJRI DeshiPat-6 (BJC-83) and BJRI DeshiPat-7 (BJC-2142, only for Faridpur region)

**JUTE (*Corchorus olitorius*)**

Var. O-9897, OM-1, BJRI Tossa-4 (O-72)

Yield Goal (Seed): 700-1000 kg/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       |
| Optimum                      | 0-35                            | 0-8   | 0-12  | 0-5   | -       | -       |
| Medium                       | 36-70                           | 9-16  | 13-24 | 6-10  | 0.0-2.0 | 0.0-1.0 |
| Low                          | 71-110                          | 17-24 | 25-36 | 11-15 | 2.1-4.0 | 1.1-2.0 |
| Very low                     | 111-140                         | 25-32 | 37-48 | 16-20 | 4.1-6.0 | 2.1-3.0 |

**Method of application:**

- All of phosphorus, potassium, sulphur, Zinc, boron and organic manure (if used) should be applied as basal during final land preparation.
- Nitrogen fertilizer should be applied as topdress in three equal splits, the first one last one-third at 40-45- DAS
- Application of 3-5 t/ha organic manure (cowdung/poultry manure) is recommended, In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

**KENAF (*Hibiscus cannabinus*)**

Var. HC-2, HC-95 and BJRI Kenaf-3

**and**

**MESTA (*Hibiscus sabdariffa*)**

Var. HS-24

**Yield Goal (Seed): 600-1000kg/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |           |         |         |
|------------------------------|---------------------------------|-------|-------|-----------|---------|---------|
|                              | N                               | P     | K     | S         | Zn      | B       |
| Optimum                      | 0-30                            | 0-6   | 0-10  | 0.0-4.0   | -       | -       |
| Medium                       | 31-60                           | 7-12  | 11-20 | 4.1-8.0   | 0.0-2.0 | 0.0-1.0 |
| Low                          | 61-90                           | 13-18 | 21-30 | 8.1-12.0  | 2.1-4.0 | 1.1-2.0 |
| Very low                     | 91-120                          | 19-24 | 31-40 | 12.1-16.0 | 4.1-6.0 | 2.1-3.0 |

**Method of application:**

- All of P, K, S, Zn, OF (if used) should be applied as basal during final land preparation.
- N fertilizer should be applied as topdress in three equal splits at final land preparation, 20-25 DAS and 40-45 DAS.
- Application of 3 t/ha OF is recommended; if applied the dose of N, P, K, and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

## COTTON (*Gossypium herbaceum*)

Var. CB-9, CB-10 and others

**Yield Goal: 2.25± 0.23 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |         | Organic fertilizer (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|---------|---------------------------|
|                              | N                               | P     | K      | S     | Zn      | B       |                           |
| Optimum                      | 0-30                            | 0-12  | 0-25   | 0-6   | -       | -       | 3                         |
| Medium                       | 31-60                           | 13-24 | 26-50  | 7-12  | 0.0-1.5 | 0-0.5   |                           |
| Low                          | 61-90                           | 25-36 | 51-75  | 13-18 | 1.6-3.0 | 0.6-1.0 |                           |
| Very low                     | 91-120                          | 37-48 | 76-100 | 19-24 | 3.1-4.5 | 1.1-1.5 |                           |

(Var. CB-12, CB-13, CB-14.)

**Yield Goal: 2.70± 0.27 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |     |         |       | Organic fertilizer (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|-----|---------|-------|---------------------------|
|                              | N                               | P     | K       | S     | Zn  | B       | Mg    |                           |
| Optimum                      | 0-40                            | 0-15  | 0-45    | 0-8   | -   | -       | 0-5   | 3                         |
| Medium                       | 41-80                           | 16-30 | 46-90   | 9-16  | 0-2 | 0.0-1.0 | 6-10  |                           |
| Low                          | 81-120                          | 31-45 | 91-135  | 17-24 | 3-4 | 1.1-2.0 | 11-15 |                           |
| Very low                     | 121-160                         | 46-60 | 136-180 | 25-32 | 5-6 | 2.1-3.0 | 16-20 |                           |

### Method of application

- a) As basal: All of FYM should be applied as basal during final land preparation. Of the recommended inorganic fertilizer nutrients, 10% of N, 75% of P, 15% of K, 30% of S and 10% of B should be applied during sowing in 7-10 cm deep furrows 5-8 cm apart from the seed rows and covered with the soil.
- b) For growing crop: Fertilizers should be applied in four installments. Of the recommended inorganic fertilizer nutrients -
  - 20% of N, 15% of K and 30% of Zn should be applied as side dressing during 20-25 days after sowing (DAS).
  - 25% of N, 25% of P, 30% of K, 40% of S, 40% of Zn and 50% of B should be applied as side dressing during 40-45 DAS.
  - 30% of N, 30% of K, 30% of S, 30% of Zn and 40% of B should be applied as side dressing during 60-65 DAS.
  - 15% of N and 10% of K should be applied as side dressing during 75-80 DAS.
  - After application the fertilizers should be mixed thoroughly with the soil as soon as possible for better utilization.

## COTTON (*Gossypium herbaceum*)

(Var. Rupali-1, DM-2 and DM-3)

Yield Goal: 3.6± 0.36 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |     |         |       | FYM |
|------------------------------|---------------------------------|-------|---------|-------|-----|---------|-------|-----|
|                              | N                               | P     | K       | S     | Zn  | B       | Mg    |     |
| Optimum                      | 0-45                            | 0-15  | 0-50    | 0-8   | -   | -       | 0-5   | 3   |
| Medium                       | 46-90                           | 16-30 | 51-100  | 9-16  | 0-2 | 0.0-1.0 | 6-10  |     |
| Low                          | 91-135                          | 31-45 | 101-150 | 17-24 | 3-4 | 1.1-2.0 | 11-15 |     |
| Very low                     | 136-180                         | 46-60 | 151-200 | 25-32 | 5-6 | 2.1-3.0 | 16-20 |     |

Method of application: Same as for the varieties CB-9 and CB-10.

### 11.1.3 Pulse Crops

#### LENTIL (*Lens culinaris*)

(Var. BARI Masur-3, BARI Masur-4, BARI Masur-5, BARI Masur-6, BARI Masur-7, BARI Masur-8, Binamasur-2, Binamasur-3, Binamasur-4, Binamasur-5 and Binamasur-6, Binamasur-7, Binamasur-8, Binamasur-9, Binamasur-10)

Yield Goal:  $1.8 \pm 0.18$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       | Mo      |
| Optimum                      | 0-7                             | 0-6   | 0-7   | 0-3   | -       | -       | -       |
| Medium                       | 8-14                            | 7-12  | 8-14  | 4-6   | 0.0-1.0 | 0.0-0.6 | 0-0.4   |
| Low                          | 15-21                           | 13-18 | 15-21 | 7-9   | 1.1-2.0 | 0.7-1.2 | 0.5-0.8 |
| Very low                     | 22-28                           | 19-24 | 22-28 | 10-12 | 2.1-3.0 | 1.3-1.8 | 0.9-1.2 |

#### CHICKPEA (*Cicer arietinum*)

(Var. BARI Chola-2, BARI Chola-3, BARI Chola-4, BARI Chola-5, BARI Chola-6, BARI Chola-7, BARI Chola-9, BARI Chola-10, Binasola-6, Binasola-7, Binasola-8, Binasola-9, Binasola-10 etc.)

Yield Goal:  $2.0 \pm 0.2$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       | Mo      |
| Optimum                      | 0-9                             | 0-6   | 0-8   | 0-4   | -       | -       | -       |
| Medium                       | 10-18                           | 7-12  | 9-16  | 5-8   | 0.0-1.0 | 0.0-0.6 | 0-0.4   |
| Low                          | 19-27                           | 13-18 | 17-24 | 9-12  | 1.1-2.0 | 0.7-1.2 | 0.5-0.8 |
| Very low                     | 28-36                           | 19-24 | 25-32 | 13-16 | 2.1-3.0 | 1.3-1.8 | 0.9-1.2 |

#### Method of application

- All fertilizers should be applied as basal during final land preparation.
- Rhizobium inoculum (at the rate of 50 g/kg seed or 1.5 kg/ha) must be used if available and in that case N fertilizer should not be used.

## MUNGBEAN (*Vigna radiata*)

(Var. BARI Mung-2, BARI Mung-3, BARI Mung-4, BARI Mung-5, BARI Mung-6, BARI Mung-7, BARI Mung-8, Binamoog-5, Binamoog-6, Binamoog-7, Binamoog-8, Binamoog-9, BAU Mung-1, BU Mung-1, BU Mung-2 and BU Mung-4)

Yield Goal:  $2.0 \pm 0.2$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       | Mo      |
| Optimum                      | 0-6                             | 0-6   | 0-8   | 0-4   | -       | -       | -       |
| Medium                       | 7-12                            | 7-12  | 9-16  | 5-8   | 0.0-1.0 | 0.0-0.6 | 0-0.4   |
| Low                          | 13-18                           | 13-18 | 17-24 | 9-12  | 1.1-2.0 | 0.7-1.2 | 0.5-0.8 |
| Very low                     | 19-24                           | 19-24 | 25-32 | 13-16 | 2.1-3.0 | 1.3-1.8 | 0.9-1.2 |

Method of application: Same as Lentil and Chickpea

## BLACKGRAM (*Vigna mungo*)

(Var. BARI Mash-1, BARI Mash-2, BARI Mash-3, BARI Mash-4, and BINAmash-1)

Yield Goal:  $1.5 \pm 0.15$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |
|------------------------------|---------------------------------|-------|-------|-------|
|                              | N                               | P     | K     | S     |
| Optimum                      | 0-6                             | 0-5   | 0-6   | 0-3   |
| Medium                       | 7-12                            | 6-10  | 7-12  | 4-6   |
| Low                          | 13-18                           | 11-15 | 13-18 | 7-9   |
| Very low                     | 19-24                           | 16-20 | 19-24 | 10-12 |

### Method of application

- All fertilizers should be applied as basal during final land preparation.
- Rhizobium inoculum (at the rate of 50 g/kg seed or 1.5 kg/ha) must be used if available and in that case N fertilizer should not be used.

## GRASSPEA (*Lathyrus sativus*)

(Var. BARI Khesari-1, BARI Khesari-2, BARI Khesari-3, BARI Khesari-4, and Binakheshari-1)  
(With tillage and no tillage)

Yield Goal: 1.5 ± 0.15 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha)* |       |       |       |
|------------------------------|----------------------------------|-------|-------|-------|
|                              | N                                | P     | K     | S     |
| Optimum                      | 0-5                              | 0-5   | 0-6   | 0-3   |
| Medium                       | 6-10                             | 6-10  | 7-12  | 4-6   |
| Low                          | 11-15                            | 11-15 | 13-18 | 7-9   |
| Very low                     | 16-20                            | 16-20 | 19-24 | 10-12 |

\*Same recommendation for the crop under tillage and no tillage condition.

### Method of application

#### With tillage

- All of N, P, K and S should be applied as basal during final land preparation.
- Rhizobium inoculum (at the rate of 40 g/kg seed or 2 kg/ha) must be used if available and in that case N fertilizer should not be used.

#### For relay crop with no tillage

- All of P, K and S should be applied as basal in the standing aman rice crop 2-3 days before sowing of the grasspea seed. Nitrogen should be topdressed at the evening after harvest of aman rice 10-15 days after sowing of the grasspea seed.

## COWPEA (*Vigna unguiculata*)

(Var. BARI Falon-1, BARI Falon-2, and others)

Yield Goal: 1.4 ± 0.14 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |          |
|------------------------------|---------------------------------|-------|-------|----------|
|                              | N                               | P     | K     | S        |
| Optimum                      | 0-5                             | 0-5   | 0-6   | 0.0-3.0  |
| Medium                       | 6-10                            | 6-10  | 7-12  | 3.1-6.0  |
| Low                          | 11-15                           | 11-15 | 13-18 | 6.1-9.0  |
| Very low                     | 16-20                           | 16-20 | 19-24 | 9.1-12.0 |

### Method of application

- All fertilizers should be applied as basal during final land preparation.
- Rhizobium inoculum (at the rate of 40 g/kg seed or 1.6 kg/ha) must be used if available and in that case N fertilizer should not be used.

### 11.1.4 Oil Seed Crops

#### MUSTARD (*Brassica juncea* and *Brassica napus*)

(Var. BARI Sharisa-6, BARI Sharisa-7, BARI Sharisa-8, BARI Sharisa-11, BARI Sharisa-13, BARI Sharisa-16, BARI Sharisa-17, Binasharisa-3, Binasharisa-4 and Binasharisa-5, Binasharisa-7, Binasharisa-9 and Binasharisa-10)

Yield Goal: 2.0 ± 0.2 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |     |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|-----|---------|---------|-----------|
|                              | N                               | P     | K      | S     | Mg  | Zn      | B       |           |
| Optimum                      | 0–40                            | 0–12  | 0–30   | 0–9   | –   | –       | –       | 3         |
| Medium                       | 41–80                           | 13–24 | 31–60  | 10–18 | 0–3 | 0.0–1.5 | 0.0–1.0 |           |
| Low                          | 81–120                          | 25–36 | 61–90  | 19–27 | 4–6 | 1.6–3.0 | 0.6–2.0 |           |
| Very low                     | 121–160                         | 37–48 | 91–120 | 28–36 | 7–9 | 3.1–4.5 | 1.1–3.0 |           |

Method of application: Same as *B. campestris*

#### *Brassica campestris*

(Var. Tori-7, BARI Sharisa-9, BARI Sharisa-14, and BARI Sharisa-15, Safal, Agrani, Binasharisa-6, Binasharisa-7, and Binasharisa-8)

Yield Goal: 1.8 ± 0.18 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Mg      | Zn      | B       |           |
| Optimum                      | 0–30                            | 0–9   | 0–20  | 0–5   | –       | –       | –       | 3         |
| Medium                       | 31–60                           | 10–18 | 21–40 | 6–10  | 0.0–2.5 | 0.0–1.0 | 0.0–0.5 |           |
| Low                          | 61–90                           | 19–27 | 41–60 | 11–15 | 2.6–5.0 | 1.1–2.0 | 0.6–1.0 |           |
| Very low                     | 91–120                          | 28–36 | 61–80 | 16–20 | 5.1–7.5 | 2.1–3.0 | 1.1–1.5 |           |

#### Method of application

- Half of N and all of P, K, S, Mg, Zn, B and OF should be applied as basal during final land preparation. Remaining half N should be applied as top dress at the time of flower initiation stage (25 days after sowing).
- Underrained condition, all fertilizers should be applied as basal during final land preparation.
- Application of OF at the rate of 3 t/ha is recommended; if applied the dose of N, P, K, and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

## SESAME (*Sesamum indicum*)

(Var: BARI Til-2, BARI Til-3, BARI Til-4, Binatil-1, Binatil-2, Binatil-3, and Binatil-4)

Yield Goal: 1.4 ± 0.14 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       |
| Optimum                      | 0-25                            | 0-10  | 0-20  | 0-7   | -       | -       |
| Medium                       | 26-50                           | 11-20 | 21-40 | 8-14  | 0.0-1.3 | 0.0-1.0 |
| Low                          | 51-75                           | 21-30 | 41-60 | 15-21 | 1.4-2.6 | 1.1-2.0 |
| Very low                     | 76-100                          | 31-40 | 61-80 | 22-28 | 2.7-3.9 | 2.1-3.0 |

### Method of application

- a) Half of N and all of P, K, S, Mg, Zn, and B should be applied as basal during final land preparation. Remaining half N should be applied as top dress at 25-30 DAS.
- b) Under rainfed condition, all fertilizers should be applied as basal during final land preparation.

## GROUNDNUT (*Arachis hypogaea*)

(Var. Jhingabadam, Tridanabadam, BARI Chinabadam-5, BARI Chinabadam-6, BARI Chinabadam-7, BARI Chinabadam-8, BARI Chinabadam-9, BARI Chinabadam-10, Binachinabadam-1, Binachinabadam-2, Binachinabadam-3 and Binachinabadam-4, Binachinabadam-5, Binachinabadam-6, Binachinabadam-7, Binachinabadam-8, and Binachinabadam-9)

Yield Goal: 2.6 ± 0.26 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       | Mo      |
| Optimum                      | 0-12                            | 0-12  | 0-15  | 0-12  | -       | -       | -       |
| Medium                       | 13-24                           | 13-24 | 16-30 | 13-24 | 0-1.0   | 0-0.7   | 0-0.2   |
| Low                          | 25-36                           | 25-36 | 31-45 | 25-36 | 1.1-2.0 | 0.8-1.4 | 0.3-0.4 |
| Very low                     | 37-48                           | 37-48 | 46-60 | 37-48 | 2.1-3.0 | 1.4-2.1 | 0.5-0.6 |

### Method of application

- a) Half of N and all of P, K, S, Mg, Zn, B, and Mo should be applied as basal during final land preparation. Remaining N should be applied as top dressing at flowering stage and mixed thoroughly with the soil as soon as possible for better utilization.
- b) Rhizobium inoculum (at the rate of 30 g/kg seed) must be used if available. In that case N fertilizer should not be used.
- c) Under rainfed condition, all fertilizers should be applied as basal during final land preparation.

## SOYBEAN (*Glycine max*)

(Var. Sohag, Bangladesh Soybean-4, BARI Soybean-5, BARI Soybean-6, Binasoybean-1, Binasoybean-2, Binasoybean-3, Binasoybean-4 and Binasoybean-5)

**Yield Goal: 2.0 ± 0.2 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |         | OF |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|---------|----|
|                              | N                               | P     | K     | S     | Zn      | B       | Mo      |    |
| Optimum                      | 0-9                             | 0-12  | 0-20  | 0-7   | -       | -       | -       | 2  |
| Medium                       | 10-18                           | 13-24 | 21-40 | 8-14  | 0-1.0   | 0.0-0.5 | 0-0.2   |    |
| Low                          | 19-27                           | 25-36 | 41-60 | 15-21 | 1.0-2.0 | 0.6-1.0 | 0.3-0.4 |    |
| Very low                     | 28-36                           | 37-48 | 61-80 | 22-24 | 2.0-3.0 | 1.1-1.5 | 0.5-0.6 |    |

### Method of application

- All fertilizers should be applied as basal during final land preparation.
- Inoculum (at the rate of 20 g/kg seed) must be used if available and in that case N fertilizer should not be used.
- Application of OF at the rate of 2 t/ha is recommended; if applied the dose of N, P, K and S should be reduced based on the rate of application of organic fertilizer (as per Appendix-6).

## SUNFLOWER (*Helianthus annus*)

(Var. Kironi and BARI Surjamukhi-2)

**Yield Goal: 2.5± 0.25 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|---------|---------|-----------|
|                              | N                               | P     | K      | S     | Mg      | Zn      | B       |           |
| Optimum                      | 0-35                            | 0-12  | 0-28   | 0-8   | -       | -       | -       | 2         |
| Medium                       | 36-70                           | 13-24 | 29-56  | 9-16  | 0.0-3.0 | 0.0-1.0 | 0.0-0.8 |           |
| Low                          | 71-105                          | 25-36 | 57-84  | 17-24 | 4.0-6.0 | 1.1-2.0 | 0.9-1.6 |           |
| Very low                     | 106-140                         | 37-48 | 49-112 | 25-32 | 7.0-9.0 | 2.1-3.0 | 1.7-2.4 |           |

### Method of application

- Half of N and all P, K, S, Mg, Zn, B, and OF should be applied as basal during final land preparation. Remaining half N should be applied as top dress in two equal splits at 20-25 DAS and 40-45 DAS (before flower initiation stage) and mixed thoroughly with the soil as soon as possible for better utilization.
- Application of OF at the rate of 2 t/ha is recommended. In that case the dose of N, P, K, and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

## SAFFLOWER (*Carthamus tinctorius*)

(Var. BARISaf-1)

Yield Goal: 1.5 ± 0.15 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       |
| Optimum                      | 0-25                            | 0-10  | 0-20  | 0-7   | -       | -       |
| Medium                       | 26-50                           | 11-20 | 21-40 | 8-14  | 0.0-1.3 | 0.0-1.0 |
| Low                          | 51-75                           | 21-30 | 41-60 | 15-21 | 1.4-2.6 | 1.1-2.0 |
| Very low                     | 76-100                          | 31-40 | 61-80 | 22-28 | 2.7-3.9 | 2.1-3.0 |

## LINSEED (*Linum usitatissimum*)

[Var. BARI Tishi-1 (Neela)]

Yield Goal: 1.0 ± 0.1 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |
|------------------------------|---------------------------------|-------|-------|-------|
|                              | N                               | P     | K     | S     |
| Optimum                      | 0-15                            | 0-5   | 0-8   | 0-3   |
| Medium                       | 16-30                           | 6-10  | 9-16  | 4-6   |
| Low                          | 31-45                           | 11-15 | 17-24 | 7-9   |
| Very low                     | 46-60                           | 16-20 | 25-32 | 10-12 |

## NIGER (*Guizotia abyssinica*)

BARI Guji-1 (Shova)

Yield Goal: 1.5 ± 0.15 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       |
| Optimum                      | 0-25                            | 0-10  | 0-20  | 0-7   | -       | -       |
| Medium                       | 26-50                           | 11-20 | 21-40 | 8-14  | 0.0-1.3 | 0.0-1.0 |
| Low                          | 51-75                           | 21-30 | 41-60 | 15-21 | 1.4-2.6 | 1.1-2.0 |
| Very low                     | 76-100                          | 31-40 | 61-80 | 22-28 | 2.7-3.9 | 2.1-3.0 |

### Method of application (for safflower, linseed, and niger)

- Half of N and all of P, K, S, Zn, and B should be applied as basal during final land preparation. Remaining N should be applied at the time of flower initiation as top dress.
- Under rainfed condition all fertilizers should be applied as basal during final land preparation.

### 11.1.5 Root and Tuber Crops

#### POTATO (*Solanum tuberosum*)

(Var. BARI Alu-6 (Multa), BARI Alu-7 (Diamant), BARI Alu-8 (Cardinal), BARI BARI Alu-13 (Granola), BARI Alu-17 (Raja), BARI Alu-25, BARI Alu-28, BARI Alu-29, BARI Alu-30, BARI Alu-31, BARI Alu-34 (Lora), BARI Alu-35, BARI Alu-36, BARI Alu-40, BARI Alu-41, BARI Alu-46, BARI Alu-48, BARI Alu-53, BARI Alu-54 (Musica), BARI Alu-56, BARI Alu-57, BARI Alu-62, BARI Alu-63, BARI Alu-66 (Pamela), BARI Alu-68 (Atlantic), BARI Alu-70 (Destiny), BARI Alu-74 (Barcelona), BARI Alu-75, BARI Alu-76 and BARI Alu-77)

**Yield Goal: 30.0± 3.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |       |         |          | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|-------|---------|----------|-----------|
|                              | N                               | P     | K       | S     | Mg    | Zn      | B        |           |
| Optimum                      | 0-45                            | 0-10  | 0-45    | 0-5   | -     | -       | -        | 3         |
| Medium                       | 46-90                           | 11-20 | 46-90   | 6-10  | 0-5   | 0-2.0   | 0-0.8    |           |
| Low                          | 91-135                          | 21-30 | 91-135  | 11-15 | 6-10  | 3.0-4.0 | 0.81-1.6 |           |
| Very low                     | 136-180                         | 31-40 | 136-180 | 16-20 | 11-15 | 5.0-6.0 | 1.61-2.4 |           |

#### Method of application

- All of OF, P, K, S, Mg, Zn, and B and half of N and K should be applied as basal during final land preparation.
- Remaining half N and K should be applied as side dressing at 30-35 days after planting during earthing up operation.

#### SWEET POTATO (*Ipomoea batatas*)

[Var. Tripti, Kamala Shundhuri, BARIMistiAlu-3 (Daulatpuri), BARI Misti Alu-4, BARI MistiAlu-5, BARI MistiAlu-8, BARI MistiAlu-10 and BARI MistiAlu-11, BARI MistiAlu12, and BARI MistiAlu-13]

**Yield Goal: 40.0 ± 4.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Mg    | Zn      | B       |           |
| Optimum                      | 0-40                            | 0-12  | 0-40    | 0-5   | -     | -       | -       | 3         |
| Medium                       | 41-80                           | 13-24 | 41-80   | 6-10  | 0-5   | 0.0-1.5 | 0.0-0.8 |           |
| Low                          | 81-120                          | 25-36 | 81-120  | 11-15 | 6-10  | 1.6-3.0 | 0.9-1.6 |           |
| Very low                     | 121-160                         | 37-48 | 121-160 | 16-20 | 11-15 | 3.1-4.5 | 1.7-2.4 |           |

#### Method of application

- All of OF, P, K, S, Mg, Zn, and B and half of N and K should be applied as basal during final land preparation.
- Remaining half N and K should be applied as side dressing at 30-35 days after planting during earthing up operation.
- Under rainfed condition all fertilizers should be applied during final land preparation.

## AROIDS

### MUKHI KACHU (*Colocasia esculenta*)

(Var. Bilashi and others)

Yield Goal: 30.0± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|-----------|
|                              | N                               | P     | K      | S     |           |
| Optimum                      | 0-35                            | 0-10  | 0-30   | 0-6   | 3         |
| Medium                       | 36-70                           | 11-20 | 31-60  | 7-12  |           |
| Low                          | 71-105                          | 21-30 | 61-90  | 13-18 |           |
| Very low                     | 106-140                         | 31-40 | 91-120 | 19-24 |           |

Method of application: As below

### PANI KACHU (*Colocasia esculenta*)

(Var. Latiraj, BARI Panikachu-2, BARI Panikachu-3, BARI Panikachu-4, BARI Panikachu-5, and BARI Panikachu-6)

Yield Goal: 30.0± 3.0 t/ha

| Soil Analysis Interpretation | Nutrient Recommendation (kg/ha) |       |        |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|-----------|
|                              | N                               | P     | K      | S     |           |
| Optimum                      | 0-30                            | 0-10  | 0-32   | 0-5   | 3         |
| Medium                       | 31-60                           | 11-20 | 33-64  | 6-10  |           |
| Low                          | 61-90                           | 21-30 | 65-96  | 11-15 |           |
| Very low                     | 91-120                          | 31-40 | 97-128 | 16-20 |           |

#### Method of application

- a) All of OF, P, K, and S should be applied as basal during final land preparation.
- b) N should be side dressed in two equal splits at 25-30 and 55-60 days after planting and mixed thoroughly with the soil for better utilization.

### 11.1.6 Vegetable Crops

#### CAULIFLOWER (*Brassica oleracea*)

Var. Snow white, Early tropical-40, White corona and White shot

Yield Goal: 50.0 ± 5.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|---------|-----------|
|                              | N                               | P     | K      | S     | Zn      | B       |           |
| Optimum                      | 0-40                            | 0-20  | 0-30   | 0-7   | -       | -       | 3         |
| Medium                       | 41-80                           | 21-40 | 31-60  | 8-14  | 0.0-1.5 | 0.0-0.8 |           |
| Low                          | 81-120                          | 41-60 | 61-90  | 15-21 | 1.6-3.0 | 0.9-1.6 |           |
| Very low                     | 121-160                         | 61-80 | 91-120 | 22-28 | 3.1-4.5 | 1.7-2.4 |           |

Method of application: As below

#### Var. BARI Phulcopi-1 (Rupa), BARI Phulcopi-2

Yield Goal: 30.0 ± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|---------|-----------|
|                              | N                               | P     | K      | S     | Zn      | B       |           |
| Optimum                      | 0-30                            | 0-15  | 0-25   | 0-6   | -       | -       | 3         |
| Medium                       | 31-60                           | 16-30 | 26-50  | 7-12  | 0.0-1.2 | 0.0-0.7 |           |
| Low                          | 61-90                           | 31-45 | 51-75  | 13-18 | 1.3-2.4 | 0.8-1.4 |           |
| Very low                     | 91-120                          | 46-60 | 76-100 | 18-24 | 2.5-3.6 | 1.5-2.1 |           |

#### Method of application

- Half of OF and all of P, K, S, Zn, and B should be applied as basal. Remaining half OF should be applied in pit before planting of seedlings.
- N and K should be applied in three equal splits at 10-15, 30, and 50 days after transplanting as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.
- Instead of urea, Urea Supper Granules (USG) might be applied 7-8 cm deep into the soil and 8-10 cm apart from the plant and as ring method.

## BROCCOLI (*Brassica oleracea*)

(All varieties)

Yield Goal: 25.0 ± 2.5 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-30                            | 0-12  | 0-20  | 0-5   | -       | -       | 3         |
| Medium                       | 31-60                           | 13-24 | 21-40 | 6-10  | 0-1.0   | 0.0-0.6 |           |
| Low                          | 61-90                           | 25-36 | 41-60 | 11-15 | 1.1-2.0 | 0.7-1.2 |           |
| Very low                     | 91-120                          | 37-48 | 61-80 | 16-20 | 2.1-3.0 | 1.3-1.8 |           |

## CABBAGE (*Brassica oleracea*)

(Var. K-K Cross, Atlas-70 and Hybrids)

Yield Goal: 90.0 ± 9.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-60                            | 0-15  | 0-20  | 0-8   | -       | -       | 3         |
| Medium                       | 61-120                          | 16-30 | 21-40 | 19-16 | 0-1.5   | 0-0.5   |           |
| Low                          | 121-180                         | 31-45 | 41-60 | 17-24 | 1.6-3.0 | 0.6-1.0 |           |
| Very low                     | 181-240                         | 46-60 | 61-80 | 25-32 | 3.1-4.5 | 1.1-1.5 |           |

### Method of application (for broccoli and cabbage)

- d) Half of organic fertilizer (OF) and all of P, K, S, Zn, and B should be applied as basal. Remaining half organic fertilizer should be applied in pit before planting of seedlings.
- e) N and K should be applied in three equal splits at 10-15, 30 and 50 days after transplanting as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.
- f) Instead of urea, Urea Supper Granules (USG) might be applied 7-8 cm deep into the soil and 8-10 cm apart from the plant and as ring method.

## CABBAGE (*Brassica oleracea*)

[Var. BARI Badhakopi-1 (Provati), BARI Badhakopi-2 (Agradut) and IPSA Cabbage]

**Yield Goal: 70.0 ± 7.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-40                            | 0-12  | 0-15  | 0-6   | -       | -       | 3         |
| Medium                       | 41-80                           | 13-24 | 16-30 | 7-12  | 0.0-1.2 | 0.0-0.4 |           |
| Low                          | 81-120                          | 25-36 | 31-45 | 13-18 | 1.3-2.4 | 0.5-0.8 |           |
| Very low                     | 121-160                         | 37-48 | 46-60 | 18-24 | 2.5-3.6 | 0.9-1.2 |           |

**Method of application:** Same as in previous page.

## CHINESE CABBAGE (*Brassica chinensis*)

(Var. BARI China Copi-1)

**Yield Goal: 40.0 ± 4.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|-----------|
|                              | N                               | P     | K     | S     |           |
| Optimum                      | 0-35                            | 0-10  | 0-12  | 0-5   | 3         |
| Medium                       | 36-70                           | 11-20 | 13-24 | 6-10  |           |
| Low                          | 71-105                          | 21-30 | 25-36 | 11-15 |           |
| Very low                     | 106-140                         | 31-40 | 37-48 | 16-20 |           |

### Method of application

- a) Half of OF and all of P, K, S, Zn, and B should be applied as basal. Remaining half OF should be applied in pit before planting of seedlings.
- b) Remaining half N and K should be applied at 20 DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

### CHINASAK (*Brassica chinensis*)

(Var. BARI Chinasak-1)

### BATISAK (*Brassica parachinensis*)

(Var. BARI Chinasak-1 and BARI Batisak-1)

Yield Goal: 30 ± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|-----------|
|                              | N                               | P     | K     | S     |           |
| Optimum                      | 0-30                            | 0-8   | 0-10  | 0-5   | 3         |
| Medium                       | 31-60                           | 9-16  | 11-20 | 6-10  |           |
| Low                          | 61-90                           | 17-24 | 21-30 | 11-15 |           |
| Very low                     | 91-120                          | 25-32 | 31-40 | 16-20 |           |

#### Method of application

- Half of N, K, and OF and all of P and S should be applied as basal during land preparation. Remaining half OF should be applied in pit before planting of seedlings.
- Remaining half N and K should be applied at 20-25 DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

### KANGKONG (*Ipomoea aquatica*)

(Var. BARI Gima Kalmi-1)

Yield Goal: 40.0 ± 4.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|-----------|
|                              | N                               | P     | K     | S     |           |
| Optimum                      | 0-30                            | 0-10  | 0-15  | 0-5   | 3         |
| Medium                       | 31-60                           | 11-20 | 16-30 | 6-10  |           |
| Low                          | 61-90                           | 21-30 | 31-45 | 11-15 |           |
| Very low                     | 91-120                          | 31-40 | 46-60 | 16-20 |           |

#### Method of application

- All of OF and all of P, K, and S and one third of N should be applied as basal during final land preparation.
- Remaining N should be applied as top dress after each harvest under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

**INDIAN SPINACH (*Basella alba*)**  
(Var. BARI Puisak-1, BARI Puisak-2 and others)

**Yield Goal: 45.0± 4.5 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|-----------|
|                              | N                               | P     | K     | S     |           |
| Optimum                      | 0-35                            | 0-10  | 0-20  | 0-5   | 3         |
| Medium                       | 36-70                           | 11-20 | 21-40 | 6-10  |           |
| Low                          | 71-105                          | 21-30 | 41-60 | 11-15 |           |
| Very low                     | 106-140                         | 31-40 | 61-80 | 16-20 |           |

**Method of application**

- a) All of OF and all of P, K, and S; and one third of N and K should be applied as basal during final land preparation.
- b) Remaining N and K should be applied in two equal splits at 14 and 28 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

**SPINACH (*Spinacea oleracea*)**  
(Var. Kupipalong and others)

**Yield Goal: 25.0 ± 2.5 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|-----------|
|                              | N                               | P     | K     | S     |           |
| Optimum                      | 0-15                            | 0-5   | 0-5   | 0-4   | 3         |
| Medium                       | 16-30                           | 6-10  | 6-10  | 5-8   |           |
| Low                          | 31-45                           | 11-15 | 11-15 | 9-12  |           |
| Very low                     | 46-60                           | 16-20 | 16-20 | 13-16 |           |

**Method of application**

- a) All of OF and all of P, K, and S should be applied as basal during final land preparation.
- b) N should be applied in two installments at 21 and 42 DAS.

## AMARANTHUS (*Amaranthus lividus*)

[Var. BARI Danta-1 (Laboni), BARI Danta-2, BARI Sabuj Dantasak-1 and others]

Yield Goal: 30.0± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|-----------|
|                              | N                               | P     | K     | S     |           |
| Optimum                      | 0-30                            | 0-9   | 0-15  | 0-4   | 3         |
| Medium                       | 31-60                           | 10-18 | 16-30 | 5-8   |           |
| Low                          | 61-90                           | 19-27 | 31-45 | 9-12  |           |
| Very low                     | 91-120                          | 28-36 | 46-60 | 13-16 |           |

### Method of application

- All of OF, P, K, and S; and one-third of N should be applied as basal during final land preparation.
- Remaining N should be applied in two equal splits at 15 and 35 DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## RED AMARANTHUS (*Amaranthus gangeticus*)

(Var. BARI Lalshak-1 and others)

Yield Goal: 14 ± 1.4 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |      | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|------|-----------|
|                              | N                               | P     | K     | S    |           |
| Optimum                      | 0-25                            | 0-6   | 0-10  | 0-3  | 3         |
| Medium                       | 26-50                           | 7-12  | 11-20 | 4-6  |           |
| Low                          | 51-75                           | 13-18 | 21-30 | 7-9  |           |
| Very low                     | 76-100                          | 19-24 | 31-40 | 9-12 |           |

### Method of application

- All of OF, P, K, and S; and half of N should be applied as basal during final land preparation.
- Remaining N should be applied as topdress at 10-15 DAS under moist soil condition.

## TOMATO (*Solanum lycopersicum*)

### (Winter)

[Var. BARI Tomato-1 (Manik), BARI Tomato-2 (Ratan), BARI Tomato-3, BARI Tomato-6 (Choity), BARI Tomato-7 (Apuabo), BARI Tomato-8 (Shila), BARI Tomato-9 (Lalima), BARI Tomato-14, BARI Tomato-15, BARI Tomato-16, BARI Tomato-18, BARI Hybrid Tomato-5, BARI Hybrid Tomato-6, BARI Hybrid Tomato-7, Roma VF, Binatomato-4, Binatomato-5, Binatomato-6, Binatomato-7, Binatomato-8, Binatomato-9, Binatomato-10, Binatomato-11 and Binatomato-12]

**Yield Goal: 75.0 ± 7.5 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-40                            | 0-15  | 0-20  | 0-7   | -       | -       | 5         |
| Medium                       | 41-80                           | 16-30 | 21-40 | 8-14  | 0.0-1.0 | 0.0-0.5 |           |
| Low                          | 81-120                          | 31-45 | 41-60 | 15-21 | 1.1-2.0 | 0.6-1.0 |           |
| Very low                     | 121-160                         | 46-60 | 61-80 | 22-28 | 2.1-3.0 | 1.1-1.5 |           |

#### Method of application

- a) Half of OF and all of P, S, Zn, and B should be applied as basal during final land preparation. Remaining OF should be applied in pits before planting of seedlings.
- b) N and K should be applied in two equal splits at 15 and 35 DAT as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## TOMATO (*Solanum lycopersicum*)

### (Summer)

(Var. BARI Tomato-10, BARI Tomato-11, BARI Tomato-19, BARI Hybrid Tomato-3, BARI Hybrid Tomato-4, BARI Hybrid Tomato-8, BARI Hybrid Tomato-10, Binatomato-2 Bahar, Binatomato-3)

**Yield Goal: 45.0 ± 4.5 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-30                            | 0-12  | 0-15  | 0-5   | -       | -       | 4         |
| Medium                       | 31-60                           | 13-24 | 16-30 | 6-10  | 0.0-1.0 | 0.0-0.5 |           |
| Low                          | 61-90                           | 25-36 | 31-45 | 11-15 | 1.1-2.0 | 0.6-1.0 |           |
| Very low                     | 91-120                          | 37-48 | 46-60 | 16-20 | 2.1-3.0 | 1.1-1.5 |           |

#### Method of application

- a) Half of OF and all of P, S, Zn, and B should be applied as basal during final land preparation. Remaining OF should be applied in pits before planting of seedlings.
- b) N and K should be applied in three equal splits at 20, 40 and 60 DAT as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## BRINJAL (*Solanum melongena*)

(Var. BARI Begun-1 (Uttara), BARI Begun-2 (Tarapuri), BARI Begun-9, BARI Begun-4 (Kazla),  
BARI Begun-6, BARI Begun-8, BARI Begun-10, BARI Hybrid Begun-3,  
BARI Hybrid Begun-4 and others)

**Yield Goal: 60.0 ± 6.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      | B       |           |
| Optimum                      | 0-45                            | 0-12  | 0-35    | 0-5   | -       | -       | 4         |
| Medium                       | 46-90                           | 13-24 | 36-70   | 6-10  | 0.0-1.0 | 0.0-0.5 |           |
| Low                          | 91-135                          | 25-36 | 71-105  | 11-15 | 1.1-2.0 | 0.6-1.0 |           |
| Very low                     | 136-180                         | 37-48 | 106-140 | 16-20 | 2.1-3.0 | 1.1-1.5 |           |

### Method of application

- a) Half of OF and all of P, S, Zn, and B should be applied as basal during final land preparation. Remaining OF should be applied in pits before planting of seedlings.
- b) N and K should be applied in three equal splits at 20, 40 and 60 DAT as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.
- c) Instead of urea, Urea Supper Granules (USG) might be applied 7-8 cm deep into the soil and 8-10 cm apart from the plant and as ring method.

## LADY'S FINGER (*Abelmoschus esculentus*)

(Var. BARI Dherosh-1, BARI Dherosh-2 & others)

**Yield Goal (16.0 ± 1.6 t/ha)**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | FYM* (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-------------|
|                              | N                               | P     | K     | S     | Zn      | B       |             |
| Optimum                      | 0-30                            | 0-10  | 0-20  | 0-5   | -       | -       | 3           |
| Medium                       | 31-60                           | 11-20 | 21-40 | 6-10  | 0.0-1.0 | 0.0-0.7 |             |
| Low                          | 61-90                           | 21-30 | 41-60 | 11-15 | 1.1-2.0 | 0.8-1.4 |             |
| Very low                     | 91-120                          | 31-40 | 61-80 | 16-20 | 2.1-3.0 | 1.5-2.1 |             |

### Method of application

- a) All of OF and all of P, S, Zn, and B; and one-fourth of N should be applied as basal during final land preparation.
- b) Remaining three-fourth N should be applied at 20, 40 and 60 DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## RADISH (*Raphanus sativus*)

[Var. BARI Mula-1 (Tasakistan), BARI Mula-2 (Pinki) and  
BARI Mula-3 (Druti), BARI Mula-4 and others]

**Yield Goal: 60.0 ± 6.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      |           |
| Optimum                      | 0-45                            | 0-15  | 0-40    | 0-6   | -       | 4         |
| Medium                       | 46-90                           | 16-30 | 41-80   | 7-12  | 0-1.5   |           |
| Low                          | 91-135                          | 31-45 | 81-120  | 13-18 | 1.6-3.0 |           |
| Very low                     | 136-180                         | 46-60 | 121-160 | 19-24 | 3.1-4.5 |           |

### Method of application

- a) All of OF and P, S, Zn; and one third of N and K should be applied as basal during final land preparation.
- b) Remaining N and K should be side dressed in two equal splits at 21 and 35DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## CARROT (*Daucus carota*)

(All cultivars)

**Yield Goal: 25 ± 2.5 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|-----------|
|                              | N                               | P     | K      | S     | Zn      |           |
| Optimum                      | 0-40                            | 0-13  | 0-30   | 0-6   | -       | 3         |
| Medium                       | 41-80                           | 14-26 | 31-60  | 7-12  | 0-1.0   |           |
| Low                          | 81-120                          | 27-39 | 61-90  | 13-18 | 1.1-2.0 |           |
| Very low                     | 121-160                         | 40-52 | 91-120 | 19-24 | 2.1-3.0 |           |

### Method of application

- a) All of OF, P, S and Zn; and one third of N should be applied as basal during final land preparation.
- b) Remaining N should be applied in two equal splits at the 3rd and 5th weeks of sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## COUNTRY BEAN (*Dolichos lablab*)

(Var. BARI Sheem-1, BARI Sheem-3, BARI Sheem-4, BARI Sheem-6, BARI Sheem-8, BARI Jack Sheem-1, IPSA Shim-2 & others)

**Yield Goal: 20.0 ± 2.0 t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      |           |
| Optimum                      | 0-15                            | 0-10  | 0-15  | 0-3   | -       | 3         |
| Medium                       | 16-30                           | 11-20 | 16-30 | 4-6   | 0.0-1.0 |           |
| Low                          | 31-45                           | 21-30 | 31-45 | 7-9   | 1.1-2.0 |           |
| Very low                     | 46-60                           | 31-40 | 46-60 | 10-12 | 2.1-3.0 |           |

### Method of application

- a) All of OF, P, S and Zn; and half of N should be applied as basal during final land preparation.
- b) Remaining half N should be applied during 25-30 DAT under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## YARDLONG BEAN (*Vigna unguiculata*)

(Var: BARI Barboti-1, KagorNatoki)

**Yield Goal: 10.0 ± 1.0 t/ha<sup>1</sup> and 12.0 ± 1.2 t/ha<sup>2</sup>**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|
|                              | N                               | P     | K     | S     | Zn      | B       |
| Optimum                      | 0-7                             | 0-9   | 0-11  | 0-3   | -       | -       |
| Medium                       | 8-14                            | 10-18 | 12-22 | 4-6   | 0.0-0.6 | 0.0-0.6 |
| Low                          | 15-21                           | 19-27 | 23-33 | 7-9   | 0.7-1.2 | 0.7-1.2 |
| Very low                     | 22-28                           | 28-26 | 34-44 | 10-12 | 1.3-2.0 | 1.3-2.0 |

### Method of application

- a) All fertilizers except N should be applied as basal during final land preparation.
- b) Nitrogen should be applied in two equal splits during the 2nd and 4th weeks of germination.
- c) Rhizobium inoculum (at the rate of 50 g/kg seed) should be used if available and in that case N fertilizer should not be used.

## FRENCH BEAN (*Phaseolus vulgaris*)

[Var. BARI Jharshim-1 and BARI Jharshim-2, BARI Jharshim-3 (Khayasha)]

Yield Goal: 15.0 ± 1.5 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-25                            | 0-10  | 0-15  | 0-3   | -       | -       | 3         |
| Medium                       | 26-50                           | 11-20 | 16-30 | 4-6   | 0.0-1.0 | 0.0-0.7 |           |
| Low                          | 51-75                           | 21-30 | 31-45 | 7-9   | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 76-100                          | 31-40 | 46-60 | 10-12 | 2.1-3.0 | 1.5-2.1 |           |

### Method of application

- a) All of OF, P, S, Zn, and B; and one-third of N should be applied as basal during final land preparation.
- b) Remaining N should be side dressed at 20 and 35 DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## GARDEN PEA (*Pisum sativum*)

(Var. BARI Motorshuti-1, BARI Motorshuti-2, BARI Motorshuti-3,  
IPSA Motorshuti-1, IPSA Motorshuti-2 and IPSA Motorshuti-3)

Yield Goal: 15.0 ± 1.5 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      |           |
| Optimum                      | 0-15                            | 0-8   | 0-10  | 0-4   | -       | 3         |
| Medium                       | 16-30                           | 9-16  | 11-20 | 5-8   | 0.0-0.7 |           |
| Low                          | 31-45                           | 17-24 | 21-30 | 9-12  | 0.8-1.4 |           |
| Very low                     | 46-60                           | 25-32 | 31-40 | 13-16 | 1.5-2.1 |           |

### Method of application:

- a) All of organic fertilizer (OF), P, SandZn; and one-third of N should be applied as basal during final land preparation.
- b) Remaining N should be side dressed at 20 and 35 DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## SWEET GOURD (*Cucurbita moschata*)

(Var. BARI Mistikumra-1, BARI Mistikumra-2,  
BARI Hybrid Mistikumra-1, and others)

Yield Goal: 40 ± 4.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-25                            | 0-12  | 0-20  | 0-7   | -       | -       | 4         |
| Medium                       | 26-50                           | 13-24 | 21-40 | 8-14  | 0-1.0   | 0.0-0.7 |           |
| Low                          | 51-75                           | 25-36 | 41-60 | 15-21 | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 76-100                          | 37-48 | 61-80 | 22-28 | 2.1-3.0 | 1.5-2.1 |           |

Method of application: As below

## BOTTLEGOURD (*Lagenaria siceraria*)

(Var. BARI Lau-1, BARI Lau-2, BARI Lau-3, BARI Lau-4,  
BARI Lau-5 and BARI Seeta Lau-1)

## ASH GOURD (*Benincasa hispida*)

(Var. BARI Chal Kumra-1 and IPSA Ash gourd-1)

Yield Goal: 30 ± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-20                            | 0-10  | 0-15  | 0-6   | -       | -       | 4         |
| Medium                       | 21-40                           | 11-20 | 16-30 | 7-12  | 0-1.0   | 0.0-0.7 |           |
| Low                          | 41-60                           | 21-30 | 31-45 | 13-18 | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 61-80                           | 31-40 | 46-60 | 19-24 | 2.1-3.0 | 1.5-2.1 |           |

### Method of application

- All of OF, P, S, Zn, and B should be applied in pit 5-7 days before planting and mixed thoroughly with the soil.
- N should be applied around the plant as side dressing at 15, 35, 55 and 75 DAT under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## TEASLE GOURD (*Momordica cochinchinensis*)

(KAKROL) (All cultivars)

Yield Goal: 18 ± 1.8 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-20                            | 0-8   | 0-14  | 0-5   | -       | -       | 3         |
| Medium                       | 21-40                           | 9-16  | 15-28 | 6-10  | 0.0-1.0 | 0.0-0.7 |           |
| Low                          | 41-60                           | 17-24 | 29-42 | 11-15 | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 61-80                           | 25-32 | 43-56 | 16-20 | 2.1-3.0 | 1.5-2.1 |           |

## BITTER GOURD (*Momordica charantia*)

(Var. BARI Karola-1, BARI Karola-2, BARI Karola-3 and others)

Yield Goal: 25 ± 2.5 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-25                            | 0-10  | 0-15  | 0-5   | -       | -       | 3         |
| Medium                       | 26-50                           | 11-20 | 16-30 | 6-10  | 0.0-0.5 | 0.0-0.5 |           |
| Low                          | 51-75                           | 21-30 | 31-45 | 11-15 | 0.6-1.0 | 0.6-1.0 |           |
| Very low                     | 76-100                          | 31-40 | 46-60 | 16-20 | 1.1-1.5 | 1.1-1.5 |           |

## POINTED GOURD (*Trichosanthes dioica*)

(Var. BARI Poto1-1 and BARI Poto1-2, BARI Hybrid Poto1-1)

Yield Goal: 20.0 ± 2.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-30                            | 0-6   | 0-12  | 0-5   | -       | -       | 3         |
| Medium                       | 31-60                           | 7-12  | 13-24 | 6-10  | 0.0-1.0 | 0.0-0.5 |           |
| Low                          | 61-90                           | 13-18 | 25-36 | 11-15 | 1.1-2.0 | 0.6-1.0 |           |
| Very low                     | 91-120                          | 19-24 | 36-48 | 16-20 | 2.1-3.0 | 1.1-1.5 |           |

### Method of application (for above three cops)

- All of OF, P, S, Zn, and B should be applied in pit 5-7 days before planting and mixed thoroughly with the soil.
- N should be applied around the plant as side dressing at 20, 40 and 60 DAT planting and mixed thoroughly with the soil as soon as possible for better utilization.

## SNAKE GOURD (*Trichosanthes anguina*)

Var. BARI Chicinga-1 and others

## RIDGE GOURD (*Luffa acutangula*)

BARI Jhinga-1, BARI Jhinga-2 and others

## SPONGE GOURD (*Luffa cylindrica*)

(All cultivars)

Yield Goal: 27.0± 2.7 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | FYM* (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-------------|
|                              | N                               | P     | K     | S     | Zn      | B       |             |
| Optimum                      | 0-25                            | 0-12  | 0-20  | 0-7   | -       | -       | 3           |
| Medium                       | 26-50                           | 13-24 | 21-40 | 8-14  | 0-1.0   | 0.0-0.7 |             |
| Low                          | 51-75                           | 25-36 | 41-60 | 15-21 | 1.1-2.0 | 0.8-1.4 |             |
| Very low                     | 76-100                          | 37-48 | 61-80 | 22-28 | 2.1-3.0 | 1.5-2.1 |             |

### Method of application

- All of OF, P, S, Zn, and B should be applied in pit 5-7 days before planting and mixed thoroughly with the soil.
- Nitrogen should be applied around the plant as side dressing at 15, 35, 55 and 75 DA Under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## CUCUMBER (*Cucumis sativus*)

Var: Local (Shila) and others

Yield Goal: 35 ± 3.5 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | FYM* (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-------------|
|                              | N                               | P     | K     | S     | Zn      | B       |             |
| Optimum                      | 0-25                            | 0-8   | 0-20  | 0-6   | -       | -       | 4           |
| Medium                       | 26-50                           | 9-16  | 21-40 | 7-12  | 0.0-1.0 | 0.0-0.7 |             |
| Low                          | 51-75                           | 17-24 | 41-60 | 13-18 | 1.1-2.0 | 0.8-1.4 |             |
| Very low                     | 76-100                          | 25-32 | 61-80 | 19-24 | 2.1-3.0 | 1.5-2.1 |             |

### Method of application

- All of OF, P, S, Zn, and B; and one-third of N and K should be applied in pit 5-7 days before planting and mixed thoroughly with the soil.
- Remaining N and K should be applied during 20, 35 and 50DAT around the plant as side dressing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

### 11.1.7 Spices Crops

#### ONION (*Allium cepa*)

(Var. BARI Peyaz-1, BARI Peyaz-2, BARI Peyaz-3, BARI Peyaz-4 and BARI Peyaz-5)

Yield Goal: 20.0 ± 2.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |          | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|----------|-----------|
|                              | N                               | P     | K      | S     | Zn      | B        |           |
| Optimum                      | 0-35                            | 0-15  | 0-30   | 0-10  | -       | -        | 3         |
| Medium                       | 36-70                           | 16-30 | 31-60  | 11-20 | 0-1.5   | 0-0.7    |           |
| Low                          | 71-105                          | 31-45 | 61-90  | 21-30 | 1.6-3.0 | 0.71-1.4 |           |
| Very low                     | 106-140                         | 46-60 | 91-120 | 31-40 | 3.1-4.5 | 1.41-2.1 |           |

#### SUMMER ONION (*Allium cepa*)

(Var. BARI Peyaz-2, BARI Peyaz-3 and BARI Peyaz-5)

Yield Goal: 12.0 ± 1.2 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-25                            | 0-10  | 0-20  | 0-8   | -       | -       | 3         |
| Medium                       | 26-50                           | 11-20 | 21-40 | 9-16  | 0-1.0   | 0.0-0.5 |           |
| Low                          | 51-75                           | 21-30 | 41-60 | 17-24 | 1.1-2.0 | 0.6-1.0 |           |
| Very low                     | 76-100                          | 31-40 | 61-80 | 25-32 | 2.1-3.0 | 1.1-1.5 |           |

#### ONION SEED (*Allium cepa*)

(Var. BARI Peyaz-1 and others)

Yield Goal (Seed): 1.0 ± 0.1 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      | B       |           |
| Optimum                      | 0-40                            | 0-15  | 0-35    | 0-8   | -       | -       | 3         |
| Medium                       | 41-80                           | 16-30 | 36-70   | 19-16 | 0-1.5   | 0-1.0   |           |
| Low                          | 81-120                          | 31-45 | 71-105  | 17-24 | 1.6-3.0 | 1.1-2.0 |           |
| Very low                     | 121-160                         | 46-60 | 106-140 | 25-32 | 3.1-4.5 | 2.1-3.0 |           |

#### Method of application

- All of OF, P, S, Zn, and B and half of N and K should be applied as basal during final land preparation.
- Remaining N and K should be applied in 2 equal splits at 25 and 50 DAP for bulb production; and in 3 equal splits at 25, 50 and 75 days after planting for seed production.

## GARLIC (*Allium sativum*)

(Var. BARI Rashun-1, BARI Rashun-2, BAU Rashun-2, BAU Rashun-3 and others)

**Yield Goal: 15.0 ± 1.5t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|---------|-----------|
|                              | N                               | P     | K      | S     | Zn      | B       |           |
| Optimum                      | 0-38                            | 0-16  | 0-30   | 0-10  | 0.0-1.0 | 0.0-1.0 | 3         |
| Medium                       | 39-76                           | 17-32 | 31-60  | 11-20 | 1.1-2.0 | 1.1-2.0 |           |
| Low                          | 77-114                          | 33-48 | 61-90  | 21-30 | 2.1-3.0 | 2.1-3.0 |           |
| Very low                     | 115-152                         | 49-64 | 91-120 | 31-40 | 3.1-4.0 | 3.1-4.0 |           |

### Method of application

- a) All of OF, P, S, Zn and B; and half of N and K should be applied as basal during final land preparation.
- b) Remaining N and K should be applied at the time of first mulching under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## GARLIC (*Allium sativum*)

(Var. BARI Rashun-1 and other suitable cultivars)  
(Under Zero tillage)

**Yield Goal: 13.0 ± 1.3 t/ha**

| Nutrient Recommendation (kg/ha) |    |     |    |    |
|---------------------------------|----|-----|----|----|
| N                               | P  | K   | S  | Zn |
| 160                             | 50 | 125 | 25 | 3  |

### Method of application

- a) Under zero tillage, garlic is cultivated widely in "ChalanBil" areas of Rajshahi, Natore, Naogaon and Pabna districts after harvesting of deep water aman rice. Before cultivation of garlic, rice straw should be removed from the land. Then all of OF, P, K, S and Zn; and one-third of N should be applied as broadcast on muddy soils. After application of fertilizers garlic should be planted by dibbling shallowly (1/3rd of the clove into the soil) and the land should be covered again with the rice straw.
- b) Remaining N should be applied in two equal splits; the first split during 25-30 DAP and the second split during 55-60 DAP. The N should be applied by topdressing on the straw mulch followed by gentle shaking of the straw for allowing the fertilizer to reach on to the soil surface.
- c) After 2-3 hours of N topdressing light irrigation should be provided. Care should be taken so that there would be no water logging after irrigation to avoid damage of the crop.

## GINGER (*Zingiber officinale*)

(Var. BARI Ada-1 and others)

Yield Goal: 30.0 ± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      | B       |           |
| Optimum                      | 0-45                            | 0-15  | 0-40    | 0-5   | -       | -       | 3         |
| Medium                       | 46-90                           | 16-30 | 41-80   | 6-10  | 0.0-1.5 | 0.0-0.7 |           |
| Low                          | 91-135                          | 31-45 | 81-120  | 11-15 | 1.6-3.0 | 0.8-1.4 |           |
| Very low                     | 136-180                         | 46-60 | 121-160 | 16-20 | 3.1-4.5 | 1.5-2.1 |           |

### Method of application:

- All of OF, P, K, S, Zn, and B; and half of N should be applied as basal during final land preparation.
- Remaining N should be applied at the 6<sup>th</sup> week of planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## TURMERIC (*Curcuma longa*)

[Var. BARI Halud-1 (Sinduri), BARI Halud-2 (Dimla) and BARI Halud-3]

Yield Goal: 30.0 ± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      | B       |           |
| Optimum                      | 0-35                            | 0-10  | 0-40    | 0-5   | -       | -       | 3         |
| Medium                       | 36-70                           | 11-20 | 41-80   | 6-10  | 0.0-1.5 | 0.0-0.7 |           |
| Low                          | 71-105                          | 21-30 | 81-120  | 11-15 | 1.6-3.0 | 0.8-1.4 |           |
| Very low                     | 106-140                         | 31-40 | 121-160 | 16-20 | 3.1-4.5 | 1.5-2.1 |           |

### Method of application

- All of OF, P, K, S, Zn, and B; and half of N should be applied as basal during final land preparation.
- Remaining N should be applied in two equal splits at 80 and 110 DAP under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## CHILLI (*Capsicum annuum*)

(Var. BARI Morich-1, Bogra local and Jamalpur local)

Yield Goal: 2.5± 0.25 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|---------|-----------|
|                              | N                               | P     | K      | S     | Zn      | B       |           |
| Optimum                      | 0-32                            | 0-15  | 0-25   | 0-5   | 0-0.5   | -       | 3         |
| Medium                       | 33-64                           | 16-30 | 26-50  | 6-10  | 0.6-1.0 | 0.0-0.7 |           |
| Low                          | 65-96                           | 31-45 | 51-75  | 11-15 | 1.1-1.5 | 0.8-1.4 |           |
| Very low                     | 97-128                          | 46-60 | 76-100 | 16-20 | 1.6-2.0 | 1.5-2.1 |           |

### Method of application

- All of OF, P, K, S, Zn, and B; and half of N should be applied as basal during final land preparation.
- Remaining N should be applied in three equal splits at 25, 50 and 70 DAP under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## CORIANDER (*Coriandrum sativum*)

(Var. BARI Dhonia-1)

Yield Goal: 2.0 ± 0.2 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-25                            | 0-10  | 0-16  | 0-5   | -       | -       | 2         |
| Medium                       | 26-50                           | 11-20 | 17-32 | 6-10  | 0-1.0   | 0.0-0.7 |           |
| Low                          | 51-75                           | 21-30 | 33-48 | 11-15 | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 76-100                          | 31-40 | 49-64 | 16-20 | 2.1-3.0 | 1.5-2.1 |           |

### Method of application

- All of OF, P, K, S, Zn, and B; and half of N should be applied as basal during final land preparation.
- Remaining N should be applied as top dress at 30 DAS under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## BLACK CUMIN (*Nigella sativa*)

(Var. BARI Kalozira-1 and others)

Yield Goal:  $1.0 \pm 0.10$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-20                            | 0-8   | 0-15  | 0-5   | -       | -       | 2         |
| Medium                       | 21-40                           | 9-16  | 16-30 | 6-10  | 0-1.0   | 0.0-0.7 |           |
| Low                          | 41-60                           | 17-24 | 31-45 | 11-15 | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 61-80                           | 25-32 | 46-60 | 16-20 | 2.1-3.0 | 1.5-2.1 |           |

Method of application: Same as below

## FENUGREEK (*Trigonella foenum-graecum*)

(Var. BARI Methi-1 and BARI Methi-2)

Yield Goal:  $2.0 \pm 0.2$  t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |       |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                               | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0-25                            | 0-10  | 0-20  | 0-5   | -       | -       | 2         |
| Medium                       | 26-50                           | 11-20 | 21-40 | 6-10  | 0-1.0   | 0.0-0.7 |           |
| Low                          | 51-75                           | 21-30 | 41-60 | 11-15 | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 76-100                          | 31-40 | 61-80 | 16-20 | 2.1-3.0 | 1.5-2.1 |           |

### Method of application

- All of OF, P, K, S, Zn, and B should be applied as basal during final land preparation.
- N should be applied in two equal splits as topdress at 30 and 55 DAS under moist soil condition.

## BLACK PEPPER (*Piper nigrum*)

(Var. Jaintagulmorich and others)

Yield Goal: 4–5kg/plant/year

| Age of plant (Year)      | Nutrient Recommendation (g/plant/year) |    |    | OF (kg/plant) |
|--------------------------|--|----|----|---------------|
|                          | N                                      | P  | K  |               |
| Before planting (in pit) | –                                      | 50 | 50 | 2-3           |
| 1                        | 25                                     | 0  | 0  | -             |
| 2                        | 50                                     | 30 | 50 | -             |
| ≥ 3                      | 75                                     | 40 | 75 | –             |

\*S, Zn and B fertilizers to be sprayed if needed based on deficiency symptoms

### Method of application:

- Before planting, recommended OF, P and K should be applied in pit 10–15 days before planting of seedling and mixed thoroughly with the soil followed by irrigation.
- For growing plant N, P and K should be applied in two equal splits during April–May and September–October under moist soil condition and mixed thoroughly with the soil. Fertilizer should be applied around the plant and mixed thoroughly with the soil followed by irrigation.

### 11.1.8 Fruit Crops

#### BANANA (*Musa paradisiaca*)

(Var. BARI Banana-1, BARI Banana-2, BARI Kola-3, BARI Kola-4 & others)

Yield Goal: 50.0± 5.0 t/ha

| Method of application | Nutrient Recommendation (g/plant) |           |            |           |            |             | OF (kg/pit) |
|-----------------------|-----------------------------------|-----------|------------|-----------|------------|-------------|-------------|
|                       | N                                 | P         | K          | S         | Zn         | B           |             |
| Basal                 | –                                 | 80        | –          | 36        | 1.2        | 0.34        | 5           |
| 1 <sup>st</sup> TD*   | 46                                | –         | 60         | –         | –          | –           | –           |
| 2 <sup>nd</sup> TD    | 46                                | –         | 60         | –         | –          | –           | –           |
| 3 <sup>rd</sup> TD    | 46                                | –         | 60         | –         | –          | –           | –           |
| 4 <sup>th</sup> TD    | 92                                | –         | 120        | –         | –          | –           | –           |
| <b>Total</b>          | <b>230</b>                        | <b>80</b> | <b>300</b> | <b>36</b> | <b>1.2</b> | <b>0.34</b> | <b>5</b>    |

\*TD: Top dressing

#### Method of application

- Half of OF and P, and all of S, Zn, and B, recommended for basal application should be applied in pit 10-15 days before planting of sucker and mixed thoroughly with the soil followed by irrigation. The remaining half manure and P should be applied as broadcast before final land preparation.
- The N and K should be applied in four splits as top dressing around the plants and mixed thoroughly with the soil followed by irrigation. The first topdressing should be done after sucker establishment, preferably about two months after planting. The next two topdressings should be done at two months interval and the last topdressing should be done after emergence of inflorescence.

## PAPAYA (*Carica papaya*)

(Var. ShahiPepeand others)

Yield Goal: 50.0 ± 5.0 t/ha

| Method of application | Nutrient Recommendation (g/plant) |            |            |           |            |          | OF (kg/pit) |
|-----------------------|-----------------------------------|------------|------------|-----------|------------|----------|-------------|
|                       | N                                 | P          | K          | S         | Zn         | B        |             |
| Basal(Pit)            | –                                 | 100        | –          | 45        | 2.5        | 4        | 5           |
| 1 <sup>st</sup> TD*   | 25                                | –          | 25         | –         | –          | –        | –           |
| 2 <sup>nd</sup> TD    | 25                                | –          | 25         | –         | –          | –        | –           |
| 3 <sup>rd</sup> TD    | 25                                | –          | 25         | –         | –          | –        | –           |
| 4 <sup>th</sup> TD    | 50                                | –          | 50         | –         | –          | –        | –           |
| 5 <sup>th</sup> TD    | 50                                | –          | 50         | –         | –          | –        | –           |
| 6 <sup>th</sup> TD    | 50                                | –          | 50         | –         | –          | –        | –           |
| <b>Total</b>          | <b>225</b>                        | <b>100</b> | <b>225</b> | <b>45</b> | <b>2.5</b> | <b>4</b> | <b>5</b>    |

### Method of application:

- The basal dose should be applied in pit 10-15 days before planting seedlings and mixed thoroughly with the soil followed by irrigation.
- The first top dressing of N and K should be done around the plant after 30 days of seedling establishment and mixed thoroughly with the soil followed by irrigation.
- The remaining N and K fertilizers should be applied around the plants at 30 days interval at the rate of 25 g/plant up to flowering and then 50 g/plant until two months before final harvest for both the nutrients and mixed thoroughly with the soil followed by irrigation.

## PINEAPPLE (*Ananas sativus*)

(Var. Giant kew, Honey queen, Ghorasal and others)

Yield Goal: 30.0 ± 3.0 t/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |        |         |       |         | OF (t/ha) |
|------------------------------|--------------------------------------|--------|---------|-------|---------|-----------|
|                              | N                                    | P      | K       | S     | Zn      |           |
| Optimum                      | 0–60                                 | 0–25   | 0–60    | 0–7   | –       | 3         |
| Medium                       | 61–120                               | 26–50  | 61–120  | 8–14  | 0.0–1.5 |           |
| Low                          | 121–180                              | 51–75  | 121–180 | 15–21 | 1.6–3.0 |           |
| Very low                     | 181–240                              | 76–100 | 181–240 | 22–28 | 3.1–4.5 |           |

### Method of application

- All of OF, P, S, and Zn should be applied as basal during final land preparation.
- The N and K should be applied in five equal splits as side dressing at one month interval starting from 4–5 months after planting and mixed thoroughly with the soil followed by irrigation.

## WATER MELON (*Citrullus colocynthis*)

(All cultivars)

**Yield Goal: 60± 6t/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|---------|-----------|
|                              | N                               | P     | K      | S     | Zn      | B       |           |
| Optimum                      | 0-35                            | 0-12  | 0-27   | 0-5   | -       | -       | 3         |
| Medium                       | 36-70                           | 13-24 | 28-54  | 6-10  | 0.0-1.0 | 0.0-0.7 |           |
| Low                          | 71-105                          | 25-36 | 55-81  | 11-15 | 1.1-2.0 | 0.8-1.4 |           |
| Very low                     | 106-140                         | 37-48 | 82-108 | 16-20 | 2.1-3.0 | 1.5-2.1 |           |

### Method of application

- All of OF, P, S, Zn, and B should be applied in pit 5-7 days prior to seedling planting and mixed thoroughly with the soil.
- N should be applied around the plant as side dressing at 15, 35, 55 and 75 DAP under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## MANGO (*Mangifera indica*)

(Var. BARI Aam-1, BARI Aam-2, BARI Aam-3, BARI Aam-4, BARI Aam-5, BARI Aam-6, BARI Aam-7, BARI Aam-8, BARI Aam-9 and others)

**Yield Goal: 250± 25 kg/tree (above 20 years old tree)**

| Age of tree (Year)    | Nutrient Recommendation (g/tree/year) |     |     |    |     |   | OF (kg/tree/year) |
|-----------------------|---------------------------------------|-----|-----|----|-----|---|-------------------|
|                       | N                                     | P   | K   | S  | Zn  | B |                   |
| Before planting (Pit) | -                                     | 100 | -   | 36 | -   | 9 | 10                |
| 0-1                   | 46                                    | 15  | 25  | -  | 1.2 | - | 5                 |
| 2-4                   | 115                                   | 32  | 50  | 18 | 3.6 | 4 | 7                 |
| 5-7                   | 230                                   | 53  | 100 | 36 | 3.6 | 4 | 10                |
| 8-10                  | 345                                   | 84  | 125 | 45 | 5.4 | 5 | 12                |
| 11-15                 | 460                                   | 105 | 175 | 63 | 5.4 | 5 | 15                |
| 16-20                 | 690                                   | 158 | 200 | 72 | 7.2 | 7 | 20                |
| >20                   | 920                                   | 211 | 250 | 90 | 9.0 | 9 | 25                |

### Method of application

- Before planting, OF, P, S, Zn, and B should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For the growing trees, fertilizers should be applied annually in two equal splits, one half immediately after harvesting of fruits during June-July and the rest half in September-October in both young and old orchards. Fertilizer should be applied around the tree up to canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## MANGO (*Mangifera indica*)

(Var: BAU Mango-1, BAU Mango-2, BAU Mango-3, BAU Mango-4, BAU Mango-5, BAU Mango-6, BAU Mango-11, BAU Mango-14, BAU Mango-15, BAU Mango-24 BAU Mango-25 and others)

**Yield Goal: 300 ± 30 kg/tree/Year (above 20 years old tree)**

| Age of tree (Year)    | Nutrient Recommendation (g/tree/year) |     |     |    |     |   | OF (kg/tree/year) |
|-----------------------|---------------------------------------|-----|-----|----|-----|---|-------------------|
|                       | N                                     | P   | K   | S  | Zn  | B |                   |
| Before planting (Pit) | -                                     | 40  | -   | 20 | -   | 7 | 15                |
| 0-1                   | 60                                    | 20  | 60  | -  | 1.5 | - | -                 |
| 2-3                   | 120                                   | 40  | 100 | 6  | 2   | - | 12                |
| 4-5                   | 170                                   | 60  | 120 | 12 | 4   | 3 | 15                |
| 6-7                   | 280                                   | 100 | 180 | 24 | 4   | 3 | 20                |
| 8-10                  | 390                                   | 140 | 240 | 36 | 6   | 5 | 22                |
| 11-15                 | 500                                   | 180 | 300 | 48 | 6   | 5 | 25                |
| 16-20                 | 610                                   | 230 | 360 | 64 | 8   | 7 | 27                |
| >20                   | 720                                   | 280 | 400 | 80 | 10  | 9 | 30                |

**Method of application:** Same as in the previous page

## JACKFRUIT (*Artocarpus heterophyllus*)

(Var. BARI Kathal-1, BARI Kathal-2, BAU Kathal-1 and others)

**Yield Goal: 800 ± 80 kg/tree (above 15 years old tree)**

| Age of tree (Year)   | Nutrient Recommendation (g/tree/year) |     |     |    |     |     | OF (kg/tree/year) |
|----------------------|---------------------------------------|-----|-----|----|-----|-----|-------------------|
|                      | N                                     | P   | K   | S* | Zn  | B   |                   |
| Before Planting(Pit) | -                                     | 80  | -   | -  | -   | -   | 15                |
| 0-1                  | 100                                   | 50  | 100 | 20 | 1.2 | -   | 5                 |
| 2-4                  | 200                                   | 90  | 200 | 25 | 3.6 | -   | 10                |
| 5-7                  | 300                                   | 130 | 300 | 30 | 3.6 | 1.0 | 15                |
| 8-10                 | 400                                   | 180 | 400 | 40 | 5.4 | 1.5 | 20                |
| 11-15                | 550                                   | 240 | 520 | 50 | 5.4 | 2.0 | 25                |
| >15                  | 700                                   | 300 | 650 | 60 | 7.2 | 3.0 | 30                |

**Method of application:** Same as in the previous page for mango

## GUAVA (*Psidium guajava*)

(Var. BARI Payara-1 (Kazi Payara), BARI Payara-2, BARI Payara-3,  
BAU Payara-7, BAU Payara-8, BAU Payara-9 and others)

**Yield Goal: 60± 6kg/tree/year (above 5 years old tree)**

| Age of tree (Year)    | Nutrient Recommendation (g/tree/year) |     |     |    |    | OF (kg/tree/year) |
|-----------------------|---------------------------------------|-----|-----|----|----|-------------------|
|                       | N                                     | P   | K   | S  | Zn |                   |
| Before Planting (Pit) | -                                     | 50  | -   | -  | -  | 5                 |
| 1                     | 46                                    | 50  | 50  | 10 | 5  | 5                 |
| 2                     | 92                                    | 50  | 50  | -  | -  | 5                 |
| 3                     | 138                                   | 50  | 150 | 10 | 5  | 7                 |
| 4                     | 200                                   | 80  | 200 | -  | -  | 10                |
| 5                     | 230                                   | 100 | 250 | 10 | 5  | 10                |
| >5                    | 230                                   | 100 | 250 | 10 | 5  | 12                |

### Method of application

- a) Before planting, OF, P, S and Zn should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- b) For the growing trees, all fertilizers should be applied around the trees in two equal splits during April–May and September–October. Fertilizer should be applied around the tree up to canopy spread leaving 1.0–1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.
- c) Sulphur should be applied in every alternate year. Boron should be applied with other fertilizers only in the fruiting trees.

## COCONUT (*Cocos nucifera*)

(BARI Narikel-1, BARI Narikel-2 and others)

**Yield Goal: 70 ± 7nut/tree/year (above 20 years old tree)**

| Age of tree (Year)    | Nutrient Recommendation (g/tree/year) |     |      |    |    |     | OF (kg/tree/year) |
|-----------------------|---------------------------------------|-----|------|----|----|-----|-------------------|
|                       | N                                     | P   | K    | S  | Zn | B   |                   |
| Before Planting (Pit) | -                                     | 50  | -    | -  | -  | -   | 12                |
| 1–4                   | 90                                    | 20  | 150  | 15 | 12 | 1.7 | 5                 |
| 5–7                   | 180                                   | 40  | 300  | 30 | 15 | 2.6 | 7                 |
| 8–10                  | 360                                   | 80  | 500  | 40 | 20 | 3.4 | 10                |
| 11–15                 | 450                                   | 100 | 800  | 50 | 25 | 5.1 | 12                |
| 16–20                 | 540                                   | 120 | 1000 | 50 | 25 | 6.8 | 15                |
| >20                   | 675                                   | 150 | 1200 | 50 | 25 | 8.5 | 20                |

### Method of application

- Before planting, recommended OF, P, S, Zn, and B should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers including OF should be applied in two equal splits, during April–May and September–October around the trees up to 2–3 meters leaving 1.0 meter from the tree base. Fertilizers should be applied by drilling with peg to a depth of 8–12 cm and covered with the soil.
- For the orchard, fertilizers may be broadcast and mixed with the soil by ploughing shallowly with power tiller followed by irrigation.

### LITCHI (*Litchi chinensis*)

(Var. BARI Lichu-1, BARI Lichu-2, BARI Lichu-3, BARI Lichu-4, BAU Litchi-3, BAU Litchi-4, BAU Litchi-4 and others)

Yield Goal: 130 ± 13 kg/tree (above 20 years old tree)

| Age of tree (Year)    | Nutrient Recommendation (g/tree/year) |     |     |    |    |      | OF (kg/tree/year) |
|-----------------------|---------------------------------------|-----|-----|----|----|------|-------------------|
|                       | N                                     | P   | K   | S  | Zn | B    |                   |
| Before Planting (Pit) | -                                     | 100 | -   | -  | -  | -    | 10                |
| 0-1                   | 138                                   | -   | -   | 15 | 10 | 2.0  | -                 |
| 2-4                   | 184                                   | 80  | 100 | 30 | 15 | 2.5  | 5                 |
| 5-7                   | 230                                   | 120 | 200 | 40 | 20 | 5.0  | 7                 |
| 8-10                  | 345                                   | 240 | 400 | 50 | 25 | 5.0  | 10                |
| 11-15                 | 552                                   | 320 | 600 | 50 | 30 | 7.5  | 15                |
| 16-20                 | 690                                   | 400 | 750 | 50 | 30 | 10.0 | 20                |
| > 20                  | 920                                   | 560 | 750 | 50 | 30 | 12.5 | 25                |

### Method of application

- Before planting, recommended OF, P, S, Zn, and B should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- In the first year, the OF and N should be applied at a time around the tree during September and mixed thoroughly with the soil.
- In the subsequent years, all fertilizers (as per recommendation) should be applied in three equal splits during March-April, June and October. Fertilizer should be applied around the tree up to canopy spread leaving 1.0–1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## CITRUS

### PUMMELO (*Citrus grandis*)

(BARI Batabilebu-1, BARI Batabilebu-2, BARI Batabilebu-3, BARI Batabilebu-4,  
BAU Jambura-1, BAU Jambura-2, BAU Jambura-3 and others)

**Yield Goal: 100± 10 kg/tree (above 10 years old tree)**

| Age of tree (Year)    | Nutrient Recommendation (g/tree/year) |    |     |    |    |     | OF (kg/tree/year) |
|-----------------------|---------------------------------------|----|-----|----|----|-----|-------------------|
|                       | N                                     | P  | K   | S  | Zn | B   |                   |
| Before Planting (Pit) | -                                     | 60 | -   | -  | -  | -   | 7                 |
| 1-2                   | 90                                    | 20 | 75  | 15 | 5  | 1.0 | 5                 |
| 3-4                   | 130                                   | 30 | 150 | 30 | 10 | 1.5 | 7                 |
| 5-7                   | 170                                   | 55 | 225 | 40 | 15 | 2.0 | 10                |
| 8-10                  | 210                                   | 75 | 263 | 40 | 15 | 2.5 | 12                |
| > 10                  | 250                                   | 85 | 320 | 40 | 15 | 2.5 | 15                |

**Method of application:** As below

### MANDARIN (*Citrus reticulanta*)

(BARI Kamala-1 and others)

**Yield Goal: 40 ± 4 kg/tree (above 10 years old tree)**

| Age of tree (Year)    | Nutrient Recommendation (g/tree/year) |     |     |    |    |     | OF (kg/tree/year) |
|-----------------------|---------------------------------------|-----|-----|----|----|-----|-------------------|
|                       | N                                     | P   | K   | S  | Zn | B   |                   |
| Before Planting (Pit) | -                                     | 50  | -   | -  | -  | -   | 7                 |
| 1-2                   | 90                                    | 20  | 75  | 20 | 4  | 1.0 | 5                 |
| 3-4                   | 135                                   | 40  | 100 | 25 | 6  | 1.5 | 7                 |
| 5-7                   | 180                                   | 60  | 150 | 30 | 8  | 2.0 | 10                |
| 8-10                  | 225                                   | 80  | 200 | 35 | 10 | 2.5 | 12                |
| > 10                  | 290                                   | 100 | 250 | 35 | 12 | 3.0 | 15                |

#### **Method of application**

- Before planting, recommended OF, P, S, and B should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in three equal splits, during February, May and September (for Mandarin) – October (for Pummelo). Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed gently with the soil followed by irrigation. Under hill condition, drilling method should be followed.
- For the highly acidic soils, dolomite lime should be applied at the rate of 250 g/tree in every 3-4 year.

## SWEET ORANGE (*Citrus sinensis*)

(Var. BARI Malta-1, BAU Malta-1)

Yield Goal:  $40 \pm 4.0$  kg/tree/year (Above 10 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    |    |     | OF (kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|----|-----|-------------------|
|                    | N                                     | P   | K   | S  | Zn | B   |                   |
| Before planting    | -                                     | 50  | -   | -  | -  | -   | 7                 |
| 1-2                | 113                                   | 20  | 63  | 20 | 4  | 1.0 | 6                 |
| 3-4                | 169                                   | 40  | 88  | 25 | 6  | 1.5 | 7                 |
| 5-7                | 236                                   | 60  | 113 | 30 | 8  | 2.0 | 9                 |
| 8-10               | 293                                   | 80  | 138 | 35 | 10 | 2.5 | 10                |
| > 10               | 338                                   | 100 | 225 | 35 | 12 | 3.0 | 12                |

Method of application: As below

## LEMON (*Citrus limon*)

(Var. BARI Lebu-1, BARI Lebu-2, BARI Lebu-3, BAU Lemon-1, BAU Lemon-2, BAU Lemon-3, BAU Lemon-4 and others)

Yield Goal:  $15.0 \pm 1.5$ kg/tree/year (above 5 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |    |     |    |     |     | OF (kg/tree/year) |
|--------------------|---------------------------------------|----|-----|----|-----|-----|-------------------|
|                    | N                                     | P  | K   | S  | Zn  | B   |                   |
| Before planting    | -                                     | 40 | -   | -  | -   | -   | 6                 |
| 1-2                | 90                                    | 40 | 100 | 20 | 3.0 | 1.0 | 7                 |
| 3-5                | 180                                   | 60 | 150 | 25 | 4.5 | 2.0 | 10                |
| > 5                | 225                                   | 80 | 200 | 30 | 6.0 | 2.5 | 12                |

### Method of application

- Before planting, recommended OF, P, S, and B should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in three equal splits, during March, May and October (just after harvesting of fruit) for sweet orange; and February, April-May and September-October for lemon. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed gently with the soil followed by irrigation. Under hill condition, drilling method should be followed.
- For the highly acidic soils, dolomite lime should be applied at the rate of 250 g/tree in every 3-4 year.

## SATKARA (*Citrus macroptera*)

(Var. BARI Satkara-1 and others)

Yield Goal: 30.0 ± 3.0 kg/tree/year (above 10 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |    |     |    | OF (kg/tree/year) |
|--------------------|---------------------------------------|----|-----|----|-------------------|
|                    | N                                     | P  | K   | S  |                   |
| Before planting    | -                                     | 50 | -   | -  | 7                 |
| 1-2                | 90                                    | 17 | 75  | 10 | 5                 |
| 3-4                | 128                                   | 31 | 150 | 12 | 7                 |
| 5-7                | 190                                   | 55 | 225 | 14 | 10                |
| 8-10               | 248                                   | 85 | 263 | 16 | 12                |
| > 10               | 293                                   | 95 | 320 | 18 | 15                |

### Method of application

- Before planting, recommended OF and P should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in three equal splits, during February, May and October. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.
- For the highly acidic soils, dolomite lime should be applied at the rate of 250 g/tree in every 3-4 year.

## BER (*Zizyphus mauritiana*)

(Var. BARI Kul-1, BARI Kul-2, BARI Kul-3 and others)

Yield Goal: 40±4 t/ha/year (above 8 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    |     | OF (kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|-----|-------------------|
|                    | N                                     | P   | K   | S  | B   |                   |
| Before planting    | -                                     | 50  | -   | -  | -   | 12                |
| 1-2                | 135                                   | 50  | 125 | 15 | 1.0 | 5                 |
| 3-4                | 225                                   | 80  | 200 | 20 | 1.5 | 7                 |
| 5-6                | 338                                   | 140 | 350 | 25 | 2.0 | 10                |
| 7-8                | 450                                   | 170 | 425 | 30 | 2.5 | 12                |
| > 8                | 563                                   | 200 | 500 | 40 | 2.5 | 15                |

**Method of application:** As in the next page

## BER (*Zizyphus mauritiana*)

Var. BAU Kul-1, BAU Kul-2, BAU Kul-3 and others

Yield Goal: 50 ±5 t/ha/year (above 2 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    |     | OF (kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|-----|-------------------|
|                    | N                                     | P   | K   | S  | B   |                   |
| Before planting    | -                                     | 40  | -   | -  | -   | 15                |
| 1                  | 120                                   | 60  | 150 | 18 | 1.0 | 7                 |
| 2                  | 240                                   | 90  | 225 | 24 | 2.0 | 10                |
| > 2                | 360                                   | 120 | 300 | 36 | 3.0 | 15                |

### Method of application

- Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in three equal splits, during March, May and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

## GOLDEN APPLE (*Spondias pinnata*)

(BARI Amra-1 and BAU Amra-1)

Yield Goal: 28± 2.8 kg/tree/year (above 10 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |    |     |    |     | OF (kg/tree/year) |
|--------------------|---------------------------------------|----|-----|----|-----|-------------------|
|                    | N                                     | P  | K   | S  | B   |                   |
| Before planting    | -                                     | 40 | -   | -  | -   | 7                 |
| 1-2                | 50                                    | 30 | 50  | 10 | 1.0 | 5                 |
| 3-4                | 75                                    | 40 | 75  | 15 | 1.5 | 7                 |
| 5-7                | 100                                   | 50 | 100 | 20 | 2.0 | 10                |
| 8-10               | 125                                   | 60 | 125 | 25 | 2.5 | 12                |
| > 10               | 150                                   | 70 | 150 | 30 | 2.5 | 15                |

### Method of application

- Before planting, recommended OF and P should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in four equal splits at 2-3 months interval during March-April, May-June, September and November. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

## GOLDEN APPLE (*Spondias pinnata*)

Var. BARI Amra-2 and others

Yield Goal: 45± 4.5 kg/tree (above 10 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    |     | OF<br>(kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|-----|----------------------|
|                    | N                                     | P   | K   | S  | B   |                      |
| Before planting    | -                                     | 60  | -   | -  | -   | 7                    |
| 1-2                | 75                                    | 45  | 75  | 15 | 1.5 | 10                   |
| 3-4                | 110                                   | 60  | 110 | 22 | 2.0 | 12                   |
| 5-7                | 150                                   | 75  | 150 | 30 | 2.5 | 15                   |
| 8-10               | 185                                   | 90  | 185 | 37 | 3.0 | 20                   |
| > 10               | 225                                   | 105 | 225 | 45 | 3.0 | 25                   |

Method of application: As in the previous page

## SAPOTA (*Achras sapota*)

(Var. BARI Sofeda-1, BARI Sofeda-2, BARI Sofeda-3, BAU Shofeda-1, BAU Shofeda-2, BAU Shofeda-3, BAU Shofeda-4 and others)

Yield Goal: 130 ± 1.3 kg/tree/year (above 15 years old tree)

| Age of tree (Year)   | Nutrient Recommendation (g/tree/year) |     |     |    | OF<br>(kg/tree/year) |
|----------------------|---------------------------------------|-----|-----|----|----------------------|
|                      | N                                     | P   | K   | S  |                      |
| Before Planting(Pit) | -                                     | 50  | -   | -  | 12                   |
| 1-3                  | 68                                    | 40  | 75  | 12 | 10                   |
| 4-7                  | 180                                   | 60  | 200 | 18 | 12                   |
| 8-10                 | 293                                   | 100 | 325 | 36 | 15                   |
| 11-15                | 383                                   | 140 | 425 | 54 | 20                   |
| > 15                 | 450                                   | 160 | 500 | 72 | 25                   |

### Method of application

- Before planting, recommended OF and P should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in four equal splits at 2-3 months interval during March-April, May-June, September and November. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

## CARAMBOLA (*Averrhoa carambola*)

(Var. BARI Kamranga-1, BARI Kamranga-2, BAU Kamranga-1,  
BAU Kamranga-2, BAU Kamranga-3 and others)

**Yield Goal:** 200± 20 kg/tree/year (above 10 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|-------------------|
|                    | N                                     | P   | K   | S  |                   |
| Before planting    | -                                     | 50  | -   | -  | 7                 |
| 1-3                | 158                                   | 55  | 138 | 18 | 5                 |
| 4-6                | 225                                   | 70  | 175 | 27 | 7                 |
| 7-10               | 315                                   | 90  | 213 | 36 | 10                |
| > 10               | 405                                   | 110 | 238 | 45 | 15                |

**Method of application:** As below for Jamun

## JAMUN (*Syzygium cumini*)

(All cultivars)

**Yield Goal:** 150 ± 15 kg/tree (above 15 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|-------------------|
|                    | N                                     | P   | K   | S  |                   |
| Before planting    | -                                     | 60  | -   | -  | 10                |
| 1-3                | 90                                    | 40  | 100 | 12 | 10                |
| 4-6                | 180                                   | 60  | 150 | 18 | 12                |
| 7-10               | 270                                   | 100 | 250 | 36 | 15                |
| 11-15              | 360                                   | 140 | 350 | 45 | 20                |
| > 15               | 450                                   | 160 | 400 | 54 | 20                |

### Method of application

- a) Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- b) For growing trees, the recommended fertilizers should be applied in two equal splits during April-May and September-October.
- c) Fertilizer should be applied around the tree up to the canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## BURMESE GRAPE (*Baccaurea ramiflora*)

(BARI Lotkan-1, BAU Lotkan-1 and others)

Yield Goal: 60 ± 6 kg/tree (above 15 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-------------------|
|                          | N                                     | P   | K   | S  |                   |
| Before Planting (in Pit) | -                                     | -   | -   | -  | 10                |
| 1-2                      | 50                                    | 40  | 100 | 18 | 10                |
| 3-4                      | 100                                   | 50  | 125 | 24 | 12                |
| 5-10                     | 200                                   | 60  | 175 | 30 | 15                |
| 11-15                    | 300                                   | 80  | 250 | 42 | 20                |
| > 15                     | 400                                   | 100 | 350 | 55 | 25                |

### Method of application

- Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in three equal splits, the first one after fruit harvest and then in the month of September-October and March for. Fertilizer should be applied around the tree up to the canopy spreadleaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## AONLA (*Emblica officinalis*)

(Var. BARI Amlöki-1, BAU Amlöki-1 and others)

Yield Goal: 130± 13kg/tree/year (above 15 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-------------------|
|                          | N                                     | P   | K   | S  |                   |
| Before planting (in Pit) | -                                     | -   | -   | -  | 7                 |
| 1-2                      | 90                                    | 20  | 50  | -  | 5                 |
| 3-5                      | 180                                   | 50  | 125 | 18 | 7                 |
| 6-10                     | 248                                   | 80  | 200 | 27 | 10                |
| 11-15                    | 405                                   | 130 | 325 | 36 | 12                |
| > 15                     | 675                                   | 200 | 500 | 45 | 15                |

### Method of application

- Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in two equal splits during June-July and September-October. Fertilizer should be applied around the tree up to the canopy spreadleaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## WAX APPLE (*Syzygium samrangense*)

(Var. BARI Jamrul-1, BAU Jamrul-1, BAU Jamrul-2 and BAU Jamrul-3 and others)

Yield Goal: 100 ± 10 kg/tree (above 8 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    | OF<br>(kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|----------------------|
|                    | N                                     | P   | K   | S  |                      |
| Before planting    | -                                     | -   | -   | -  | 15                   |
| 1-2                | 80                                    | 40  | 100 | 15 | 10                   |
| 3-4                | 120                                   | 70  | 120 | 20 | 15                   |
| 5-6                | 160                                   | 90  | 150 | 25 | 20                   |
| 7-8                | 200                                   | 100 | 180 | 30 | 25                   |
| >8                 | 240                                   | 110 | 220 | 36 | 30                   |

**Method of application:** Same as below

## WOOD APPLE (*Aegle marmelos*)

(Bel)

(All cultivars)

Yield Goal: 500 ± 50 fruits/tree (above 20 years old tree)

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |     |     |    | OF<br>(kg/tree/year) |
|--------------------|---------------------------------------|-----|-----|----|----------------------|
|                    | N                                     | P   | K   | S  |                      |
| Before planting    | -                                     | -   | -   | -  | 10                   |
| 1-4                | 90                                    | 40  | 100 | 12 | 5                    |
| 5-8                | 180                                   | 80  | 150 | 18 | 7                    |
| 9-12               | 270                                   | 120 | 200 | 27 | 10                   |
| 13-16              | 360                                   | 160 | 250 | 36 | 12                   |
| 17-20              | 450                                   | 200 | 300 | 45 | 15                   |
| > 20               | 500                                   | 220 | 350 | 54 | 17                   |

### Method of application

- a) Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- b) For growing trees, the recommended fertilizers should be applied in two equal splits during May and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## ELEPHANT'S FOOT APPLE (*Feronia limonia*)

(Var. BAUKodbel-1 and others)

Yield Goal: 200 ± 20 fruits/tree (above 15 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-------------------|
|                          | N                                     | P   | K   | S  |                   |
| Before planting (in pit) | -                                     | -   | -   | -  | 7                 |
| 1-3                      | 70                                    | 40  | 100 | -  | 5                 |
| 4-6                      | 90                                    | 50  | 125 | 18 | 10                |
| 7-9                      | 110                                   | 60  | 150 | 27 | 12                |
| 10-12                    | 170                                   | 75  | 175 | 36 | 15                |
| 13-15                    | 230                                   | 90  | 200 | 45 | 17                |
| > 15                     | 300                                   | 110 | 250 | 54 | 20                |

**Method of application:** Same as below

## BULLOCK'S HEART (*Anona squamosa*)

(Ata phal)  
(All cultivars)

Yield Goal: 60 ± 6 kg/tree (above 10 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-------------------|
|                          | N                                     | P   | K   | S  |                   |
| Before planting (in pit) | -                                     | -   | -   | -  | 7                 |
| 1-2                      | 100                                   | 40  | 50  | 10 | 5                 |
| 3-4                      | 150                                   | 50  | 75  | 15 | 7                 |
| 5-6                      | 200                                   | 60  | 100 | 18 | 10                |
| 7-8                      | 250                                   | 75  | 140 | 36 | 12                |
| 9-10                     | 300                                   | 90  | 180 | 45 | 15                |
| > 10                     | 350                                   | 100 | 200 | 54 | 17                |

### Method of application

- Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in three equal splits during February, May and October (just after harvesting of fruit) for Elephant's Foot Apple; and during April-May and September-October for Bullock's Heart. Fertilizer should be applied around the tree up to the canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## CUSTARD APPLE (*Annona squamosa*)

(Sharifa)

(All cultivars)

Yield Goal:  $25 \pm 0.25$  kg/tree (above 10 years old tree)

| Age of tree (Year)         | Nutrient Recommendation (g/tree/year) |    |     |    | OF<br>(kg/tree/year) |
|----------------------------|---------------------------------------|----|-----|----|----------------------|
|                            | N                                     | P  | K   | S  |                      |
| Beforeplanting<br>(in pit) | -                                     | -  | -   | -  | 7                    |
| 1-2                        | 50                                    | 20 | 65  | 8  | -                    |
| 3-5                        | 100                                   | 30 | 80  | 10 | 5                    |
| 6-8                        | 150                                   | 40 | 115 | 12 | 7                    |
| 9-10                       | 200                                   | 50 | 145 | 16 | 10                   |
| > 10                       | 250                                   | 60 | 175 | 20 | 12                   |

**Method of application:** Same as below

## VELVET APPLE (*Diospyros discolor*)

(Var. BARI Bilatigab-1, BAU Bilatigab-1, BAU Bilatigab-2 and others)

Yield Goal:  $120 \pm 12$  kg/tree (above 15 years old tree)

| Age of tree (Year)          | Nutrient Recommendation (g/tree/year) |    |     |    | OF<br>(kg/tree/year) |
|-----------------------------|---------------------------------------|----|-----|----|----------------------|
|                             | N                                     | P  | K   | S  |                      |
| Before planting<br>(in pit) | -                                     | -  | -   | -  | 7                    |
| 1-3                         | 100                                   | 40 | 100 | 8  | -                    |
| 4-7                         | 200                                   | 50 | 200 | 10 | 5                    |
| 8-11                        | 300                                   | 60 | 300 | 20 | 7                    |
| 12-15                       | 400                                   | 70 | 400 | 30 | 10                   |
| > 15                        | 500                                   | 80 | 500 | 40 | 12                   |

### Method of application

- Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in three equal splits during February-March, May-June and September-October for Custard Apple; and in two equal splits during May-June and September-October for Velvet Apple. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

## TAMARIND (*Tamarindus indicus*)

[Var. BARI Tentul-1 and others]

**Yield Goal:** 80 ± 8 kg/tree/year (above 15 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-------------------|
|                          | N                                     | P   | K   | S  |                   |
| Before planting (in pit) | -                                     | -   | -   | -  | 10                |
| 1-3                      | 100                                   | 40  | 150 | 8  | -                 |
| 4-6                      | 200                                   | 80  | 250 | 10 | 10                |
| 7-10                     | 300                                   | 120 | 400 | 20 | 12                |
| 11-15                    | 400                                   | 170 | 500 | 30 | 15                |
| >15                      | 500                                   | 220 | 600 | 40 | 20                |

**Method of application:** Same as below

Var. BAU Tatul-1 (Misti), BAU Tatul-2 (Sour)

**Yield Goal:** 30 ± 3 kg/tree/year (above 8 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |    |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|----|-----|----|-------------------|
|                          | N                                     | P  | K   | S  |                   |
| Before planting (in pit) | -                                     | -  | -   | -  | 7                 |
| 1-2                      | 60                                    | 30 | 75  | 15 | -                 |
| 3-4                      | 80                                    | 40 | 100 | 20 | 7                 |
| 5-6                      | 100                                   | 50 | 125 | 25 | 9                 |
| 7-8                      | 140                                   | 60 | 150 | 30 | 10                |
| >8                       | 200                                   | 80 | 200 | 40 | 12                |

### Method of application

- a) Before planting, OF should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- b) For growing trees, the recommended fertilizers should be applied in three equal splits during May-June and September-October and February-March for the high yielding varieties (80 ± 8 kg/tree/year); and in two equal splits during May-June and September-October for low yielding varieties (30 ± 3 kg/tree/year).
- c) Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

## INDIAN DILLENIA (*Dillenia indica*) (Chalta)

(All cultivars)

**Yield Goal: 100 ± 10 kg/tree (above 12 years old tree)**

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-------------------|
|                          | N                                     | P   | K   | S  |                   |
| Before planting (in Pit) | -                                     | -   | -   | -  | 7                 |
| 1-4                      | 100                                   | 30  | 100 | 18 | -                 |
| 5-8                      | 200                                   | 50  | 150 | 36 | 5                 |
| 9-12                     | 300                                   | 75  | 200 | 45 | 7                 |
| > 12                     | 400                                   | 100 | 250 | 54 | 10                |

### Method of application

- a) Before planting, OF should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- b) For growing trees, the recommended fertilizers should be applied in two equal splits during April-May and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

## DRAGON FRUIT (*Hylocereus undatus*)

(Var. BAU Dragon-1, BAU Dragon-2, BAU Dragon-3 and BAU Dragon-4)

**Yield Goal: 60 ± 6 kg/plant/year (above 6 years)**

| Age of tree (Year) | Nutrient Recommendation (g/plant/year) |     |     |    |     | OF (kg/plant/year) | Rice husk (kg/plant/year) |
|--------------------|--|-----|-----|----|-----|--------------------|---------------------------|
|                    | N                                      | P   | K   | S  | B   |                    |                           |
| Before Planting    | -                                      | 20  | -   | 10 | -   | 30                 | 15                        |
| 1-2                | 75                                     | 50  | 100 | -  | 1.0 | 10                 | 2                         |
| 3-4                | 100                                    | 60  | 120 | 10 | 1.5 | 12                 | 3                         |
| 5-6                | 125                                    | 75  | 150 | 15 | 2.0 | 15                 | 4                         |
| 7-8                | 150                                    | 90  | 200 | 20 | 2.5 | 22                 | 5                         |
| >8                 | 175                                    | 100 | 250 | 25 | 2.5 | 25                 | 6                         |

### Method of application

- a) Before planting, OF, rice husk, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- b) For growing trees, the recommended fertilizers should be applied in two equal splits during April-May and September-October. Fertilizer should be applied around the plant and mixed thoroughly with the soil followed by irrigation.

## STRAWBERRY (*Fragaria ananassa*)

(Var. BARI Strawberry-1, BAU Strawberry-1 and others)

Yield Goal: 10± 1.0 t/ha

| Soil Analysis Interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      | B       |           |
| Optimum                      | 0-45                            | 0-18  | 0-40    | 0-9   | -       | -       | 5         |
| Medium                       | 46-90                           | 19-36 | 41-80   | 10-18 | 0.0-1.5 | 0.0-0.7 |           |
| Low                          | 91-135                          | 37-54 | 81-120  | 19-27 | 1.6-3.0 | 0.8-1.4 |           |
| Very low                     | 136-180                         | 55-72 | 121-160 | 28-36 | 3.1-4.5 | 1.5-2.1 |           |

### Method of application

- All of OF, P,S, Zn and B; and half of potassium should be applied as basal during final land preparation.
- Nitrogen and remaining potassium should be applied in 4-5 installments at 15-20 days interval starting from 15 DAP.

## LONGAN (*Nephelium longana*)

(Var. BAU Longan-1, BAU Longan-2)

Yield Goal: 40 ± 4 kg/tree/year (above 10 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    |     | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-----|-------------------|
|                          | N                                     | P   | K   | S  | B   |                   |
| Before planting (in pit) | -                                     | -   | -   | -  | -   | 7                 |
| 1-2                      | 100                                   | 40  | 90  | 10 | -   | -                 |
| 3-4                      | 150                                   | 60  | 120 | 15 | 1.0 | 10                |
| 5-6                      | 200                                   | 80  | 160 | 20 | 1.5 | 12                |
| 7-8                      | 250                                   | 100 | 200 | 25 | 2.0 | 15                |
| 9-10                     | 300                                   | 120 | 250 | 32 | 2.5 | 17                |
| >10                      | 350                                   | 150 | 300 | 40 | 2.5 | 20                |

### Method of application

- Before planting, recommended OF should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in two equal splits during April-May and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## CASHEWNUT (*Anacardium occidentale*)

(Var. BAU Kajubadam-1)

Yield Goal: 20 ± 2 kg/tree/year (above 8 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |    |     |    |     | OF (kg/tree/year) |
|--------------------------|---------------------------------------|----|-----|----|-----|-------------------|
|                          | N                                     | P  | K   | S  | B   |                   |
| Before planting (in pit) | -                                     | -  | -   | -  | -   | 7                 |
| 1-2                      | 75                                    | 30 | 70  | -  | 1.0 | -                 |
| 3-4                      | 90                                    | 40 | 85  | 15 | 1.5 | 7                 |
| 5-6                      | 105                                   | 50 | 100 | 20 | 2.0 | 10                |
| 7-8                      | 125                                   | 60 | 120 | 25 | 2.5 | 12                |
| >8                       | 145                                   | 70 | 140 | 30 | 2.5 | 15                |

### Method of application

- Before planting, recommended OF should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in two equal splits during April-May and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## STAR GOOSE BERRY (*Phyllanthus acidus*)

(Var. BAU Orbiroi-1)

Yield Goal: 30 ± 3 kg/plant/year (above 8 years old tree )

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |    |     |    |     | OF (kg/plant/year) |
|--------------------------|---------------------------------------|----|-----|----|-----|--------------------|
|                          | N                                     | P  | K   | S  | B   |                    |
| Before planting (in pit) | -                                     | -  | -   | -  | -   | 7                  |
| 1-2                      | 50                                    | 30 | 100 | 10 | 1.0 | -                  |
| 3-4                      | 75                                    | 50 | 120 | 15 | 1.5 | 7                  |
| 5-6                      | 100                                   | 50 | 150 | 20 | 2.0 | 10                 |
| 7-8                      | 125                                   | 60 | 200 | 25 | 2.5 | 12                 |
| >8                       | 150                                   | 70 | 250 | 30 | 2.5 | 15                 |

### Method of application

- Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in two equal splits during June-July and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

### Fig (*Ficus carica*)

(Var. BAU Dumur-1)

Yield Goal:  $5 \pm 0.5$  kg/plant/year (above 8 years old tree )

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |    |     |    |     | OF (kg/plant/year) |
|--------------------------|---------------------------------------|----|-----|----|-----|--------------------|
|                          | N                                     | P  | K   | S  | B   |                    |
| Before planting (in pit) | -                                     | -  | -   | -  | -   | 7                  |
| 1-2                      | 50                                    | 30 | 70  | 10 | 1.0 | -                  |
| 3-4                      | 90                                    | 40 | 85  | 15 | 1.5 | 7                  |
| 5-6                      | 105                                   | 50 | 100 | 20 | 2.0 | 10                 |
| 7-8                      | 125                                   | 60 | 120 | 25 | 2.5 | 12                 |
| >8                       | 145                                   | 70 | 140 | 30 | 2.5 | 15                 |

**Method of application:** Same as below

### INDIAN OLIVE (*Elaeocarpus floribundus*)

(Var. BAU Jalpai-1)

Yield Goal:  $20 \pm 2$  kg/tree/year (above 8 years old tree)

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |    |     |    |     | OF (kg/tree/year) |
|--------------------------|---------------------------------------|----|-----|----|-----|-------------------|
|                          | N                                     | P  | K   | S  | B   |                   |
| Before planting (in pit) | -                                     | -  | -   | -  | -   | 7                 |
| 1-2                      | 75                                    | 30 | 70  | -  | 1.0 | -                 |
| 3-4                      | 90                                    | 40 | 85  | 15 | 1.5 | 7                 |
| 5-6                      | 105                                   | 50 | 100 | 20 | 2.0 | 10                |
| 7-8                      | 125                                   | 60 | 120 | 25 | 2.5 | 12                |
| >8                       | 145                                   | 70 | 140 | 30 | 2.5 | 15                |

#### Method of application

- a) Before planting, recommended OF, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- e) For growing trees, the recommended fertilizers should be applied in two equal splits during June-July and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## PALMYRA PALM (*Borassus flabellifer*)

(Tal)

(All cultivars)

Yield Goal: 200 ± 20 fruits/tree (above 20 years old tree)

| Age of tree (Year)          | Nutrient Recommendation (g/tree/year) |     |     | OF<br>(kg/tree/year) |
|-----------------------------|---------------------------------------|-----|-----|----------------------|
|                             | N                                     | P   | K   |                      |
| Before<br>Planting (in Pit) | -                                     | -   | -   | 7                    |
| 1-4                         | 100                                   | 40  | 100 | 5                    |
| 5-10                        | 200                                   | 50  | 200 | 7                    |
| 11-15                       | 300                                   | 60  | 300 | 10                   |
| 16-20                       | 400                                   | 80  | 400 | 12                   |
| > 20                        | 500                                   | 100 | 500 | 15                   |

### Method of application

- Before planting, recommended OF should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.
- For growing trees, the recommended fertilizers should be applied in two equal splits during April-May and September-October. Fertilizer should be applied around the tree and mixed thoroughly with the soil followed by irrigation.

### 11.1.9 Plantation Crops

## SUGARCANE (*Saccharum officinarum*)

(All varieties)

Yield Goal: 100 ± 10 t/ha

| Soil Analysis Interpretation | Nutrient Recommendation (kg/ha) |       |         |       |       |         |
|------------------------------|---------------------------------|-------|---------|-------|-------|---------|
|                              | N                               | P     | K       | S     | Mg    | Zn      |
| Optimum                      | 0-60                            | 0-20  | 0-45    | 0-15  | 0-10  | -       |
| Medium                       | 61-120                          | 21-40 | 46-90   | 16-30 | 11-20 | 0.0-2.5 |
| Low                          | 121-180                         | 41-60 | 91-135  | 31-45 | 21-30 | 2.6-5.0 |
| Very low                     | 181-240                         | 61-80 | 136-180 | 46-60 | 31-40 | 5.1-7.5 |

### Method of application

- For heavy textured soils, half of N and K and all of P, S, Mg and Zn should be applied in trench and mixed thoroughly with the soil before planting of sugarcane. Remaining N and K should be applied as top dress at tillering stage (120-150 days after planting).
- For light textured soils, one-third of N and K, and all of P, S, Mg and Zn should be applied in trench and mixed thoroughly with the soil before planting of sugarcane. Remaining N and K should be applied in two equal splits as top dress at tillering stage (90-120 DAP) and after completion of tillering (150-180 DAP).
- Top dressing of N and K in both the cases (a and b) should be done under moist soil condition. If the soil is dry, top dressing should be delayed for rainfall.
- For transplanted sugarcane basal N should be applied 20-30 DAT.
- For ratoon cane additional 40 kg N/ha should be applied. All other nutrients should be same as of the plant cane.

## SUGAR BEET (*Beta vulgaris*)

(All varieties)

Yield Goal: 80 ± 8 t/ha

| Soil Analysis Interpretation | Nutrient Recommendation (kg/ha) |       |         |       |       |     | OF |
|------------------------------|---------------------------------|-------|---------|-------|-------|-----|----|
|                              | N                               | P     | K       | S     | Mg    | Zn  |    |
| Optimum                      | 0-50                            | 0-15  | 0-40    | 0-5   | 0-5   | -   | 5  |
| Medium                       | 51-100                          | 16-30 | 41-80   | 6-10  | 6-10  | 0-2 |    |
| Low                          | 101-150                         | 31-45 | 81-120  | 11-15 | 11-15 | 3-4 |    |
| Very low                     | 151-200                         | 56-60 | 121-160 | 16-20 | 16-20 | 5-6 |    |

### Methods of application

- All of OF, P, S, Mg and Zn; and one third of N and K should be applied as basal during final land preparation.
- Remaining N and K should be side dressed in two equal splits at 30 and 60 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

## TEA (*Camellia sinensis*)

(All varieties)

### Young Tea

| Age of Plant (year) | Nutrient Recommendation (kg/ha) |    |     | OF (kg/plant) |
|---------------------|---------------------------------|----|-----|---------------|
|                     | N                               | P  | K   |               |
| 1                   | 80                              | 40 | 80  | 2             |
| 2                   | 90                              | 45 | 90  | 2             |
| 3                   | 120                             | 40 | 80  | 3             |
| 4                   | 135                             | 45 | 90  | 5             |
| 5                   | 150                             | 50 | 100 | 5             |

### Method of application

Fertilizers should be applied in three split doses

- 1<sup>st</sup> split : April – May
- 2<sup>nd</sup> split : August
- 3<sup>rd</sup> split : October – November

### Mature tea\*

| Yield (kg/ha) | Nutrient Recommendation (kg/ha) |       |       |    |  |    |                             |
|---------------|---------------------------------|-------|-------|----|--|----|-----------------------------|
|               | 1 <sup>st</sup> Split           |       |       |    | 2 <sup>nd</sup> Split in soil (NK) & Foliar spray (Zn) |    |                             |
|               | N                               | P     | K     | Zn | N  | K  | Zn (g/200 lit water per ha) |
| Up to 1000    | 50                              | 15    | 25    | –  | –  | –  | –                           |
| 1001–2000     | 51–100                          | 15–20 | 26–50 | 2  | 60   | 20 | 840                         |
| 2001–3000     | 101–150                         | 20–25 | 51–75 | 3  | 60   | 20 | 840                         |

\*Fertilizer recommendation has been estimated on the basis of production of made tea in kg/ha

### Method of application

- a) All of P and Zn; and half of N and K should be applied during April–May with onset of shower. Remaining half N and K should be applied within July to first week of August.
- b) Urea is generally used in tea cultivation as the source of nitrogen; and TSP/Rock phosphate/DAP and MOP might be used as the sources of P and K respectively.
- c) Zinc should also be applied as foliar spray four times a year- twice during mid-April to Mid-June and twice during mid-September to mid-October.
- d) If soil pH is below 5.0, dolomite [(CaMg(CO<sub>3</sub>)<sub>2</sub>)] application is suggested, usually after a good shower.

### Nucleus Clone Plot

The tea plants which are nourished for vegetative cuttings.

#### Fertilizer Recommendation for Nucleus Clone Plot

| Age of plant (year) | NPK ratio | Mixture (g/bush) | Fertilizer mixture (kg/ha) |                             | Method of application |
|---------------------|-----------|------------------|----------------------------|-----------------------------|-----------------------|
|                     |           |                  | Planting geometry          |                             |                       |
|                     |           |                  | Square (6944 bushes/ha)    | Triangular (8019 bushes/ha) |                       |
| 1                   | 2:1:2     | 30               | 208                        | 240                         | Ring                  |
| 2                   | 2:1:2     | 50               | 347                        | 400                         | Ring                  |
| 3                   | 2:1:2     | 70               | 485                        | 560                         | Ring                  |
| 4                   | 2:1:2     | 80               | 530                        | 630                         | Ring                  |
| > 4                 | 2:1:2     | 80               | 530                        | 630                         | Broadcast             |

**Method of application:** Same as below

### Seed Bari

A seed garden is popularly known as seed bari and the plants are not plucked. The plants are reared for collection of tea seeds.

#### Fertilizer Recommendation for SeedBari

| Age of Plant (Year) | Urea (g/plant) | TSP (g/plant) | MoP (g/plant) | Cowdung (kg/plant) | Oilcake (kg/plant) |
|---------------------|----------------|---------------|---------------|--------------------|--------------------|
| 1                   | 50             | 50            | 50            | 5                  | 0.5                |
| 2                   | 100            | 100           | 100           | 5                  | 0.5                |
| 3                   | 150            | 300           | 300           | 10                 | 1.0                |
| 4                   | 200            | 400           | 400           | 10                 | 1.0                |
| > 4                 | 250            | 500           | 500           | 10                 | 1.0                |

#### Method of application

- Fertilizers should be applied in two equal splits annually.
- Rate of N is 90 kg/ha for the first to third year; and from fourth year onwards N rate is 100 kg/ha

## BETEL LEAF (*Piper betle*)

(Var. BARI Pan-1, BARI Pan-2, BARI Pan-3)

**Yield Goal: 35± 3.5 lac leaf/ha/year**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         | Oilcake (t/ha/year) |
|------------------------------|--------------------------------------|-------|-------|-------|---------|---------------------|
|                              | N                                    | P     | K     | S     | Zn      |                     |
| Optimum                      | 0-20                                 | 0-8   | 0-12  | 0-4   | -       | 3                   |
| Medium                       | 21-40                                | 9-16  | 13-24 | 5-8   | 0-1.0   |                     |
| Low                          | 41-60                                | 17-24 | 25-36 | 9-12  | 1.1-2.0 |                     |
| Very low                     | 61-80                                | 25-32 | 37-48 | 13-16 | 2.1-3.0 |                     |

### Method of application

- a) One-third of oilcake and all of P, K and S should be applied as basal at the time of final land preparation.
- b) After 30-40 days of planting, remaining oilcake should be applied at 15-20 days interval in rows until the vine grows up to 1.0-1.5 meter in length.
- c) N should be applied in 3 equal installments before the monsoon rain and in September and December.
- d) In the subsequent years, the above fertilizer doses should be applied in 3 equal installments, before the monsoon rains and in the month of September and December.

## BETELNUT (*Areca catechu*)

(All cultivars)

**Yield Goal: 3.0± 0.3 kg dry nut/tree (Above 11 years old tree)**

| Age of tree (Year)       | Nutrient Recommendation (g/tree/year) |     |     |    | OF (kg/tree/year) |
|--------------------------|---------------------------------------|-----|-----|----|-------------------|
|                          | N                                     | P   | K   | S  |                   |
| Before planting (in Pit) | -                                     | 30  | -   | 18 | 6                 |
| 1-2                      | 120                                   | 120 | 135 | -  | -                 |
| 3-5                      | 175                                   | 165 | 180 | 36 | 5                 |
| 6-8                      | 225                                   | 210 | 230 | 42 | 7                 |
| 9-11                     | 275                                   | 255 | 280 | 48 | 7                 |
| > 11                     | 325                                   | 300 | 325 | 54 | 10                |

### Method of application

- a) All of OF, P and S recommended for 'before planting' applications should be applied in pit as basal dose 15-20 days before planting of seedling and mixed thoroughly with the soil followed by irrigation.
- b) For growing trees, the recommended fertilizers should be applied in two equal splits during May just after harvesting of fruit and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

## RUBBER (*Hevea brasiliensis*)

(Clone: TJIR-1, RRIM-600, PBIG, PB-217, PB-235 and GG)

Yield Goal:  $2.7 \pm 0.27$  t/ha/year

| Age of tree (Year) | Nutrient Recommendation (g/tree/year) |    |    |
|--------------------|---------------------------------------|----|----|
|                    | N                                     | P  | K  |
| Before planting    | 45                                    | 90 | 50 |
| 1-7                | 45                                    | 45 | 50 |
| > 7                | 56                                    | 68 | 55 |

### Method of application

- All of N, P and K, recommended for 'before planting' application should be applied in pit 10-15 days before planting of saplings followed by irrigation.
- For growing trees, N and K should be applied in two equal splits during April-May at the onset of monsoon and after monsoon during September-October. Fertilizers should be applied around the tree up to canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.
- P should be applied in alternate year as broadcast and mixed thoroughly with the soil followed by irrigation.
- In the hill slope, the fertilizers should be applied in dibbling method (4 to 5 holes per tree to a depth 5-8 cm at the upper part of the slope)

### 11.1.10 Flower crops

#### MARIGOLD (*Tagetes erecta*)

(French marigold)

**Yield Goal : 10.0 ± 1.0 ton flowers/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|--------|-------|---------|-----------|
|                              | N                               | P     | K      | S     | Zn      |           |
| Optimum                      | 0-30                            | 0-13  | 0-30   | 0-5   | -       | 3         |
| Medium                       | 31-60                           | 14-26 | 31-60  | 6-10  | 0-2.0   |           |
| Low                          | 61-90                           | 27-39 | 61-90  | 11-15 | 2.1-4.0 |           |
| Very low                     | 91-120                          | 40-52 | 91-120 | 16-20 | 4.1-6.0 |           |

**Method of application:** Same as below

#### MARIGOLD (*Tagetes erecta*)

(African marigold)

**Yield Goal: 15± 1.5 ton flowers/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      |           |
| Optimum                      | 0-45                            | 0-20  | 0-40    | 0-6   | -       | 5         |
| Medium                       | 46-90                           | 21-40 | 41-80   | 7-12  | 0-3.0   |           |
| Low                          | 91-135                          | 41-60 | 81-120  | 13-14 | 3.1-6.0 |           |
| Very low                     | 136-180                         | 61-80 | 121-160 | 15-24 | 6.1-9.0 |           |

#### Method of application

- All of OF and chemical fertilizers except N should be applied as basal during final land preparation.
- N should be applied in three equal splits at 25, 45 and 65 DAP.

## ROSE (*Rosa centiflora*)

(Class: Hybrid tea)

Yield Goal : 750,000 – 800,000 flower sticks/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |        |         |       |         | OF (t/ha) |
|------------------------------|---------------------------------|--------|---------|-------|---------|-----------|
|                              | N                               | P      | K       | S     | Zn      |           |
| Optimum                      | 0-35                            | 0-25   | 0-35    | 0-5   | -       | 5         |
| Medium                       | 36-70                           | 26-50  | 36-70   | 6-10  | 0-2.0   |           |
| Low                          | 71-105                          | 51-75  | 71-105  | 11-15 | 2.1-4.0 |           |
| Very low                     | 106-140                         | 76-100 | 106-140 | 16-20 | 4.1-6.0 |           |

**Method of application:** Same as below

## TUBEROSE (*Polianthes tuberosa*)

(Var. Double)

Yield Goal: 115,000–125,000 sticks/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      | B       |           |
| Optimum                      | 0-75                            | 0-23  | 0-44    | 0-5   | -       | -       | 5         |
| Medium                       | 76-150                          | 24-46 | 45-88   | 6-10  | 0.0-2.0 | 0-1.0   |           |
| Low                          | 151-225                         | 47-69 | 89-132  | 15-15 | 2.1-4.0 | 1.1-2.0 |           |
| Very low                     | 226-300                         | 70-92 | 133-176 | 16-20 | 4.1-6.0 | 2.1-3.0 |           |

**Method of application:** Same as below

## GLADIOLUS (*Gladiolus spp.*)

(Var. BARI Gladiolus-1, BARI Gladiolus-2 and BARI Gladiolus-3)

Yield Goal: 175,000–200,000 flower sticks/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |         |       |         |         | OF (t/ha) |
|------------------------------|---------------------------------|-------|---------|-------|---------|---------|-----------|
|                              | N                               | P     | K       | S     | Zn      | B       |           |
| Optimum                      | 0-60                            | 0-22  | 0-45    | 0-8   | -       | -       | 5         |
| Medium                       | 61-120                          | 23-44 | 46-90   | 9-16  | 0.0-2.0 | 0.0-0.7 |           |
| Low                          | 121-180                         | 45-66 | 91-135  | 17-24 | 2.1-4.0 | 0.8-1.4 |           |
| Very low                     | 181-240                         | 67-88 | 136-180 | 25-32 | 4.1-6.0 | 1.5-2.1 |           |

### Method of application

- All of organic and chemical fertilizers except N should be applied as basal during final land preparation.
- N should be applied in three equal splits as topdress at 30, 60 and 90 DAP for Rose and at 30, 45 and 60 DAP for Tuberose and Gladiolus.

## ZINNIA (*Zinnia elegans*)

**Yield Goal : 200,000 – 300,000 flower stick/ha**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha) |       |        |       |         | OF (kg/tree/year) |
|------------------------------|---------------------------------|-------|--------|-------|---------|-------------------|
|                              | N                               | P     | K      | S     | Zn      |                   |
| Optimum                      | 0–25                            | 0–8   | 0–15   | 0–5   | –       | 5                 |
| Medium                       | 26–50                           | 9–16  | 16–30  | 6–10  | 0.0–2.0 |                   |
| Low                          | 51–75                           | 17–24 | 11–45  | 11–15 | 2.1–4.0 |                   |
| Very low                     | 76–100                          | 25–32 | 46–180 | 16–20 | 4.1–6.0 |                   |

**Method of application:** Same as below

## GERBERA (*Gerbera jamesonii*)

(Var. BARI Gerbera-1 and BARI Gerbera-2)

**Yield Goal: 850,000 – 900,000 flower sticks/ha (FRG-2018)**

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |        |         |       |         |         | OF (t/ha) | Coco-dust (kg/ha) |
|------------------------------|--------------------------------------|--------|---------|-------|---------|---------|-----------|-------------------|
|                              | N                                    | P      | K       | S     | Zn      | B       |           |                   |
| Optimum                      | 0-50                                 | 0-25   | 0-40    | 0-8   | -       | -       | 5         | 1000              |
| Medium                       | 51-100                               | 26-50  | 41-80   | 9-16  | 0-2.0   | 0-1.0   |           |                   |
| Low                          | 101-150                              | 51-75  | 81-120  | 17-24 | 2.1-4.0 | 1.1-2.0 |           |                   |
| Very low                     | 151-200                              | 76-100 | 121-160 | 25-32 | 4.1-6.0 | 2.1-3.0 |           |                   |

### Method of application

- a) All of organic and chemical fertilizers except N should be applied as basal during final land preparation.
- b) Nitrogen should be applied in three equal installments at 25, 45, 65 DAP for Zinnia and 30, 60 and 90 days after planting for Gerbera.

## CHRYSANTHEMUM (*Chrysanthemum coronarium*)

(Large flowered varieties)

Yield Goal : 2500,000–3000,000 flowers/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |        |         |       |         |         | OF (t/ha) |
|------------------------------|--------------------------------------|--------|---------|-------|---------|---------|-----------|
|                              | N                                    | P      | K       | S     | Zn      | B       |           |
| Optimum                      | 0–50                                 | 0–25   | 0–40    | 0–5   | -       | -       | 3         |
| Medium                       | 51–100                               | 26–50  | 41–80   | 6–10  | 0–2.0   | 0–1.0   |           |
| Low                          | 101–150                              | 51–75  | 81–120  | 11–15 | 2.1–4.0 | 1.1–2.0 |           |
| Very low                     | 151–200                              | 76–100 | 121–160 | 16–20 | 4.1–6.0 | 2.1–3.0 |           |

**Method of application:** Same as below

## CHRYSANTHEMUM (*Chrysanthemum coronarium*)

(Small flowered varieties)

Yield Goal : 3500,000–4000,000 flowers/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |         |       |         |         | OF (t/ha) | Bonemeal (kg/ha) |
|------------------------------|--------------------------------------|-------|---------|-------|---------|---------|-----------|------------------|
|                              | N                                    | P     | K       | S     | Zn      | B       |           |                  |
| Optimum                      | 0–45                                 | 0–22  | 0–40    | 0–5   | -       | -       | 2         | 15               |
| Medium                       | 46–90                                | 23–44 | 41–80   | 6–10  | 0–2.0   | 0–1.0   |           |                  |
| Low                          | 91–135                               | 45–66 | 81–120  | 11–15 | 2.1–4.0 | 1.1–2.0 |           |                  |
| Very low                     | 136–180                              | 67–88 | 121–160 | 16–20 | 4.1–6.0 | 2.1–3.0 |           |                  |

### Method of application

- All of organic and chemical fertilizers except N should be applied as basal during final land preparation.
- N should be applied in three equal installments at 25, 45 and 65 DAT.

## ORCHID (*Phaius tankervilleae*)

(Var. BARI Orchid-1)

Yield Goal : 18,000–20,000 flowers/ha

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |         | OF (t/ha) |
|------------------------------|--------------------------------------|-------|-------|-------|---------|---------|-----------|
|                              | N                                    | P     | K     | S     | Zn      | B       |           |
| Optimum                      | 0–22                                 | 0–10  | 0–20  | 0–5   | -       | -       | 5         |
| Medium                       | 23–44                                | 11–20 | 21–40 | 6–10  | 0-2.0   | 0-1.0   |           |
| Low                          | 45–66                                | 21–30 | 41–60 | 11–15 | 2.1-4.0 | 1.1-2.0 |           |
| Very low                     | 67–88                                | 31–40 | 61–80 | 16–20 | 4.1-6.0 | 2.1-3.0 |           |

### Method of application

- All of organic and chemical fertilizers except N should be applied as basal during final land preparation.
- N should be applied as topdressing in three equal splits at 30, 60 and 90DAT and mixed thoroughly with the soil.

### 11.1.11 Fodder Crops

#### NAPIER GRASS (*Pennisetum purpureum*)

(Var. IGFRI-3, IGFRI-6, IGFRI-7, IGFRI-10, CO-3)

Yield Goal (Green biomass): 370+37 t/ha/year

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |
|------------------------------|--------------------------------------|-------|-------|-------|---------|
|                              | N                                    | P     | K     | S     | Zn      |
| Optimum                      | 0-45                                 | 0-12  | 0-15  | 0-5   | -       |
| Medium                       | 46-90                                | 13-24 | 16-30 | 6-10  | 0-2.0   |
| Low                          | 91-135                               | 25-36 | 31-45 | 11-15 | 2.1-4.0 |
| Very low                     | 136-180                              | 37-48 | 46-60 | 16-20 | 4.1-6.0 |

**Method of application:** Same as below

#### PARA GRASS (*Brachiaria mutica*)

Yield Goal (Green biomass): 120+12 t/ha/year

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |
|------------------------------|--------------------------------------|-------|-------|-------|---------|
|                              | N                                    | P     | K     | S     | Zn      |
| Optimum                      | 0-40                                 | 0-10  | 0-11  | 0-5   | -       |
| Medium                       | 41-80                                | 11-20 | 12-22 | 6-10  | 0-2.0   |
| Low                          | 81-120                               | 21-30 | 23-33 | 11-15 | 2.1-4.0 |
| Very low                     | 121-160                              | 31-40 | 34-44 | 16-20 | 4.1-6.0 |

#### Method of application

- All of P, K, S and Zn and half of N should be applied as basal during final land preparation.
- The rest half of N should be top dressed after 25 days of sowing/planting.
- After each cut (at 30 – 40 days intervals), half of the recommended rate of N should be topdressed.

### GERMAN GRASS (*Echinochloa crusgalli*)

Yield Goal (Green biomass): 135+14 t/ha/year

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |
|------------------------------|--------------------------------------|-------|-------|-------|---------|
|                              | N                                    | P     | K     | S     | Zn      |
| Optimum                      | 0-35                                 | 0-10  | 0-11  | 0-5   | -       |
| Medium                       | 36-70                                | 11-20 | 12-22 | 6-10  | 0-2.0   |
| Low                          | 71-105                               | 21-30 | 23-33 | 11-15 | 2.1-4.0 |
| Very low                     | 106-140                              | 31-40 | 34-44 | 16-20 | 4.1-6.0 |

### DHAL GRASS (*Hymenachne amplexicaulis*)

Yield Goal (Green biomass): 110+11 t/ha/year

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |
|------------------------------|--------------------------------------|-------|-------|-------|---------|
|                              | N                                    | P     | K     | S     | Zn      |
| Optimum                      | 0-50                                 | 0-10  | 0-11  | 0-5   | -       |
| Medium                       | 51-100                               | 11-20 | 12-22 | 6-10  | 0-2.0   |
| Low                          | 101-150                              | 21-30 | 23-33 | 11-15 | 2.1-4.0 |
| Very low                     | 151-200                              | 31-40 | 34-44 | 16-20 | 4.1-6.0 |

### GUINEA GRASS (*Panicum maximum*)

Yield Goal (Green biomass): 120+12 t/ha/year

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |
|------------------------------|--------------------------------------|-------|-------|-------|---------|
|                              | N                                    | P     | K     | S     | Zn      |
| Optimum                      | 0-45                                 | 0-10  | 0-12  | 0-5   | -       |
| Medium                       | 46-90                                | 11-20 | 13-24 | 6-10  | 0-2.0   |
| Low                          | 91-135                               | 21-30 | 25-36 | 11-15 | 2.1-4.0 |
| Very low                     | 136-180                              | 31-40 | 37-48 | 16-20 | 4.1-6.0 |

#### Method of application for the above grasses

- Full rate of P and K and half of N should be applied as basal during final land preparation.
- The rest half of N should be top dressed after 25 days of sowing/planting.
- After each cut (at 30 – 40 days intervals), half of the recommended rate of N should be topdressed.

## JUMBO (Hybrid sorghum)

Yield Goal (Green biomass): 120+12 t/ha/year

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |
|------------------------------|--------------------------------------|-------|-------|-------|---------|
|                              | N                                    | P     | K     | S     | Zn      |
| Optimum                      | 0-40                                 | 0-10  | 0-11  | 0-5   | -       |
| Medium                       | 41-80                                | 11-20 | 12-22 | 6-10  | 0-2.0   |
| Low                          | 81-120                               | 21-30 | 23-33 | 11-15 | 2.1-4.0 |
| Very low                     | 121-160                              | 31-40 | 34-44 | 16-20 | 4.1-6.0 |

**Method of application:** Same as below

## ZAMBOO GRASS (Hybrid jowar)

Yield Goal (Green biomass): 18+1.8 t/ha/year

| Soil analysis interpretation | Nutrient Recommendation (kg/ha/year) |       |       |       |         |
|------------------------------|--------------------------------------|-------|-------|-------|---------|
|                              | N                                    | P     | K     | S     | Zn      |
| Optimum                      | 0-15                                 | 0-3   | 0-4   | 0-5   | -       |
| Medium                       | 16-30                                | 4-6   | 5-8   | 6-10  | 0-2.0   |
| Low                          | 31-45                                | 7-9   | 9-12  | 11-15 | 2.1-4.0 |
| Very low                     | 46-60                                | 10-12 | 13-16 | 16-20 | 4.1-6.0 |

### Method of application

- Full rate of P and K and half of N should be applied as basal during final land preparation.
- The rest half of N should be top dressed after 25 days of sowing/planting.
- After each cut (at 30 - 40 days intervals), half of the recommended rate of N should be topdressed.

## 11.2 Fertilizer Recommendation for Cropping Patterns in Different AEZs

The most efficient and economic use of chemical fertilizers and organic manures requires a knowledge about basic data of soil, climate and crops. The soil related data include pH, texture, organic matter content and some other soil properties. The requirement of nutrient for a particular crop depends on overall environmental conditions as well as on the yield potential of the crop in question. The more the climate and the soil physical conditions are favorable for crop growth, the more will be the need for nutrients. High yielding varieties require more quantities of nutrients than traditional (local) varieties. Utilization of applied nutrients thus depends on the cropping system, efficiency of crop management and time and method of fertilizer application. In fertilizer scheduling for different crops and cropping patterns, nutrient loss mechanisms and immobilization process should be taken into account.

In AEZ basis fertilizer recommendation, attention has been paid to the information of cropping patterns and land type. The other important information like soil pH, organic matter and nutrient content has been furnished in the Chapter 3.1. For all cases, the rabi crops (with a particular yield Goal) have been considered as the first crops in the patterns. Since fertilizer recommendations are based on soil test values available for different AEZs, not on the basis of site specific soil test, the suggested fertilizer doses are not absolute values, rather it is only indicative and subject to variations as arises. The residual effect of P, K, S, Zn, and B should be taken into consideration, as mentioned in section 5.7 while making fertilizer recommendations for the second and third crops in a year.

## 11.2 FERTILIZER RECOMMENDATION FOR CROPPING PATTERNS IN DIFFERENT AEZs

### AEZ 1: Old Himalayan Piedmont Plain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Highland        | 58      | Most of Thakurgaon and Panchagar and north-western parts of Dinajpur districts. |
| Medium highland | 34      |   |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |     |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|-----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg  | Zn  | B   | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 18 | -   | 1.3 | -   | -  | -         |
| Khariif-1        | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 6  | -   | 1.0 | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 40 | 15 | 2.5 | -   | 1.5 | -  | -         |
| Khariif-1        | Boro    | 6.0 ± 0.6         | 144                             | 9  | 60 | 6  | -   | 2   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 6  | -   | 1   | -   | -  | -         |
| Rabi             | Potato  | 3.0 ± 3.0         | 135                             | 20 | 90 | 15 | 5   | -   | 1.5 | -  | 3.0       |
| Khariif-1        | Boro    | 6.0 ± 0.6         | 144                             | 9  | 39 | 6  | -   | 2   | -   | -  | -         |
| Khariif-2        | T. Aman | 3.0 ± 0.5         | 90                              | 7  | 33 | 6  | -   | 1   | -   | -  | -         |
| Rabi             | Potato  | 3.0 ± 3.0         | 135                             | 20 | 90 | 15 | 5   | -   | 1.5 | -  | 3.0       |
| Khariif-1        | Maize   | 6.0 ± 0.6         | 135                             | 23 | 31 | 14 | 5   | 2   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 33 | 6  | -   | 1   | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 15 | 4   | -   | 1.5 | -  | -         |
| Khariif-1        | Maize   | 6.0 ± 0.6         | 135                             | 36 | 31 | 27 | 5   | 2   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 33 | 12 | -   | 1   | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 15 | 4   | 0   | 1.5 | -  | -         |
| Khariif-1        | Jute    | 3.5 ± 0.35        | 75                              | 5  | 40 | 15 | -   | 1.5 | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 12 | -   | 1.5 | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 15 | 4   | 1.5 | 1.5 | -  | -         |
| Khariif-1        | T. Aus  | 4.0 ± 0.4         | 72                              | 5  | 40 | 9  | -   | -   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 12 | -   | 1.5 | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 15 | 4   | -   | 1.5 | -  | -         |
| Khariif-1        | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 8  | 50 | 12 | -   | 2.0 | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 15 | 4   | 1.0 | 1.5 | -  | -         |
| Khariif-1        | M. bean | 2.0 ± 0.20        | 18                              | 8  | 16 | 12 | -   | -   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 12 | -   | 1.5 | -   | -  | -         |
| Rabi             | Maize   | 10 ± 0.1          | 225                             | 40 | 80 | 45 | 10  | 2.0 | 1.5 | -  | -         |
| Khariif-1        | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 6  | -   | 1.5 | -   | -  | -         |
| Rabi             | Chilli  | 2.5 ± 0.25        | 96                              | 30 | 50 | 15 | -   | 1.0 | 1.5 | -  | 3.0       |
| Khariif-1        | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khariif-2        | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 6  | -   | 1.5 | -   | -  | -         |

## AEZ 2: Active Tista Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Medium highland | 72      | The region occupies narrow belts, within and adjoining the channels, rivers in Nilphamari, Rangpur, Lalmonirhat, Kurigram and Gaibandha Districts. |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |     |      |    |     |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|-----|------|----|-----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P   | K    | S  | Mg  | Zn  | B   | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16  | 76   | 12 | -   | 2   | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -   | -    | -  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6.5 | 50   | 4  | -   | 1   | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16  | 76   | 12 | -   | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -   | -    | -  | -   | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -   | -    | -  | -   | -   | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18  | 40   | 10 | 2.5 | 0   | 0.5 | -  | 3         |
|                  | Boro    | 6.0 ± 0.6         | 144                             | 9.1 | 60   | 4  | -   | 2   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6.5 | 50   | 4  | -   | 1.5 | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20  | 90   | 10 | 5   | 2   | 1   | -  | 3         |
|                  | Boro    | 6.0 ± 0.6         | 144                             | 9.1 | 39   | 4  | -   | 2.5 | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6.5 | 32.5 | 4  | -   | -   | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20  | 90   | 10 | 5   | 2   | 1   | -  | 3         |
| Kharif-1         | Jute    | 4.5 ± 0.45        | 90                              | 6.5 | 32.5 | 8  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6.5 | 32.5 | 4  | -   | 2   | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20  | 90   | 10 | 5   | 2   | 1.5 | -  | 3         |
| Kharif-1         | Maize   | 6.0 ± 0.6         | 135                             | 24  | 31.2 | 18 | -   | 2.5 | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6.5 | 32.5 | 4  | -   | -   | -   | -  | -         |
| Rabi             | Maize   | 10 ± 1.0          | 225                             | 40  | 80   | 30 | 10  | 2   | 1   | -  | -         |
| Rabi             | Fallow  | -                 | -                               | -   | -    | -  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.50        | 90                              | 5.5 | 25   | 4  | -   | 1   | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16  | 60   | 10 | 4   | 2   | 1   | -  | -         |
| Kharif-1         | Jute    | 4.5 ± 0.45        | 90                              | 5.5 | 50   | 8  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.50        | 90                              | 5.5 | 50   | 4  | -   | 1   | -   | -  | -         |

### AEZ 3: Tista Meander Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 35      | Most of greater Rangpur, Nilphamari and Guibandha, eastern part of Panchagar and Dinajpur, northern Bogra and part of Jaipurhat, Naogaon and Rajshahi districts. |
| Medium highland | 51      |  |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |     |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|-----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg  | Zn  | B   | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -   | 1.5 | -   | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 4  | -   | 1.0 | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -   | 1.5 | -   | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khari-2          | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 40 | 10 | 2.5 | -   | 1.0 | -  | 3.0       |
| Khari-1          | Boro    | 6.0 ± 0.6         | 144                             | 8  | 60 | 4  | -   | 2.0 | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 4  | -   | 1.0 | -   | -  | -         |
| Rabi             | Potato  | 3.0 ± 3.0         | 135                             | 20 | 90 | 10 | 5   | -   | 1.0 | -  | 3.0       |
| Khari-1          | Boro    | 6.0 ± 0.6         | 144                             | 8  | 39 | 4  | -   | 2.0 | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 33 | 4  | -   | 1.0 | -   | -  | -         |
| Rabi             | Potato  | 3.0 ± 3.0         | 135                             | 20 | 90 | 10 | 5   | -   | 1.5 | -  | 3.0       |
| Khari-1          | Maize   | 6.6 ± 0.6         | 135                             | 16 | 31 | 18 | -   | 2.0 | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 33 | 4  | -   | 1.0 | -   | -  | -         |
| Rabi             | Maize   | 10 ± 1.0          | 225                             | 40 | 80 | 30 | 10  | 2.5 | 1.0 | -  | -         |
| Khari-1          | Jute    | 3.5 ± 0.35        | 75                              | 4  | 40 | 5  | -   | -   | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 4  | -   | 1.0 | -   | -  | -         |
| Rabi             | Maize   | 10 ± 1.0          | 225                             | 40 | 80 | 30 | 10  | 2.5 | 1.0 | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.8         | 90                              | 6  | 50 | 4  | -   | 1.0 | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 10 | 4   | 1.5 | 1.0 | -  | -         |
| Khari-1          | Jute    | 3.5 ± 0.35        | 90                              | 6  | 50 | 16 | -   | 0   | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.8         | 90                              | 6  | 50 | 8  | -   | 1.5 | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 10 | 4   | 1.5 | 1.0 | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -   | 1.0 | 0   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 10 | 4   | 2.0 | 1.0 | -  | -         |
| Khari-1          | T. Aus  | 4.0 ± 0.4         | 72                              | 4  | 40 | 6  | -   | -   | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -   | 1.0 | -   | -  | -         |
| Rabi             | Chilli  | 2.5 ± 0.25        | 96                              | 30 | 50 | 10 | -   | 1.0 | 1.0 | -  | 3.0       |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -  | -   | -   | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 33 | 8  | -   | 1.5 | -   | -  | -         |

### AEZ 4: Karatoya-bangali Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 23      | Eastern half of Bogra, most of Sirajganj and small areas of Pabna districts. |
| Medium highland | 44      |  |
| Medium lowland  | 14      |  |

| Cropping pattern |              | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|--------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop         |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 10  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 2.0 | -   | -  | -         |
| Kharif-1         | T. Aus       | 4.0 ± 0.4         | 72                              | 7  | 40 | 3.0 | -  | 0.0 | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Jute         | 3.5 ± 0.35        | 75                              | 7  | 40 | 5   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 50 | 4   | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 2.0 | -   | -  | -         |
| Kharif-1         | B. Aman      | 2.5 ± 0.25        | 36                              | 9  | 20 | -   | -  | -   | -   | -  | -         |
| Kharif-2         |              | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Mustard      | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | 3  | -   | 1.0 | -  | 3.0       |
|                  | Boro         | 6.0 ± 0.6         | 144                             | 12 | 60 | 4   | -  | 2.0 | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 60 | 4   | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard      | 1.8 ± 0.18        | 120                             | 36 | 60 | 18  | -  | 1.0 | 1.5 | -  | 3.0       |
|                  | Boro         | 6.0 ± 0.6         | 144                             | 12 | 60 | 4   | -  | 1.5 | -   | -  | -         |
| Kharif-2         | Fallow       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Potato       | 30 ± 3.0          | 135                             | 40 | 90 | 10  | -  | -   | 1.5 | -  | 3.0       |
|                  | Boro         | 6.0 ± 0.6         | 144                             | 12 | 39 | 4   | -  | 2.0 | -   | -  | -         |
| Kharif-1         | -            | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 39 | 4   | -  | 1.0 | -   | -  | -         |
| Rabi             | Maize        | 10 ± 1.0          | 225                             | 60 | 80 | 30  | 5  | 2.0 | 1.5 | -  | -         |
| Kharif-1         | Sesbania     | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Cabbage      | 90 ± 9.0          | 180                             | 45 | 40 | 16  | -  | 2.0 | 1.5 | -  | 3.0       |
|                  | Cauliflower  | 50 ± 5.0          | 120                             | 60 | 60 | 14  | -  | 2.0 | 1.5 | -  | 3.0       |
|                  | Tomato       | 75 ± 7.5          | 120                             | 45 | 40 | 14  | -  | 1.5 | 1.5 | -  | 3.0       |
|                  | Radish       | 60 ± 6.0          | 135                             | 45 | 80 | 12  | -  | 2.0 | 1.5 | -  | 3.0       |
|                  | Country bean | 20 ± 2.0          | 45                              | 20 | 30 | 6.0 | -  | 1.5 | 1.5 | -  | 3.0       |
|                  | Potato       | 30 ± 3.0          | 135                             | 30 | 90 | 10  | -  | 2.0 | 1.5 | -  | 3.0       |
|                  | Sweet gourd  | 40 ± 4.0          | 75                              | 24 | 40 | 14  | -  | 1.5 | 1.5 | -  | 3.0       |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Kharif-1         | Cucumberer     | 35 ± 3.5          | 75                              | 10 | 26 | 6.0 | -  | -   | -   | -  | -         |
|                  | Okra           | 16 ± 1.6          | 90                              | 20 | 26 | 5.0 | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 20 | 22 | 5.0 | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5.0 | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 13 | 20 | 6.0 | -  | -   | -   | -  | -         |
|                  | Amaranthush    | 30 ± 3.0          | 90                              | 18 | 17 | 4.0 | -  | -   | -   | -  | -         |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 16 | 46 | 5.0 | -  | 1.0 | 1.0 | -  | 1.5       |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6.0 | -  | 1.0 | 1.0 | -  | 1.5       |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 20 | 20 | 5.0 | -  | 1.0 | 1.0 | -  | 1.5       |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 12 | 16 | 5.0 | -  | 1.0 | 1.0 | -  | 1.5       |
|                  | Cucumberer     | 35 ± 3.5          | 75                              | 16 | 26 | 6.0 | -  | 1.0 | 1.0 | -  | 1.5       |

### AEZ 5: Lower Atrai Basin

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Medium lowland  | 21      | Most of this region lies in Naogaon and Natore districts, small areas extend into Rajshahi, Bogra and Sirajganj districts. |
| Lowland         | 65      |  |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |   |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|-----|----|-----|---|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S   | Mg | Zn  | B | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12  | -  | 1.5 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12  | -  | 1.5 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 4.0 | -  | 1.0 | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12  | -  | 2.0 | - | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.4         | 72                              | 5  | 40 | 3.0 | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 4.0 | -  | 1.0 | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 70 | 12  | -  | 1.5 | - | -  | -         |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 4  | 20 | 4.0 | -  | -   | - | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20 | 90 | 10  | -  | -   | - | -  | 3.0       |
|                  | Boro    | 6.0 ± 0.6         | 144                             | 9  | 39 | 4.0 | -  | 2.0 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 33 | 4.0 | -  | 1.0 | - | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 40 | 10  | -  | -   | - | -  | 3.0       |
|                  | Boro    | 6.0 ± 0.6         | 144                             | 9  | 60 | 4.0 | -  | 2.0 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 4.0 | -  | 1.0 | - | -  | -         |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 40 | 10  | -  | -   | -   | -  | 3.0       |
|                  | Boro    | 6.0 ± 0.6         | 144                             | 9  | 60 | 4.0 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.15        | 120                             | 16 | 60 | 10  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | M. Bean | 2.0 ± 0.2         | 18                              | 8  | 16 | 4.0 | -  | 0.0 | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 4.0 | -  | 1.5 | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 5.0 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 8.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 60 | 5.0 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.4         | 72                              | 5  | 40 | 3.0 | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 8.0 | -  | 1.5 | -   | -  | -         |
| Rabi             | Cowpea  | 1.4 ± 0.14        | 15                              | 10 | 12 | 3.0 | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 8.0 | -  | 1.5 | -   | -  | -         |
| Rabi             | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 50 | 8.0 | -  | 1.5 | -   | -  | -         |
| Rabi             | Garlic  | 15 ± 0.5          | 114                             | 32 | 60 | 20  | -  | 2.0 | 1.0 | -  | -         |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 4  | 13 | 4.0 | -  | -   | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |

### AEZ 6: Lower Purnabhaha Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Medium lowland  | 10      | Extreme western part of Noagaon and the extreme northern part of Chapai Nawabganj districts. |
| Lowland         | 60      |  |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |    |   |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|-----|----|----|---|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S   | Mg | Zn | B | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6.0 | -  | -  | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | - | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6.0 | -  | -  | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 25 | 2.0 | -  | -  | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6.0 | -  | -  | - | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.4         | 72                              | 4  | 15 | 1.5 | -  | -  | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 25 | 2.0 | -  | -  | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 25 | 4.0 | -  | -  | - | -  | -         |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 3  | 10 | 2.0 | -  | -  | - | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | -   | -  | -  | - | -  | -         |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |    |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|-----|----|----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S   | Mg | Zn | B   | Mo |           |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20 | 45 | 5.0 | -  | -  | -   | -  | 3.0       |
|                  | Boro    | 6.0 ± 0.6         | 144                             | 8  | 20 | 4.0 | -  | -  | -   | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 16 | 4.0 | -  | -  | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 20 | 5.0 | -  | -  | 1.0 | -  | 3.0       |
|                  | Boro    | 6.0 ± 0.60        | 144                             | 8  | 30 | 6.0 | -  | -  | -   | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.50        | 90                              | 6  | 25 | 4.0 | -  | -  | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 20 | 5.0 | -  | -  | 1.0 | -  | 3.0       |
|                  | Boro    | 6.0 ± 0.60        | 144                             | 8  | 30 | 4.0 | -  | -  | -   | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Khari-2          | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 30 | 5.0 | -  | -  | 1.0 | -  | -         |
| Khari-1          | T. Aus  | 4.0 ± 0.4         | 72                              | 4  | 20 | 3.0 | -  | -  | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 25 | 4.0 | -  | -  | -   | -  | -         |
| Rabi             | Wheat   | 4.5 ± 0.45        | 120                             | 16 | 30 | 5.0 | -  | -  | 1.0 | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 25 | 4.0 | -  | -  | -   | -  | -         |
| Rabi             | Cowpea  | 1.4 ± 0.14        | 15                              | 10 | 6  | 3.0 | -  | -  | -   | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 25 | 4.0 | -  | -  | -   | -  | -         |
| Rabi             | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
|                  | Fallow  | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 10 | 25 | 4.0 | -  | -  | -   | -  | -         |

### AEZ 7: Active Brahmaputra-jamuna Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Medium highland | 37      | Eastern parts of Kurigram, Gaibandha, Bogra, Sirajganj and Pabna districts and Jamalpur and Manikganj district. Minor areas also occur in Tangail, Dhaka, Munshiganj, Narayanganj and Chandpur districts |
| Medium lowland  | 20      |  |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |   |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|----|-----|---|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg | Zn  | B | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | - | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Khari-2          | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 4  | -  | 1.0 | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | - | -  | -         |
| Khari-1          | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Khari-2          | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 16 | 76 | 12  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | B. Aman        | 2.5 ± 0.25        | 36                              | 6  | 20 | 4   | -  | -   | -   | -  | -         |
| Kharif-2         | -              | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 16 | 76 | 12  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Mustard        | 1.8 ± 0.18        | 90                              | 18 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro           | 6.0 ± 0.6         | 144                             | 8  | 90 | 6   | -  | 1.5 | -   | -  | -         |
| Kharif-1         | -              | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 7  | 60 | 5   | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard        | 1.8 ± 0.18        | 90                              | 18 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro           | 6.0 ± 0.6         | 144                             | 8  | 90 | 6   | -  | 2.0 | -   | -  | -         |
| Kharif-1         | -              | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Maize          | 10 ± 1.0          | 225                             | 40 | 80 | 30  | 5  | 2.0 | -   | -  | -         |
| Kharif-1         | Sesbania       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Maize          | 10 ± 1.0          | 225                             | 40 | 80 | 30  | 5  | 2.0 | 1.0 | -  | -         |
| Kharif-1         | Maize          | 6.0 ± 0.6         | 135                             | 16 | 48 | 9   | -  | 1.0 | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 16 | 60 | 10  | 4  | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 6  | 50 | 8   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 6  | 50 | 8   | -  | 1.0 | -   | -  | -         |
| Rabi             | Rudish         | 60 ± 6.0          | 135                             | 30 | 80 | 12  | -  | 1.5 | -   | -  | 3.0       |
|                  | Cabbage        | 90 ± 9.0          | 180                             | 30 | 40 | 16  | -  | 1.5 | -   | -  | 3.0       |
|                  | Cauliflower    | 50 ± 5.0          | 120                             | 40 | 60 | 14  | -  | 1.5 | -   | -  | 3.0       |
|                  | Tomato         | 75 ± 7.5          | 120                             | 30 | 40 | 14  | -  | 1.5 | -   | -  | 3.0       |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 11 | 26 | 5.0 | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 11 | 22 | 5.0 | -  | -   | -   | -  | -         |
|                  | Amaranthush    | 30 ± 3.0          | 90                              | 10 | 17 | 4.0 | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 13 | 46 | 5.0 | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |

### AEZ 8: Young-Brahmaputra Jamuna Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 18      | Western parts of Shepur, Jamalpur and Tangail Districts, parts of Manikganj, Dhaka, Munshiganj, Narayanganj and Gazipur districts and a belt adjoining the old Brahmaputra channel through Mymensingh, Kishoreganj and Narshingdi districts. |
| Medium Highland | 42      |  |
| Medium Lowland  | 19      |  |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro           | 6.0 ± 0.6         | 144                             | 21 | 60 | 8.0 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | T. Aus         | 4.0 ± 0.4         | 72                              | 8  | 40 | 3.0 | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 8  | 40 | 3.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Boro           | 6.0 ± 0.6         | 144                             | 21 | 60 | 8.0 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 10 | 50 | 8.0 | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard        | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro           | 6.0 ± 0.6         | 144                             | 14 | 60 | 4.0 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard        | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro           | 6.0 ± 0.6         | 144                             | 14 | 60 | 4.0 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | B. Aman        | 2.5 ± 0.25        | 36                              | 9  | 20 | 2.0 | -  | -   | -   | -  | -         |
| Kharif-2         | -              | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Mustard        | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro           | 7.5 ± 0.75        | 180                             | 16 | 76 | 6.0 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Cabbage        | 90 ± 9.0          | 180                             | 45 | 40 | 24  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower    | 50 ± 5.0          | 120                             | 60 | 60 | 21  | -  | 1.5 | 1.5 | -  | 3.0       |
|                  | Tomato         | 75 ± 7.5          | 120                             | 45 | 40 | 21  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Radish         | 60 ± 6.0          | 135                             | 45 | 80 | 18  | -  | 1.5 | -   | -  | 3.0       |
|                  | Potato         | 30 ± 3.0          | 135                             | 30 | 90 | 15  | -  | 2.0 | 1.5 | -  | 3.0       |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 20 | 26 | 7.5 | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 20 | 22 | 7.5 | -  | -   | -   | -  | -         |
|                  | Amaranthush    | 30 ± 3.0          | 90                              | 18 | 17 | 7.5 | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 7.5 | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 9.0 | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |

### AEZ 9: Old Brahmaputra Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 28      | Large areas in Sherpur, Jamalpur, Tangail, Mymensingh, Netrokona, Kishoreganj, Narsingdi and Narayanganj districts and small areas in the east of Dhaka and Gazipur districts. |
| Medium highland | 35      |  |
| Medium lowland  | 20      |  |

| Cropping pattern |             | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|-------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop        |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro        | 6.0 ± 0.6         | 144                             | 21 | 60 | 8.0 | -  | 1.5 | -   | -  | -         |
| Khariif-1        | T. Aus      | 4.0 ± 0.4         | 72                              | 7  | 40 | 3.0 | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman     | 5.0 ± 0.5         | 90                              | 85 | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro        | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 1.5 | -   | -  | -         |
| Khariif-1        | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman     | 5.0 ± 0.5         | 90                              | 8  | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro        | 6.0 ± 0.6         | 144                             | 21 | 60 | 8.0 | -  | 1.0 | -   | -  | -         |
| Khariif-1        | Jute (O)    | 4.5 ± 0.45        | 90                              | 8  | 50 | 8.0 | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman     | 5.0 ± 0.50        | 90                              | 8  | 50 | 4.0 | -  | -   | -   | -  | -         |
| Rabi             | Boro        | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 1.5 | -   | -  | -         |
| Khariif-1        | B. Aman     | 2.5 ± 0.25        | 36                              | 5  | 20 | 2.0 | -  | -   | -   | -  | -         |
| Khariif-2        | -           | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Boro        | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 1.5 | -   | -  | -         |
| Khariif-1        | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Khariif-2        | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Mustard     | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro        | 6.0 ± 0.6         | 144                             | 12 | 60 | 4.0 | -  | 1.5 | -   | -  | -         |
| Khariif-1        | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman     | 5.0 ± 0.5         | 90                              | 8  | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard     | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro        | 6.0 ± 0.6         | 144                             | 12 | 60 | 4.0 | -  | 1.5 | -   | -  | -         |
| Khariif-1        | B. Aman     | 2.5 ± 0.25        | 36                              | 5  | 20 | 2.0 | -  | -   | -   | -  | -         |
| Khariif-2        | -           | -                 | -                               | -  | -  | 2.0 | -  | -   | -   | -  | -         |
| Rabi             | Mustard     | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro        | 7.5 ± 0.75        | 180                             | 13 | 76 | 6.0 | -  | 1.5 | -   | -  | -         |
| Khariif-1        | -           | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Khariif-2        | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Khariif-1        | T. Aus      | 4.0 ± 0.4         | 72                              |    | 40 | 6.0 | -  | 1.5 | -   | -  | -         |
| Khariif-2        | T. Aman     | 5.0 ± 0.5         | 90                              |    | 50 | 4.0 | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Khariif-1        | Fallow      | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman     | 5.0 ± 0.5         | 90                              |    | 50 | 8.0 | -  | 1.5 | -   | -  | -         |
| Rabi             | Cabbage     | 90 ± 9.0          | 180                             | 45 | 40 | 16  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower | 50 ± 5.0          | 120                             | -  | 60 | 14  | -  | 1.5 | 1.5 | -  | 3.0       |
|                  | Tomato      | 75 ± 7.5          | 120                             | -  | 40 | 14  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Radish      | 60 ± 6.0          | 135                             | 45 | 80 | 12  | -  | 1.5 | 1.0 | -  | 3.0       |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Country bean   | 20 ± 2.0          | 45                              | 30 | 30 | 6.0 | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Potato         | 30 ± 3.0          | 135                             | 30 | 90 | 10  | -  | 1.5 | 1.5 | -  | 3.0       |
|                  | Sweet gourd    | 40 ± 4.0          | 75                              | 36 | 40 | 14  | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | Cucumberer     | 35 ± 3.5          | 75                              | 16 | 26 | 6.0 | -  | -   | -   | -  | -         |
|                  | Okra           | 16 ± 1.6          | 90                              | 20 | 26 | 5.0 | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 20 | 22 | 5.0 | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6.0 | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5.0 | -  | -   | -   | -  | -         |
|                  | Amaranthush    | 30 ± 3.0          | 90                              | 18 | 17 | 4.0 | -  | -   | -   | -  | -         |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 20 | 20 | 5.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 12 | 16 | 5.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Cucumberer     | 35 ± 3.5          | 75                              | 16 | 26 | 6.0 | -  | 1.0 | -   | -  | 1.5       |

### AEZ 10: Active Ganges Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Highland        | 12      | The region extends along the Ganges and lower Meghna river Channels from the Indian border through Chapai Nawabganj, Rajshahi, Kushtia, Faridpur, Shariatpur and Munshiganj districts to the mouth of Meghna Estuary in Laxmipur and Barisal districts. |
| Medium highland | 33      |   |
| Medium lowland  | 18      |   |

| Cropping pattern |          | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop     |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro     | 7.5 ± 0.75        | 180                             | 24 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Boro     | 7.5 ± 0.75        | 180                             | 24 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 8  | 50 | 4  | -  | -   | -   | -  | -         |
| Rabi             | Mustard  | 1.8 ± 0.18        | 90                              | 27 | 40 | 10 | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro     | 7.5 ± 0.75        | 180                             | 13 | 76 | 6  | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Mustard  | 1.8 ± 0.18        | 90                              | 27 | 40 | 10 | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro     | 6.0 ± 0.6         | 144                             | 12 | 60 | 4  | -  | 2.0 | -   | -  | -         |
| Kharif-1         | T. Aus   | 4.0 ± 0.4         | 72                              | 7  | 40 | 3  | -  | 1.0 | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Mustard  | 2.0 ± 0.2         | 120                             | 36 | 60 | 18 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | Jute (O) | 4.5 ± 0.45        | 90                              | 8  | 50 | 8  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 24 | 60 | 10  | -  | 1.0 | 1.5 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 8   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 8  | 50 | 4   | -  | 1.5 | -   | -  | -         |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 24 | 60 | 10  | -  | 1.5 | 1.5 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 8   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 24 | 60 | 10  | -  | 1.5 | 1.5 | -  | -         |
| Kharif-1         | B. Aman        | 2.5 ± 0.25        | 36                              | 5  | 20 | 4   | -  | -   | -   | -  | -         |
| Kharif-2         | -              | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Grasspea       | 1.5 ± 0.15        | 15                              | 15 | 12 | 6   | -  | -   | -   | -  | -         |
| Kharif-1         | B. Aman        | 2.5 ± 0.25        | 36                              | 5  | 20 | 4   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Onion          | 20 ± 2.0          | 105                             | 45 | 60 | 20  | -  | 2.0 | 1.5 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 8.8 | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Onion          | 20 ± 2.0          | 105                             | 45 | 60 | 20  | -  | -   | 1.5 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 8   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 96                              | 8  | 50 | 4   | -  | -   | -   | -  | -         |
| Rabi             | Cabbage        | 90 ± 9.0          | 180                             | 45 | 40 | 16  | -  | 2.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower    | 50 ± 5.0          | 120                             | 60 | 60 | 14  | -  | 2.5 | 1.5 | -  | 3.0       |
|                  | Tomato         | 75 ± 7.5          | 120                             | 45 | 40 | 14  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Country bean   | 20 ± 2.0          | 45                              | 30 | 30 | 6   | -  | 1.0 | -   | -  | 3.0       |
|                  | Radish         | 60 ± 6.0          | 135                             | 45 | 80 | 12  | -  | 2.5 | -   | -  | 3.0       |
|                  | Potato         | 30 ± 3.0          | 135                             | 30 | 90 | 10  | -  | 2.5 | 1.5 | -  | 3.0       |
|                  | Sweet gourd    | 40 ± 4.0          | 75                              | 36 | 40 | 14  | -  | 1.0 | 1.5 | -  | 3.0       |
| Kharif-1         | Cucumber       | 35 ± 3.5          | 75                              | 16 | 26 | 6.0 | -  | -   | -   | -  | -         |
|                  | Okra           | 16 ± 1.6          | 90                              | 20 | 26 | 5.0 | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 20 | 22 | 5.0 | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6.0 | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5.0 | -  | -   | -   | -  | -         |
|                  | Amaranthush    | 30 ± 3.0          | 90                              | 18 | 17 | 4.0 | -  | -   | -   | -  | -         |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 20 | 20 | 5.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 12 | 16 | 5.0 | -  | 1.0 | -   | -  | 1.5       |
|                  | Cucumberer     | 35 ± 3.5          | 75                              | 16 | 26 | 6.0 | -  | 1.0 | -   | -  | 1.5       |

## AEZ 11: High Ganges River Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Highland        | 43      | Chapai Nawabganj, Rajshahi, Natore, southern Pabna, Kushtia, Meherpur, Chuadanga, Jhenidah, Magura, Jessore, Satkhira and Khulna districts together with minor areas in Naogaon and Narail districts. |
| Medium Highland | 32      |   |
| Medium Lowland  | 12      |   |

| Cropping pattern |              | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|--------------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop         |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 12 | -  | 2.5 | -   | -  | -         |
| Khariif-1        | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 50 | 4  | -  | 1.5 | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 12 | -  | 2.5 | -   | -  | -         |
| Khariif-1        | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Khariif-2        | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Boro         | 6.0 ± 0.6         | 144                             | 21 | 60 | 8  | -  | 2.0 | -   | -  | -         |
| Khariif-1        | T. Aus       | 4.0 ± 0.4         | 72                              | 7  | 40 | 3  | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman      | 4.0 ± 0.4         | 72                              | 7  | 40 | 3  | -  | 1.5 | -   | -  | -         |
| Rabi             | Lentil       | 1.8 ± 0.18        | 21                              | 18 | 14 | 6  | -  | 1.0 | -   | -  | -         |
| Khariif-1        | Jute (O)     | 4.5 ± 0.45        | 90                              | 8  | 51 | 8  | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman      | 4.0 ± 0.4         | 72                              | 7  | 40 | 6  | -  | 1.5 | -   | -  | -         |
| Rabi             | Wheat        | 4.5 ± 0.45        | 120                             | 24 | 60 | 10 | -  | 2.0 | 1.0 | -  | -         |
| Khariif-1        | Jute (O)     | 4.5 ± 0.45        | 90                              | 8  | 51 | 8  | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 50 | 8  | -  | 1.5 | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 76 | 12 | -  | 2.5 | -   | -  | -         |
| Khariif-1        | T. Aus       | 4.0 ± 0.4         | 72                              | 7  | 40 | 6  | -  | -   | -   | -  | -         |
| Khariif-2        | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Mustard      | 1.8 ± 0.18        | 90                              | 27 | 40 | 10 | -  | -   | 1.0 | -  | 3.0       |
|                  | Boro         | 6.0 ± 0.6         | 144                             | 12 | 60 | 8  | -  | 2.0 | -   | -  | -         |
| Khariif-2        | T. Aman      | 4.0 ± 0.4         | 72                              | 7  | 40 | 6  | -  | 1.5 | -   | -  | -         |
| Rabi             | Boro         | 6.0 ± 0.6         | 144                             | 21 | 60 | 8  | -  | 2.0 | -   | -  | -         |
| Khariif-1        | Jute (O)     | 4.5 ± 0.45        | 90                              | 8  | 51 | 8  | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman      | 5.0 ± 0.5         | 90                              | 8  | 50 | 8  | -  | 1.5 | -   | -  | -         |
| Rabi             | Maize        | 10 ± 1.0          | 225                             | 60 | 80 | 30 | -  | 4.0 | 1.0 | -  | -         |
| Khariif-1        | Jute (O)     | 4.5 ± 0.45        | 90                              | 8  | 51 | 8  | -  | -   | -   | -  | -         |
| Khariif-2        | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Maize        | 10 ± 1.0          | 225                             | 60 | 80 | 30 | -  | 4.0 | 1.0 | -  | -         |
| Khariif-1        | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman      | 5.0 ± 0.5         | 90                              | 10 | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Maize        | 10 ± 1.0          | 225                             | 60 | 80 | 30 | -  | 4.0 | 1.0 | -  | -         |
| Khariif-1        | M. bean      | 2.0 ± 0.2         | 18                              | 12 | 16 | 4  | -  | -   | -   | -  | -         |
| Khariif-2        | T. Aman      | 5.0 ± 0.5         | 90                              |    | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Radish       | 60 ± 6.0          | 135                             | 45 | 80 | 12 | -  | 3.0 | -   | -  | 3.0       |
|                  | Cabbage      | 70 ± 7.0          | 120                             | 36 | 30 | 12 | -  | 2.5 | 1.0 | -  | 3.0       |
|                  | Country bean | 20 ± 2.0          | 45                              | 30 | 30 | 6  | -  | 1.0 | -   | -  | 3.0       |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
|                  | Cauliflow      | 50 ± 5.0          | 120                             | 60 | 60 | 14 | -  | 3.0 | 1.0 | -  | 3.0       |
|                  | Tomato         | 75 ± 7.5          | 120                             | 45 | 40 | 14 | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Brinjal        | 6.0 ± 6.0         | 135                             | 36 | 70 | 10 | -  | 2.0 | 1.0 | -  | 3.0       |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 20 | 26 | 5  | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6  | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5  | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 20 | 22 | 5  | -  | -   | -   | -  | -         |
|                  | Amaranthush    | 30 ± 3.0          | 90                              | 18 | 17 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5  | -  | 1.5 | -   | -  | 1.5       |
|                  | Bottle gourd   | 3.0 ± 3.0         | 60                              | 20 | 20 | 6  | -  | 1.5 | -   | -  | 1.5       |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 20 | 20 | 5  | -  | 1.0 | -   | -  | 1.5       |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 12 | 16 | 5  | -  | 1.0 | -   | -  | 1.5       |
|                  | Cucumberer     | 35 ± 3.5          | 75                              | 16 | 26 | 6  | -  | 1.0 | -   | -  | 1.5       |
| Rabi             | Sugarcane      | 100 ± 10          | 180                             | 60 | 90 | 30 | -  | 4.0 | -   | -  | -         |
| Kharif-1         |                | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         |                | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |

### AEZ 12: Low Ganges River Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Highland        | 13      | Faridpur, Pabna, Rajbari, Madaripur, Narail, Gopalganj and Sariatpur, Natore, eastern parts of Kushtia, Magura and Narail, north-eastern parts of Khulna and Bagerhat, northern Barisal, and south-western parts of Manikganj, Dhaka and Mushiganj districts. |
| Medium highland | 29      |   |
| Medium lowland  | 31      |   |
| Lowland         | 14      |   |

| Cropping pattern |          | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |     |     |    | OF (t/ha) |
|------------------|----------|-------------------|---------------------------------|----|----|---|----|-----|-----|----|-----------|
| Season           | Crop     |                   | N                               | P  | K  | S | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro     | 7.5 ± 0.75        | 180                             | 24 | 76 | 6 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Rabi             | Boro     | 7.5 ± 0.75        | 180                             | 24 | 76 | 6 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 8  | 50 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Wheat    | 4.5 ± 0.45        | 120                             | 24 | 60 | 5 | -  | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Jute (O) | 4.5 ± 0.45        | 90                              | 8  | 50 | 4 | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 8  | 50 | 2 | -  | 1.0 | -   | -  | -         |
| Rabi             | Wheat    | 4.5 ± 0.45        | 120                             | 24 | 60 | 5 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Jute (C) | 3.5 ± 0.35        | 75                              | 7  | 40 | 5 | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Rabi             | Boro     | 7.5 ± 0.75        | 180                             | 24 | 76 | 6 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | B. Aman  | 2.5 ± 0.25        | 36                              | 5  | 20 | 4 | -  | -   | -   | -  | -         |
| Kharif-2         | -        | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Mustard        | 2.0 ± 0.2         | 120                             | 36 | 60 | 9   | -  | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 4   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Mustard        | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -  | 1.0 | 1.0 | -  | 3.0       |
| Kharif-1         | Boro           | 6.0 ± 0.60        | 144                             | 12 | 60 | 4   | -  | 1.0 | -   | -  | -         |
| Kharif-2         | B. Aman        | 2.5 ± 0.25        | 36                              | 5  | 20 | 4   | -  | -   | -   | -  | -         |
| Rabi             | Onion          | 20 ± 2.0          | 105                             | 45 | 60 | 10  | -  | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 4   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | -  | 50 | 4   | -  | 1.0 | -   | -  | -         |
| Rabi             | Onion          | 20 ± 2.0          | 105                             | 45 | 60 | 10  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Garlic         | 15 ± 15           | 114                             | 48 | 60 | 10  | -  | 2.0 | 1.5 | -  | 3.0       |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 8   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | 0  | 0   | -  | -   | -   | -  | -         |
| Rabi             | Lentil         | 1.8 ± 0.18        | 21                              | 18 | 14 | 3   | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 25  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Lentil         | 1.8 ± 0.18        | 21                              | 18 | 14 | 3   | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 8  | 50 | 8   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 7  | 40 | 1.5 | -  | 1.0 | -   | -  | -         |
| Rabi             | Grasspea       | 1.5 ± 0.15        | 15                              | 15 | 12 | 3   | -  | -   | -   | -  | -         |
| Kharif-1         | Jute (C)       | 3.5 ± 0.35        | 75                              | 7  | 40 | 5   | -  | 1.5 | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Potato         | 30 ± 3.0          | 135                             | 30 | 90 | 5   | -  | 2.0 | 1.0 | -  | -         |
| Kharif-1         | Sesbania       | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | -              | -                 | -                               | -  | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Radish         | 60 ± 6.0          | 135                             | 45 | 80 | 6   | -  | 1.5 | -   | -  | 3.0       |
|                  | Cabbage        | 90 ± 9.0          | 180                             | 45 | 40 | 8   | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Tomato         | 75 ± 7.5          | 120                             | 36 | 30 | 5   | -  | 1.0 | -   | -  | 3.0       |
|                  | Country bean   | 20 ± 2.0          | 45                              | 30 | 30 | 6   | -  | 1.0 | -   | -  | 3.0       |
|                  | Cauliflower    | 50 ± 5.0          | 120                             | 60 | 60 | 7   | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 36 | 70 | 5   | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Sweet gourd    | 40 ± 4.0          | 75                              | 36 | 40 | 14  | -  | 1.0 | 1.0 | -  | 3.0       |
| Kharif-1         | Okra           | 16 ± 0.16         | 90                              | 20 | 26 | 5   | -  | -   | -   | -  | -         |
|                  | Cucumber       | 35 ± 3.5          | 75                              | 16 | 26 | 6   | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 0.45         | 105                             | 20 | 22 | 5   | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6   | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5   | -  | -   | -   | -  | -         |
|                  | Amaran,        | 30 ± 0.3          | 90                              | 18 | 17 | 4   | -  | -   | -   | -  | -         |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5   | -  | 1.0 | -   | -  | 1.5       |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6   | -  | 1.0 | -   | -  | 1.5       |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 20 | 20 | 5   | -  | 1.0 | -   | -  | 1.5       |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 12 | 16 | 5   | -  | 1.0 | -   | -  | 1.5       |
|                  | Cucumber       | 35 ± 3.5          | 75                              | 16 | 26 | 6   | -  | 1.0 | -   | -  | 1.5       |

### AEZ 13: Ganges Tidal Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Medium highland | 78      | The region occupies all or most of Khulna, Bagerhat, Satkhira, Barisal, Patuakhali, Burguna, Pirojpur and Jhalakati districts. It also includes the Khulna and Bagerhat Sundarbans reserved forests. |

| Cropping pattern |            | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |     |     |    | OF (t/ha) |
|------------------|------------|-------------------|---------------------------------|----|----|---|----|-----|-----|----|-----------|
| Season           | Crop       |                   | N                               | P  | K  | S | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro       | 7.5 ± 0.75        | 180                             | 24 | 76 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Rabi             | Boro       | 7.5 ± 0.75        | 180                             | 24 | 76 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman    | 5.0 ± 0.5         | 90                              | 8  | 50 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman    | 5.0 ± 0.5         | 90                              | 15 | 50 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Grasspea   | 1.5 ± 0.15        | 15                              | 15 | 12 | 3 | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman    | 5.0 ± 0.5         | 90                              | 8  | 50 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Mungbean   | 2.0 ± 0.2         | 18                              | 18 | 16 | 4 | -  | 0.0 | -   | -  | -         |
| Kharif-1         | T. Aus     | 4.0 ± 0.4         | 72                              | 7  | 40 | 3 | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman    | 4.0 ± 0.4         | 72                              | 7  | 40 | 3 | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-1         | T. Aus     | 4.0 ± 0.4         | 72                              | 12 | 40 | 3 | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman    | 4.0 ± 0.4         | 72                              | 7  | 40 | 2 | -  | 1.0 | -   | -  | -         |
| Rabi             | Grasspea   | 1.5 ± 0.15        | 15                              | 15 | 12 | 3 | -  | -   | -   | -  | -         |
| Kharif-1         | T. Aus     | 4.0 ± 0.4         | 72                              | 7  | 40 | 3 | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman    | 4.0 ± 0.4         | 72                              | 7  | 40 | 3 | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-1         | M. bean    | 2.0 ± 0.2         | 18                              | 18 | 16 | 4 | -  | -   | 1.0 | -  | -         |
| Kharif-2         | T. Aman    | 5.0 ± 0.5         | 90                              | 8  | 50 | 2 | -  | 1.0 | -   | -  | -         |
| Rabi             | Chilli     | 2.5 ± 0.25        | 96                              | 45 | 50 | 5 | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman    | 5.0 ± 0.5         | 90                              | 8  | 50 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Watermelon | 60 ± 6.0          | 105                             | 36 | 54 | 5 | -  | 1.5 | 1.0 | -  | -         |
| Kharif-1         | T. Aus     | 4.0 ± 0.4         | 72                              | 7  | 40 | 3 | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman    | 4.0 ± 0.4         | 72                              | 7  | 40 | 3 | -  | 1.0 | -   | -  | -         |
| Rabi             | Chili      | 2.5 ± 0.25        | 96                              | 45 | 50 | 5 | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman    | 5.0 ± 0.5         | 90                              | 8  | 50 | 2 | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow     | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-1         | Sesame     | 1.4 ± 0.14        | 75                              | 30 | 40 | 7 | -  | -   | 1.0 | -  | -         |
| Kharif-2         | T. Aman    | 5.0 ± 0.5         | 72                              | 7  | 40 | 3 | -  | 1.5 | -   | -  | -         |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Radish         | 60 ± 6.0          | 135                             | 45 | 80 | 6  | -  | 1.5 | -   | -  | 3.0       |
|                  | Cabbage        | 90 ± 9.0          | 180                             | 45 | 40 | 8  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Tomato         | 75 ± 7.5          | 120                             | 45 | 40 | 14 | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Cauliflower    | 50 ± 5.0          | 120                             | 60 | 60 | 7  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Sweet gourd    | 40 ± 4.0          | 75                              | 36 | 40 | 7  | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 36 | 70 | 5  | -  | 1.0 | 1.0 | -  | 3.0       |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 20 | 26 | 5  | -  | -   | -   | -  | -         |
|                  | Cucumber       | 35 ± 3.5          | 75                              | 16 | 26 | 6  | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6  | -  | -   | -   | -  | -         |
|                  | Country bean   | 20 ± 2.0          | 45                              | 20 | 20 | 6  | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5  | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 17 | 22 | 5  | -  | -   | -   | -  | -         |
|                  | Amaranthus     | 30 ± 3.0          | 90                              | 15 | 17 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 23 | 46 | 5  | -  | 1.0 | -   | -  | 1.5       |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 20 | 20 | 6  | -  | 1.0 | -   | -  | 1.5       |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 20 | 20 | 5  | -  | 1.0 | -   | -  | 1.5       |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 12 | 16 | 5  | -  | 1.0 | -   | -  | 1.5       |
|                  | Cucumber       | 35 ± 3.5          | 75                              | 23 | 26 | 6  | -  | 1.0 | -   | -  | 1.5       |

### AEZ 14: Gopalganj-Khulna Bils

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Medium highland | 13      | The region occupies a number of separate basin areas in Gopalganj, Khulna, Jessore, Bagerhat, Narail and Madaripur districts. |
| Medium lowland  | 41      |   |
| Lowland         | 28      |   |
| Very lowland    | 11      |   |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |   |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|----|-----|---|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg | Zn  | B | Mo |           |
| Rabi             | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 60                              | 10 | 25 | 8  | -  | 1.5 | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 120                             | 16 | 38 | 12 | -  | 2.0 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 60                              | 6  | 25 | 4  | -  | 1.0 | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 120                             | 16 | 38 | 12 | -  | 1.5 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |

| Cropping pattern |          | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop     |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro     | 7.5 ± 0.75        | 120                             | 16 | 38 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | B. Aman  | 2.5 ± 0.25        | 24                              | 3  | 10 | 2  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | 0                               | -  | 0  | 0  | -  | -   | -   | -  | -         |
| Rabi             | Boro     | 6.0 ± 0.6         | 96                              | 14 | 30 | 8  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus   | 4.0 ± 0.4         | 48                              | 4  | 20 | 3  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 4.0 ± 0.4         | 48                              | 4  | 20 | 3  | -  | 1.0 | -   | -  | -         |
| Rabi             | Lentil   | 1.8 ± 0.18        | 14                              | 12 | 7  | 6  | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Jute (O) | 4.5 ± 0.45        | 60                              | 6  | 25 | 8  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 4.0 ± 0.4         | 48                              | 4  | 20 | 3  | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard  | 1.8 ± 0.18        | 60                              | 18 | 20 | 10 | -  | -   | 1.0 | -  | 3.0       |
| Kharif-1         | Boro     | 6.0 ± 0.6         | 96                              | 8  | 30 | 4  | -  | 1.5 | -   | -  | -         |
| Kharif-2         | T. Aman  | 4.0 ± 0.4         | 48                              | 4  | 20 | 3  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro     | 6.0 ± 0.6         | 96                              | 14 | 30 | 8  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus   | 4.0 ± 0.4         | 48                              | 4  | 20 | 3  | -  | 1.0 | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Grasspea | 1.5 ± 0.15        | 10                              | 10 | 6  | 6  | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 60                              | 6  | 25 | 4  | -  | 1.5 | -   | -  | -         |
| Rabi             | Grasspea | 1.5 ± 0.15        | 10                              | 10 | 6  | 6  | -  | -   | -   | -  | -         |
| Kharif-1         | Jute (O) | 4.5 ± 0.45        | 60                              | 6  | 25 | 8  | -  | 1.5 | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-1         | Sesame   | 1.4 ± 0.14        | 50                              | 20 | 20 | 14 | -  | -   | 1.0 | -  | -         |
| Kharif-2         | T. Aman  | 4.0 ± 0.4         | 48                              | 4  | 20 | 3  | -  | 1.5 | -   | -  | -         |
| Rabi             | Mustard  | 2.0 ± 0.2         | 80                              | 24 | 30 | 18 | -  | 1.0 | 1.0 | -  | 3.0       |
| Kharif-1         | Jute (O) | 4.5 ± 0.45        | 60                              | 6  | 25 | 8  | -  | 1.5 | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |

### AEZ 15: Arial Bil

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT            |
|-----------------|---------|--------------------------------|
| Medium lowland  | 13      | Munshiganj and Dhaka districts |
| Lowland         | 73      |                                |

| Cropping pattern |            | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |     |    |   |    |    |     |    | OF (t/ha) |
|------------------|------------|-------------------|---------------------------------|-----|----|---|----|----|-----|----|-----------|
| Season           | Crop       |                   | N                               | P   | K  | S | Mg | Zn | B   | Mo |           |
| Rabi             | Potato     | 30 ± 3.0          | 135                             | 20  | 90 | 5 | -  | -  | 1.0 | -  | 3.0       |
| Kharif-1         | Jute ( C ) | 3.5 ± 0.35        | 75                              | 4.4 | 26 | 5 | -  | -  | -   | -  | -         |
| Kharif-2         | Fallow     | -                 | -                               | -   | -  | - | -  | -  | -   | -  | -         |
| Rabi             | Potato     | 30 ± 3.0          | 135                             | 20  | 90 | 5 | -  | -  | 1.0 | -  | 3.0       |
| Kharif-1         | T. Aus     | 4.0 ± 0.4         | 72                              | 4   | 26 | 3 | -  | -  | -   | -  | -         |
| Kharif-2         | Fallow     | -                 | -                               | -   | -  | - | -  | -  | -   | -  | -         |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |    |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|---|----|----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S | Mg | Zn | B   | Mo |           |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20 | 90 | 5 | -  | -  | 1.0 | -  | 3.0       |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 3  | 13 | 2 | -  | -  | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20 | 90 | 5 | -  | -  | 1.0 | -  | 3.0       |
|                  | Boro    | 7.5 ± 0.75        | 180                             | 9  | 49 | 6 | -  | -  | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 6 | -  | -  | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20 | 90 | 5 | -  | -  | 1.0 | -  | 3.0       |
| Kharif-1         | Sesame  | 1.4 ± 0.14        | 75                              | 11 | 26 | 7 | -  | -  | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 40 | 5 | -  | -  | 1.0 | -  | -         |
|                  | Boro    | 7.5 ± 0.75        | 180                             | 9  | 76 | 6 | -  | -  | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | - | -  | -  | -   | -  | -         |

### AEZ 16: Middle Meghna River Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Medium lowland  | 29      | The region occurs between the southern part of the Sylhet Basin and the confluence of the Meghna river with the Dhaleshwari and Ganges rivers. It covers parts of Kishorganj, B. Baria, Comilla, Chandpur, Narshingdi, Munshiganj and Narayanganj districts. |
| Lowland         | 25      |  |
| Very lowland    | 11      |  |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |     |    |    |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|-----|----|----|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P   | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro    | 6.0 ± 0.6         | 144                             | 14  | 60 | 8  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.4         | 72                              | 4.4 | 40 | 6  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 4.0 ± 0.4         | 72                              | 4.4 | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16  | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -   | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -   | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16  | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 6   | 20 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -   | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18  | 40 | 10 | -  | -   | 1.0 | -  | 3.0       |
| Kharif-1         | Boro    | 7.5 ± 0.75        | 180                             | 9   | 76 | 6  | -  | 2.0 | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -   | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Mustard | 2.0 ± 0.2         | 120                             | 24  | 60 | 18 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 6   | 20 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -   | -  | -  | -  | -   | -   | -  | -         |

| Cropping pattern |          | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |   |    | OF (t/ha) |
|------------------|----------|-------------------|---------------------------------|----|----|----|----|-----|---|----|-----------|
| Season           | Crop     |                   | N                               | P  | K  | S  | Mg | Zn  | B | Mo |           |
| Rabi             | Potato   | 30 ± 3.0          | 135                             | 20 | 90 | 10 | -  | 1.5 | - | -  | 3.0       |
| Kharif-1         | Boro     | 6.0 ± 0.6         | 144                             | 8  | 39 | 8  | -  | 1.5 | - | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Rabi             | Potato   | 30 ± 3.0          | 135                             | 20 | 90 | 10 | -  | 1.5 | - | -  | 3.0       |
| Kharif-1         | Boro     | 6.0 ± 0.6         | 144                             | 8  | 39 | 8  | -  | 1.5 | - | -  | -         |
| Kharif-2         | T. Aman  | 4.0 ± 0.4         | 72                              | 5  | 26 | 6  | -  | -   | - | -  | -         |
| Rabi             | Potato   | 30 ± 3.0          | 135                             | 20 | 90 | 10 | -  | 2.0 | - | -  | 3.0       |
| Kharif-1         | B. Aman  | 2.5 ± 0.25        | 36                              | 6  | 13 | 4  | -  | -   | - | -  | -         |
| Kharif-2         | -        | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Rabi             | Potato   | 30 ± 3.0          | 135                             | 20 | 90 | 10 | -  | 2.0 | - | -  | 3.0       |
| Kharif-1         | Sesbania | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |

### AEZ 17: Lower Meghna River Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT                        |
|-----------------|---------|--|
| Highland        | 14      | Chandpur, Laxmipur and Noakhali districts. |
| Medium highland | 28      |  |
| Medium lowland  | 31      |  |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 3  | 20 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Tomato  | 7.5 ± 7.5         | 90                              | 24 | 30 | 10 | -  | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Jute(O) | 4.5 ± 0.45        | 90                              | 7  | 33 | 8  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Soybean | 2.0 ± 0.20        | 27                              | 30 | 40 | 14 | -  | -   | 1.0 | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 4  | -  | 1.5 | -   | -  | -         |
| Rabi             | Boro    | 6.0 ± 0.6         | 144                             | 18 | 60 | 8  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.4         | 72                              | 6  | 40 | 6  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 4.0 ± 0.4         | 72                              | 6  | 40 | 6  | -  | 1.0 | -   | -  | -         |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Potato         | 30 ± 3.0          | 135                             | 25 | 90 | 10 | -  | 2.0 | 1.0 | -  | -         |
| Kharif-1         | Sesame         | 1.4 ± 0.14        | 75                              | 14 | 26 | 7  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 6  | 26 | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | Potato         | 30 ± 3.0          | 135                             | 25 | 90 | 10 | -  | -   | -   | -  | -         |
| Kharif-1         | Maize          | 10 ± 1.0          | 225                             | 33 | 52 | 15 | -  | 1.5 | 1.0 | -  | -         |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 6  | 26 | 6  | -  | 1.5 | -   | -  | -         |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 16 | 40 | 5  | -  | 1.0 | -   | -  | 1.5       |
|                  | Botte gourd    | 30 ± 3.0          | 60                              | 16 | 30 | 6  | -  | 1.0 | -   | -  | 2.0       |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 16 | 70 | 5  | -  | 1.0 | -   | -  | 2.0       |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 14 | 22 | 5  | -  | -   | -   | -  | 1.5       |
|                  | Amaranthus     | 30 ± 3.0          | 90                              | 13 | 17 | 8  | -  | -   | -   | -  | 1.5       |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |

### AEZ 18: Young Meghna Estuarine Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Medium highland | 45      | Chittagong, Feni, Noakhali, Laxmipur, Bhola, Barisal, Patuakhali and Barguna districts. |
| Medium lowland  | 7       |   |

| Cropping pattern |          | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop     |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro     | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 6  | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 10 | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | G. nut   | 2.6 ± 0.26        | 36                              | 24 | 30 | 24 | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Grasspea | 1.5 ± 0.15        | 15                              | 10 | 12 | 6  | -  | -   | -   | -  | -         |
| Kharif-1         | T. Aus   | 4.0 ± 0.4         | 72                              | 4  | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman  | 4.0 ± 0.4         | 72                              | 4  | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro     | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | M. bean  | 2.0 ± 0.20        | 18                              | 12 | 16 | 8  | -  | -   | 1.0 | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -  | 1.5 | -   | -  | -         |

| Cropping pattern |          | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop     |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Chilli   | 2.5 ± 0.25        | 96                              | 30 | 50 | 10 | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Grasspea | 1.5 ± 0.15        | 15                              | 10 | 12 | 6  | -  | -   | -   | -  | -         |
| Kharif-1         | T. Aus   | 4.0 ± 0.4         | 72                              | 4  | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman  | 4.0 ± 0.4         | 72                              | 4  | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | W. Melon | 60 ± 6.0          | 105                             | 24 | 54 | 10 | -  | 1.0 | 1.0 | -  | 3.0       |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Cowpea   | 1.4 ± 0.14        | 15                              | 10 | 12 | 6  | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow   | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman  | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -  | 1.0 | -   | -  | -         |

### AEZ 19: Old Meghna Estuarine Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Medium highland | 24      | Kishoreganj, Habiganj, B. Baria, Comilla, Chandpur, Feni, Noakhali, Laxmipur, Narshingdi, Narayanganj, Munshiganj, Dhaka, Shariatpur, Madaripur, Gopalganj and Barisal districts. |
| Medium lowland  | 33      |   |
| Lowland         | 21      |   |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 6  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Boro    | 6.0 ± 0.6         | 144                             | 14 | 60 | 8  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.4         | 72                              | 4  | 40 | 6  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 4.0 ± 0.4         | 72                              | 4  | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 3  | 20 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Mustard | 1.8 ± 0.18        | 90                              | 18 | 40 | 10 | -  | -   | 1.0 | -  | 3.0       |
| Kharif-1         | Boro    | 7.5 ± 0.75        | 180                             | 9  | 76 | 6  | -  | 1.5 | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Mustard | 2.0 ± 0.20        | 120                             | 24 | 60 | 18 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 6  | 20 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20 | 90 | 10 | -  | 1.5 | -   | -  | 3.0       |
| Kharif-1         | Maize   | 10 ± 1.0          | 225                             | 26 | 52 | 15 | -  | 1.5 | 1.0 | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 20 | 90 | 10 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | Boro    | 7.5 ± 0.75        | 180                             | 9  | 49 | 6  | -  | 1.3 | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |

| Cropping pattern |                | Yield goal<br>(t/ha) | Nutrient Recommendation<br>(kg/ha) |    |    |    |    |     |     |    | OF<br>(t/ha) |
|------------------|----------------|----------------------|------------------------------------|----|----|----|----|-----|-----|----|--------------|
| Season           | Crop           |                      | N                                  | P  | K  | S  | Mg | Zn  | B   | Mo |              |
| Rabi             | Potato         | 30 ± 3.0             | 135                                | 20 | 90 | 10 | -  | 2.0 | 1.0 | -  | 3.0          |
| Kharif-1         | Jute(C)        | 3.5 ± 0.35           | 75                                 | 4  | 26 | 5  | -  | 1.5 | -   | -  | -            |
| Kharif-2         | Fallow         | -                    | -                                  | -  | -  | -  | -  | -   | -   | -  | -            |
| Rabi             | Chilli         | 2.5 ± 0.25           | 96                                 | 30 | 50 | 10 | -  | 1.0 | 1.0 | -  | 3.0          |
| Kharif-1         | Fallow         | -                    | -                                  | -  | -  | -  | -  | -   | -   | -  | -            |
| Kharif-2         | Fallow         | -                    | -                                  | -  | -  | -  | -  | -   | -   | -  | -            |
| Rabi             | Wheat          | 4.5 ± 0.45           | 120                                | 16 | 60 | 10 | -  | 1.5 | 1.0 | -  | -            |
| Kharif-1         | B. Aman        | 2.5 ± 0.25           | 36                                 | 9  | 20 | 4  | -  | -   | -   | -  | -            |
| Kharif-2         | -              | -                    | -                                  | -  | -  | -  | -  | -   | -   | -  | -            |
| Rabi             | Fallow         | -                    | -                                  | -  | -  | -  | -  | -   | -   | -  | -            |
| Kharif-1         | Felon          | 1.4 ± 0.14           | 15                                 | 10 | 12 | 6  | -  | -   | -   | -  | -            |
| Kharif-2         | T. Aman        | 5.0 ± 0.5            | 90                                 | 6  | 50 | 8  | -  | 1.0 | -   | -  | -            |
| Rabi             | Grasspea       | 1.5 ± 0.15           | 15                                 | 10 | 12 | 6  | -  | -   | -   | -  | -            |
| Kharif-1         | T. Aus         | 4.0 ± 0.4            | 72                                 | 4  | 40 | 6  | -  | 1.0 | -   | -  | -            |
| Kharif-2         | T. Aman        | 4.0 ± 0.4            | 72                                 | 4  | 40 | 6  | -  | 1.0 | -   | -  | -            |
| Rabi             | Cabbage        | 90 ± 9.0             | 180                                | 30 | 40 | 16 | -  | 1.5 | 1.0 | -  | 3.0          |
|                  | Cauliflower    | 50 ± 5.0             | 120                                | 40 | 60 | 14 | -  | 1.5 | 1.0 | -  | 3.0          |
|                  | Country bean   | 20 ± 2.0             | 45                                 | 20 | 30 | 6  | -  | 1.0 | 1.0 | -  | 3.0          |
|                  | Tomato         | 75 ± 7.5             | 120                                | 30 | 40 | 14 | -  | 1.0 | 1.0 | -  | 3.0          |
|                  | Radish         | 60 ± 6.0             | 135                                | 30 | 80 | 12 | -  | 1.5 | 1.0 | -  | 3.0          |
|                  | Sweet gourd    | 40 ± 4.0             | 75                                 | 24 | 40 | 14 | -  | 1.0 | 1.0 | -  | 3.0          |
|                  | Potato         | 30 ± 3.0             | 135                                | 20 | 90 | 10 | -  | 2.0 | 1.0 | -  | 3.0          |
| Kharif-1         | Cucumber       | 35 ± 3.5             | 75                                 | 10 | 26 | 12 | -  | -   | -   | -  | -            |
|                  | Okra           | 16 ± 1.6             | 90                                 | 13 | 26 | 10 | -  | -   | -   | -  | -            |
|                  | Indian spinach | 45 ± 4.5             | 105                                | 11 | 22 | 10 | -  | -   | -   | -  | -            |
|                  | Bottle gourd   | 30 ± 3.0             | 60                                 | 13 | 20 | 12 | -  | -   | -   | -  | -            |
|                  | Brinjal        | 60 ± 6.0             | 135                                | 16 | 46 | 10 | -  | -   | -   | -  | -            |
|                  | Amaranthus     | 30 ± 3.0             | 90                                 | 10 | 17 | 8  | -  | -   | -   | -  | -            |
| Kharif-2         | Brinjal        | 60 ± 6.0             | 135                                | 16 | 46 | 5  | -  | 1.0 | -   | -  | 1.5          |
|                  | Bottle gourd   | 30 ± 3.0             | 60                                 | 13 | 20 | 6  | -  | 1.0 | -   | -  | 1.5          |
|                  | Bitter gourd   | 25 ± 2.5             | 75                                 | 13 | 20 | 5  | -  | 1.0 | -   | -  | 1.5          |
|                  | Pointed gourd  | 20 ± 2.0             | 90                                 | 8  | 16 | 5  | -  | 1.0 | -   | -  | 1.5          |
|                  | Cucumber       | 35 ± 3.5             | 75                                 | 10 | 26 | 6  | -  | 1.0 | -   | -  | 1.5          |

### AEZ 20: Surma-kushiyara Floodplain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT                                    |
|-----------------|---------|--|
| Medium highland | 25      | Sylhet, Moulvibazar, Sunamganj and Habiganj districts. |
| Medium lowland  | 20      |  |
| Lowland         | 36      |  |

| Cropping pattern |              | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |    |     |    | OF (t/ha) |
|------------------|--------------|-------------------|---------------------------------|----|----|-----|----|----|-----|----|-----------|
| Season           | Crop         |                   | N                               | P  | K  | S   | Mg | Zn | B   | Mo |           |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 16 | 76 | 12  | -  | -  | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 10 | 75 | 6   | -  | -  | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 16 | 76 | 12  | -  | -  | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Kharif-2         | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Rabi             | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.50        | 90                              | 10 | 75 | 12  | -  | -  | -   | -  | -         |
| Rabi             | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Kharif-1         | T. Aus       | 4.0 ± 0.4         | 72                              | 12 | 60 | 9   | -  | -  | -   | -  | -         |
| Kharif-2         | T. Aman      | 4.0 ± 0.4         | 72                              | 8  | 60 | 4.5 | -  | -  | -   | -  | -         |
| Rabi             | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Kharif-1         | B. Aman      | 2.5 ± 0.25        | 36                              | 9  | 30 | 6   | -  | -  | -   | -  | -         |
| Kharif-2         |              | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Rabi             | Fallow       | -                 | -                               | -  | -  | -   | -  | -  | -   | -  | -         |
| Kharif-1         | T. Aus       | 4.0 ± 0.4         | 72                              | 12 | 60 | 9   | -  | -  | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 10 | 75 | 6   | -  | -  | -   | -  | -         |
| Rabi             | Cabbage      | 90 ± 9.0          | 180                             | 30 | 40 | 16  | -  | -  | 1.0 | -  | 3.0       |
|                  | Cauliflower  | 50 ± 5.0          | 120                             | 40 | 60 | 14  | -  | -  | 1.0 | -  | 3.0       |
|                  | Tomato       | 75 ± 7.5          | 120                             | 30 | 40 | 14  | -  | -  | 1.0 | -  | 3.0       |
|                  | Radish       | 60 ± 6.0          | 135                             | 30 | 80 | 12  | -  | -  | -   | -  | 3.0       |
|                  | Sweet gourd  | 4.0 ± 4.0         | 75                              | 24 | 40 | 14  | -  | -  | 1.0 | -  | 3.0       |
|                  | Potato       | 30 ± 3.0          | 135                             | 20 | 90 | 10  | -  | -  | 1.0 | -  | 3.0       |
| Kharif-1         | Okra         | 16 ± 1.6          | 90                              | 20 | 26 | 5   | -  | -  | -   | -  | -         |
|                  | Cucumber     | 35 ± 3.5          | 75                              | 16 | 26 | 6   | -  | -  | -   | -  | -         |
|                  | Country bean | 20 ± 2.0          | 45                              | 20 | 20 | 6   | -  | -  | -   | -  | -         |
|                  | Bottle gourd | 30 ± 3.0          | 60                              | 20 | 20 | 6   | -  | -  | -   | -  | -         |
|                  | Brinjal      | 60 ± 6.0          | 135                             | 24 | 46 | 5   | -  | -  | -   | -  | -         |
|                  | Amaranthus   | 30 ± 3.0          | 90                              | 10 | 17 | 8   | -  | -  | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 7  | 50 |     | -  | -  | -   | -  | -         |
| Rabi             | Cabbage      | 90 ± 9.0          | 180                             | 30 | 40 | 16  | -  | -  | 1.0 | -  | 3.0       |
|                  | Cauliflower  | 50 ± 5.0          | 120                             | 40 | 60 | 14  | -  | -  | 1.0 | -  | 3.0       |
|                  | Tomato       | 75 ± 7.5          | 120                             | 30 | 40 | 14  | -  | -  | 1.0 | -  | 3.0       |
|                  | Radish       | 60 ± 6.0          | 135                             | 30 | 80 | 12  | -  | -  | -   | -  | 3.0       |
|                  | Country bean | 20 ± 2.0          | 45                              | 20 | 30 | 6   | -  | -  | -   | -  | 3.0       |
|                  | Sweet gourd  | 4.0 ± 4.0         | 75                              | 24 | 40 | 41  | -  | -  | 1.0 | -  | 3.0       |
|                  | Potato       | 30 ± 3.0          | 135                             | 20 | 90 | 10  | -  | -  | 1.0 | -  | 3.0       |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 10 | 75 | 6  | -  | -   | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 15 | 75 | 12 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 10 | 49 | 6  | -  | 1.0 | -   | -  | -         |

### AEZ 21: Sylhet Basin

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Medium lowland  | 19      | This region extends over large parts of Sunamganj, Habiganj, Netrokona, Kishoreganj and B. Baria districts. |
| Lowland         | 43      |   |
| Very lowland    | 23      |   |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|---|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.50        | 90                              | 7  | 25 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.40        | 72                              | 8  | 20 | 3 | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 25 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 25 | 2 | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard | 2.0 ± 0.2         | 120                             | 24 | 30 | 9 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 6  | 10 | 2 | -  | -   | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Rabi             | Boro    | 7.0 ± 0.7         | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus  | 3.5 ± 0.35        | 66                              | 5  | 15 | 3 | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 4.0 ± 0.40        | 72                              | 5  | 20 | 3 | -  | 1.0 | -   | -  | -         |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 10 | 75 | 6  | -  | -   | -   | -  | -         |
| Rabi             | Potato  | 30 ± 3.0          | 135                             | 15 | 75 | 12 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 10 | 49 | 6  | -  | 1.0 | -   | -  | -         |

### AEZ 21: Sylhet Basin

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT   |
|-----------------|---------|---|
| Medium lowland  | 19      | This region extends over large parts of Sunamganj, Habiganj, Netrokona, Kishoreganj and B. Baria districts. |
| Lowland         | 43      |   |
| Very lowland    | 23      |   |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |     |     |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|---|----|-----|-----|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.50        | 90                              | 7  | 25 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.40        | 72                              | 8  | 20 | 3 | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 25 | 4 | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 7  | 25 | 2 | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard | 2.0 ± 0.2         | 120                             | 24 | 30 | 9 | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | B. Aman | 2.5 ± 0.25        | 36                              | 6  | 10 | 2 | -  | -   | -   | -  | -         |
| Kharif-2         | -       | -                 | -                               | -  | -  | - | -  | -   | -   | -  | -         |
| Rabi             | Boro    | 7.0 ± 0.7         | 180                             | 16 | 38 | 6 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus  | 3.5 ± 0.35        | 66                              | 5  | 15 | 3 | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman | 4.0 ± 0.40        | 72                              | 5  | 20 | 3 | -  | 1.0 | -   | -  | -         |

### AEZ 23: Chittagong Coastal Plain

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT                         |
|-----------------|---------|---|
| Highland        | 17      | Feni, Chittagong and Cox's Bazar districts. |
| Medium highland | 43      |   |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 24 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard        | 2.0 ± 0.2         | 120                             | 36 | 60 | 18 | 3  | -   | 1.0 | -  | -         |
| Kharif-1         | T. Aus         | 4.0 ± 0.4         | 72                              | 8  | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 8  | 40 | 6  | -  | 1.5 | -   | -  | -         |
| Rabi             | Tomato         | 75 ± 7.5          | 120                             | 45 | 40 | 14 | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 30 | 26 | 10 | -  | 1.0 | -   | -  | -         |
| Kharif-2         | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Chilli         | 2.5 ± 0.25        | 96                              | 45 | 50 | 10 | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Aus            | 4.0 ± 0.4         | 72                              | 8  | 40 | 6  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 8  | 40 | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 24 | 60 | 10 | -  | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Cabbage        | 90 ± 9.0          | 180                             | 45 | 40 | 16 | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower    | 50 ± 5.0          | 120                             | 60 | 60 | 14 | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Tomato         | 75 ± 7.5          | 120                             | 45 | 40 | 14 | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Country bean   | 20 ± 2.0          | 45                              | 20 | 30 | 6  | -  | 1.0 | -   | -  | 3.0       |
|                  | Radish         | 60 ± 6.0          | 135                             | 45 | 80 | 12 | -  | 1.5 | -   | -  | 3.0       |
|                  | Potato         | 30 ± 3.0          | 135                             | 30 | 90 | 10 | -  | 2.0 | 1.0 | -  | 3.0       |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 30 | 26 | 5  | -  | -   | -   | -  | -         |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 11 | 22 | 5  | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 30 | 20 | 6  | -  | -   | -   | -  | -         |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 36 | 46 | 5  | -  | -   | -   | -  | -         |
|                  | Amaranthus     | 30 ± 3.0          | 90                              | 10 | 17 | 8  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 33 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 30 | 40 | 5  | -  | -   | 1.0 | -  | 3.0       |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 11 | 22 | 5  | -  | -   | 1.0 | -  | 3.0       |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 30 | 30 | 6  | -  | -   | 1.0 | -  | 3.0       |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 36 | 70 | 5  | -  | -   | 1.0 | -  | 3.0       |
|                  | Amaranthus     | 30 ± 3.0          | 90                              | 15 | 17 | 8  | -  | -   | -   | -  | 3.0       |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 36 | 46 | 5  | -  | 1.0 | -   | -  | -         |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 30 | 20 | 6  | -  | 1.0 | -   | -  | -         |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 30 | 20 | 5  | -  | 1.0 | -   | -  | -         |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 18 | 16 | 5  | -  | 1.0 | -   | -  | -         |
|                  | Cucumber       | 35 ± 3.5          | 75                              | 24 | 26 | 6  | -  | 1.0 | -   | -  | -         |

### AEZ 24: St. Martin's Coral Island

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|----------------------|
| Highland        | 33      | St. Martin's Island. |
| Medium highland | 63      |                      |

| Cropping pattern |              | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |   |    | OF (t/ha) |
|------------------|--------------|-------------------|---------------------------------|----|----|----|----|-----|---|----|-----------|
| Season           | Crop         |                   | N                               | P  | K  | S  | Mg | Zn  | B | Mo |           |
| Rabi             | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 15 | 50 | 8  | -  | 1.5 | - | -  | -         |
| Rabi             | Onion        | 20 ± 2.0          | 105                             | 45 | 60 | 20 | -  | 2.0 | - | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -  | -  | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 10 | 50 | 4  | -  | 1.0 | - | -  | -         |
| Rabi             | Cabbage      | 90 ± 9.0          | 180                             | 45 | 40 | 16 | -  | 2.0 | - | -  | 3.0       |
|                  | Cauliflower  | 50 ± 5.0          | 120                             | 60 | 60 | 14 | -  | 2.0 | - | -  | 3.0       |
|                  | Country bean | 20 ± 2.0          | 45                              | 30 | 30 | 6  | -  | 1.0 | - | -  | 3.0       |
|                  | Tomato       | 75 ± 7.5          | 120                             | 45 | 40 | 14 | -  | 1.0 | - | -  | 3.0       |
|                  | Radish       | 60 ± 6.0          | 135                             | 45 | 80 | 12 | -  | 1.5 | - | -  | 3.0       |
|                  | Potato       | 30 ± 3.0          | 135                             | 30 | 90 | 10 | -  | 2.0 | - | -  | 3.0       |
| Kharif-1         | Okra         | 16 ± 1.6          | 90                              | 30 | 26 | 5  | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.5         | 90                              | 10 | 33 | 4  | -  | 1.0 | - | -  | -         |

### AEZ 25: Level Barind Tract

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 30      | Dinajpur, Gaibandha, Joypurhat, Bogra, Naogaon, Sirajganj, Rajshahi and Natore districts |
| Medium highland | 55      |  |

| Cropping pattern |         | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |    |     |   |    | OF (t/ha) |
|------------------|---------|-------------------|---------------------------------|----|----|-----|----|-----|---|----|-----------|
| Season           | Crop    |                   | N                               | P  | K  | S   | Mg | Zn  | B | Mo |           |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 1.5 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Kharif-2         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Rabi             | Boro    | 7.5 ± 0.75        | 180                             | 24 | 76 | 12  | -  | 1.5 | - | -  | -         |
| Kharif-1         | Fallow  | -                 | -                               | -  | -  | -   | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 5.0 ± 0.5         | 90                              | 10 | 50 | 4.0 | -  | 1.0 | - | -  | -         |
| Rabi             | Boro    | 6.0 ± 0.6         | 144                             | 21 | 60 | 8.0 | -  | 1.5 | - | -  | -         |
| Kharif-1         | T. Aus  | 4.0 ± 0.4         | 72                              | 8  | 40 | 6.0 | -  | -   | - | -  | -         |
| Kharif-2         | T. Aman | 4.0 ± 0.4         | 72                              | 8  | 40 | 6.0 | -  | 1.0 | - | -  | -         |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |     |     |     |     |    | OF     |
|------------------|----------------|-------------------|---------------------------------|----|----|-----|-----|-----|-----|----|--------|
| Season           | Crop           |                   | N                               | P  | K  | S   | Mg  | Zn  | B   | Mo | (t/ha) |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 24 | 60 | 10  | 4.0 | 1.5 | 1.0 | -  | -      |
| Kharif-1         | Jute (O)       | 4.5 ± 0.45        | 90                              | 10 | 50 | 8.0 | -   | -   | -   | -  | -      |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 8.0 | -   | 1.0 | -   | -  | -      |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 24 | 60 | 10  | 4.0 | 1.5 | 1.0 | -  | -      |
| Kharif-1         | T. Aus         | 4.0 ± 0.4         | 72                              | 8  | 40 | 6.0 | -   | -   | -   | -  | -      |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 8  | 40 | 6.0 | -   | 1.0 | -   | -  | -      |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 24 | 60 | 10  | 4.0 | 1.5 | 1.0 | -  | -      |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -   | -   | -   | -   | -  | -      |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 4.0 | -   | 1.0 | -   | -  | -      |
| Rabi             | Maize          | 10 ± 1.0          | 225                             | 60 | 80 | 30  | -   | 2.0 | -   | -  | -      |
| Kharif-1         | Fallow         | -                 | -                               | -  | -  | -   | -   | -   | -   | -  | -      |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 50 | 8.0 | -   | 1.0 | -   | -  | -      |
| Rabi             | Onion          | 20 ± 2.0          | 105                             | 45 | 60 | 20  | -   | 1.5 | 1.0 | -  | -      |
| Kharif-1         | T. Aus         | 4.0 ± 0.4         | 72                              | 8  | 40 | 6.0 | -   | -   | -   | -  | -      |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 8  | 40 | 6.0 | -   | 1.0 | -   | -  | -      |
| Rabi             | Mustard        | 1.8 ± 0.18        | 90                              | 27 | 40 | 10  | -   | -   | 1.0 | -  | -      |
| Kharif-1         | Boro           | 6.0 ± 0.6         | 144                             | 14 | 60 | 8   | -   | 1.5 | -   | -  | -      |
| Kharif-2         | T. Aman        | 4.0 ± 0.4         | 72                              | 8  | 40 | 6   | -   | 1.0 | -   | -  | -      |
| Rabi             | Sugarcane      | 100 ± 10.0        | 180                             | 60 | 90 | 30  | 20  | 2.5 | -   | -  | -      |
| Kharif-1         | -              | -                 | -                               | -  | -  | -   | -   | -   | -   | -  | -      |
| Kharif-2         | -              | -                 | -                               | -  | -  | -   | -   | -   | -   | -  | -      |
| Rabi             | Potato         | 30 ± 3.0          | 135                             | 30 | 90 | 10  | 5.0 | -   | 1.0 | -  | -      |
| Kharif-1         | Boro           | 6.0 ± 0.6         | 144                             | 14 | 39 | 8   | -   | 1.5 | -   | -  | -      |
| Kharif-2         | T. Aman        | 5.0 ± 0.5         | 90                              | 10 | 33 | 8   | -   | 1.0 | -   | -  | -      |
| Rabi             | Cabbage        | 90 ± 9.0          | 180                             | 45 | 40 | 16  | -   | 1.5 | 1.0 | -  | 3.0    |
|                  | Cauliflower    | 50 ± 5.0          | 120                             | 60 | 60 | 14  | -   | 1.5 | 1.0 | -  | 3.0    |
|                  | Country bean   | 20 ± 2.0          | 45                              | 30 | 30 | 6.0 | -   | 1.0 | -   | -  | 3.0    |
| Rabi             | Tomato         | 75 ± 7.5          | 120                             | 45 | 40 | 14  | -   | 1.0 | 1.0 | -  | 3.0    |
|                  | Radish         | 60 ± 6.0          | 135                             | 45 | 80 | 12  | -   | 1.5 | -   | -  | 3.0    |
|                  | Potato         | 30 ± 3.0          | 135                             | 30 | 90 | 10  | 5.0 | 2.0 | 1.0 | -  | 3.0    |
| Kharif-1         | Okra           | 16 ± 1.6          | 90                              | 30 | 39 | 5.0 | -   | -   | -   | -  | -      |
|                  | Indian spinach | 45 ± 4.5          | 105                             | 17 | 33 | 5.0 | -   | -   | -   | -  | -      |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 30 | 29 | 6.0 | -   | -   | -   | -  | -      |
|                  | Brinjal        | 60 ± 6.0          | 135                             | 36 | 68 | 5.0 | -   | -   | -   | -  | -      |
|                  | Amaranthus     | 30 ± 3.0          | 90                              | 15 | 25 | 8.0 | -   | -   | -   | -  | -      |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 36 | 68 | 5.0 | -   | 1.0 | -   | -  | 2.0    |
|                  | Bottle gourd   | 30 ± 3.0          | 60                              | 30 | 29 | 6.0 | -   | 1.0 | -   | -  | 2.0    |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 30 | 29 | 5.0 | -   | 1.0 | -   | -  | 1.5    |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 18 | 23 | 5.0 | -   | 1.0 | -   | -  | 1.5    |
|                  | Cucumber       | 35 ± 3.5          | 75                              | 24 | 39 | 6.0 | -   | 1.0 | -   | -  | 2.0    |

### AEZ 26: High Barind Tract

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT                               |
|-----------------|---------|---|
| Highland        | 93      | Rajshahi, Chapai Nawabganj and Naogaon districts. |

| Cropping pattern |           | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |     |    |     |     |     |    | OF (t/ha) |
|------------------|-----------|-------------------|---------------------------------|----|-----|----|-----|-----|-----|----|-----------|
| Season           | Crop      |                   | N                               | P  | K   | S  | Mg  | Zn  | B   | Mo |           |
| Rabi             | Boro      | 7.0 ± 0.75        | 180                             | 24 | 114 | 12 | -   | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman   | 5.0 ± 0.50        | 90                              | 10 | 75  | 8  | -   | -   | -   | -  | -         |
| Rabi             | Chickpea  | 2.0 ± 0.20        | 27                              | 18 | 24  | 8  | 4.0 | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman   | 5.0 ± 0.50        | 90                              | 10 | 75  | 8  | -   | 1.0 | -   | -  | -         |
| Rabi             | Wheat     | 4.5 ± 0.45        | 120                             | 24 | 90  | 10 | 4.0 | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman   | 5.0 ± 0.50        | 90                              | 10 | 75  | 8  | -   | 1.0 | -   | -  | -         |
| Rabi             | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-1         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman   | 5.0 ± 0.5         | 90                              | 15 | 75  | 8  | -   | 1.0 | -   | -  | -         |
| Rabi             | Sugarcane | 100 ± 10.0        | 180                             | 60 | 135 | 30 | 20  | 2.5 | -   | -  | -         |
| Kharif-1         | -         | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | -         | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Rabi             | Potato    | 30 ± 3.0          | 135                             | 30 | 135 | 10 | 5.0 | -   | 1.0 | -  | -         |
| Boro             |           | 6.0 ± 0.60        | 144                             | 14 | 59  | 8  | -   | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | T. Aman   | 5.0 ± 0.5         | 90                              | 10 | 49  | 8  | -   | 1.0 | -   | -  | -         |
| Rabi             | Mustard   | 1.8 ± 0.18        | 90                              | 27 | 60  | 10 | 2.5 | -   | 1.0 | -  | -         |
| Boro             |           | 6.0 ± 0.60        | 144                             | 14 | 90  | 8  | -   | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Rabi             | Wheat     | 4.5 ± 0.45        | 120                             | 24 | 90  | 10 | 4.0 | 1.5 | 1.0 | -  | -         |
| Kharif-1         | Aus       | 4.0 ± 0.4         | 72                              | 8  | 60  | 6  | -   | -   | -   | -  | -         |
| Kharif-2         | B. gram   | 1.5 ± 0.15        | 18                              | 10 | 18  | 6  | -   | -   | -   | -  | -         |
| Rabi             | Boro      | 7.5 ± 0.75        | 180                             | 24 | 114 | 12 | -   | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Kharif-2         | Fallow    | -                 | -                               | -  | -   | -  | -   | -   | -   | -  | -         |
| Rabi             | Potato    | 30 ± 3.0          | 135                             | 30 | 135 | 10 | 5.0 | -   | 1.0 | -  | -         |
| Kharif-1         | Maize     | 6.0 ± 0.6         | 135                             | 36 | 47  | 18 | -   | 1.5 | -   | -  | -         |
| Kharif-2         | T. Aman   | 4.0 ± 0.4         | 72                              | 8  | 39  | 6  | -   | 1.5 | -   | -  | -         |

### AEZ 27: North Eastern Barind Tract

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 36      | Dinajpur, Rangpur, Gaibandha, Jaipurhat and Bogra districts. |
| Medium highland | 56      |  |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro           | 7.5 ± 0.75        | 180                             | 16 | 76 | 12 | -  | 1.5 | -   | -  | -         |
| Khari-1          | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Khari-2          | T. Aman        | 5.0 ± 0.50        | 90                              | 7  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro           | 6.0 ± 0.6         | 144                             | 14 | 60 | 8  | -  | 1.5 | -   | -  | -         |
| Khari-1          | T. Aus         | 4.0 ± 0.40        | 72                              | 5  | 40 | 6  | -  | -   | -   | -  | -         |
| Khari-2          | T. Aman        | 4.0 ± 0.40        | 72                              | 5  | 40 | 6  | -  | 1.5 | -   | -  | -         |
| Rabi             | Potato         | 3.0 ± 3.0         | 135                             | 20 | 90 | 10 | 5  | -   | 1.0 | -  | -         |
| Khari-1          | T. Aus         | 4.0 ± 0.40        | 72                              | 5  | 26 | 6  | -  | 1.0 | -   | -  | -         |
| Khari-2          | T. Aman        | 4.0 ± 0.40        | 72                              | 5  | 40 | 6  | -  | 1.5 | -   | -  | -         |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 16 | 60 | 10 | 4  | 1.5 | 1.0 | -  | -         |
| Khari-1          | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Khari-2          | T. Aman        | 5.0 ± 0.50        | 90                              | 7  | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Potato         | 3.0 ± 3.0         | 135                             | 20 | 90 | 10 | 5  | -   | 1.0 | -  | -         |
| Khari-1          | Boro           | 6.0 ± 0.6         | 144                             | 9  | 39 | 8  | -  | 1.5 | -   | -  | -         |
| Khari-2          | T. Aman        | 5.0 ± 0.5         | 90                              | 7  | 33 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Maize          | 10 ± 1.0          | 225                             | 40 | 80 | 30 | 10 | 2.0 | 1.0 | -  | -         |
| Khari-1          | Fallow         | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Khari-2          | T. Aman        | 5.0 ± 0.50        | 90                              | 7  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Wheat          | 4.5 ± 0.45        | 120                             | 16 | 60 | 10 | 4  | 1.5 | 1   | -  | -         |
| Khari-1          | Jute (O)       | 4.5 ± 0.45        | 90                              | 7  | 50 | 8  | -  | -   | -   | -  | -         |
| Khari-2          | T. Aman        | 5.0 ± 0.50        | 90                              | 7  | 50 | 8  | -  | 1.0 | -   | -  | -         |
| Rabi             | Sugarcane      | 100 ± 10.0        | 180                             | 40 | 90 | 30 | 20 | 2.5 | -   | -  | -         |
| Khari-1          | -              | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Khari-2          | -              | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Cabbage        | 9.0 ± 9.0         | 180                             | 30 | 40 | 16 | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower    | 5.0 ± 5.0         | 120                             | 40 | 60 | 14 | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Country bean   | 2.0 ± 2.0         | 45                              | 20 | 30 | 6  | -  | 1.0 | -   | -  | 3.0       |
|                  | Tomato         | 7.5 ± 7.5         | 120                             | 30 | 40 | 14 | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Radish         | 6.0 ± 6.0         | 135                             | 30 | 80 | 12 | -  | 1.5 | -   | -  | 3.0       |
|                  | Potato         | 3.0 ± 3.0         | 135                             | 20 | 90 | 10 | 5  | 2.0 | 1.0 | -  | 3.0       |
| Khari-1          | Okra           | 1.6 ± 1.6         | 90                              | 20 | 39 | 5  | -  | -   | -   | -  | -         |
|                  | Indian spinach | 4.5 ± 4.5         | 105                             | 11 | 33 | 5  | -  | -   | -   | -  | -         |
|                  | Bottle gourd   | 3.0 ± 3.0         | 60                              | 20 | 29 | 6  | -  | -   | -   | -  | -         |
|                  | Brinjal        | 6.0 ± 6.0         | 135                             | 24 | 68 | 5  | -  | -   | -   | -  | -         |
|                  | Amaranthush    | 3.0 ± 3.0         | 90                              | 10 | 25 | 8  | -  | -   | -   | -  | -         |
| Khari-2          | Brinjal        | 6.0 ± 6.0         | 135                             | 24 | 46 | 5  | -  | 1.0 | -   | -  | 1.5       |
|                  | Bottle gourd   | 3.0 ± 3.0         | 60                              | 20 | 20 | 6  | -  | 1.0 | -   | -  | 1.5       |

| Cropping pattern |               | Yield goal (t/ha) | Fertilizer Nutrient Recommendation (kg/ha) |    |    |   |    |     |   |    | OF (t/ha) |
|------------------|---------------|-------------------|--|----|----|---|----|-----|---|----|-----------|
| Season           | Crop          |                   | N  | P  | K  | S | Mg | Zn  | B | Mo |           |
|                  | Bitter gourd  | 25 ± 2.5          | 75   | 20 | 20 | 5 | -  | 1.0 | - | -  | 1.5       |
|                  | Pointed gourd | 20 ± 2.0          | 90   | 12 | 16 | 5 | -  | 1.0 | - | -  | 1.5       |
|                  | Cucumberer    | 35 ± 3.5          | 75   | 16 | 26 | 6 | -  | 1.0 | - | -  | 1.5       |

### AEZ 28: Madhupur Tract

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 56      | Dhaka, Gazipur, Narshingdi, Narayanganj, Tangail, Dhaka and Kishoreganj districts. |
| Medium Highland | 18      |  |

| Cropping pattern |             | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     |     |    | OF (t/ha) |
|------------------|-------------|-------------------|---------------------------------|----|----|----|----|-----|-----|----|-----------|
| Season           | Crop        |                   | N                               | P  | K  | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro        | 7.5 ± 0.75        | 180                             | 16 | 76 | 6  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow      | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow      | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Boro        | 7.5 ± 0.75        | 180                             | 16 | 76 | 6  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow      | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman     | 5.0 ± 0.50        | 90                              | 7  | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard     | 1.8 ± 0.18        | 90                              | 18 | 40 | 5  | -  | -   | 1.0 | -  | 3.0       |
| Kharif-1         | Boro        | 6.0 ± 0.60        | 144                             | 9  | 60 | 4  | -  | 1.5 | -   | -  | -         |
| Kharif-2         | T. Aman     | 5.0 ± 0.50        | 90                              | 7  | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro        | 6.0 ± 0.60        | 144                             | 14 | 60 | 4  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus      | 4.0 ± 0.40        | 72                              | 5  | 40 | 3  | -  | 0   | -   | -  | -         |
| Kharif-2         | T. Aman     | 4.0 ± 0.40        | 72                              | 5  | 40 | 3  | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow      | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow      | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman     | 5.0 ± 0.50        | 90                              | 10 | 50 | 4  | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro        | 7.5 ± 0.75        | 180                             | 16 | 76 | 6  | -  | 1.5 | -   | -  | -         |
| Kharif-1         | B. Aman     | 2.5 ± 0.25        | 36                              | 6  | 20 | 4  | -  | -   | -   | -  | -         |
| Kharif-2         |             | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Cabbage     | 90 ± 9.0          | 180                             | 30 | 40 | 8  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower | 50 ± 5.0          | 120                             | 40 | 60 | 7  | -  | 1.5 | 1.0 | -  | 3.0       |
| Kharif-1         | Okra        | 16 ± 1.6          | 90                              | 20 | 26 | 5  | -  | -   | -   | -  | 3.0       |
|                  | brinjal     | 60 ± 6.0          | 135                             | 24 | 45 | 5  | -  | -   | -   | -  | 3.0       |
| Kharif-2         | Fallow      | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Sugarcane   | 100 ± 10          | 180                             | 40 | 90 | 15 | 10 | 2.5 | -   | -  | -         |
| Kharif-1         |             | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Kharif-2         |             | -                 | -                               | -  | -  | -  | -  | -   | -   | -  | -         |
| Rabi             | Cabbage     | 90 ± 9.0          | 180                             | 45 | 40 | 8  | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower | 50 ± 5.0          | 120                             | 60 | 60 | 7  | -  | 1.5 | 1.0 | -  | 3.0       |

| Cropping pattern |                | Yield goal<br>(t/ha) | Nutrient Recommendation<br>(kg/ha) |     |    |   |    |     |     |    | OF<br>(t/ha) |
|------------------|----------------|----------------------|------------------------------------|-----|----|---|----|-----|-----|----|--------------|
| Season           | Crop           |                      | N                                  | P   | K  | S | Mg | Zn  | B   | Mo |              |
|                  | Tomato         | 75 ± 7.5             | 120                                | 30  | 40 | 5 | -  | 1.0 | 1.0 | -  | 3.0          |
|                  | Radish         | 60 ± 6.0             | 135                                | 30  | 80 | 6 | -  | 1.5 | -   | -  | 3.0          |
|                  | Potato         | 30 ± 3.0             | 135                                | 20  | 90 | 5 | -  | 2.0 | 1.0 | -  | 3.0          |
| Kharif-1         | Okra           | 16 ± 1.6             | 90                                 | 20  | 26 | 5 | -  | -   | -   | -  | -            |
|                  | Indian spinach | 45 ± 4.5             | 105                                | 11  | 22 | 5 | -  | -   | -   | -  | -            |
|                  | Bottle gourd   | 30 ± 3.0             | 60                                 | 20  | 20 | 6 | -  | -   | -   | -  | -            |
|                  | Brinjal        | 60 ± 6.0             | 135                                | 24  | 46 | 5 | -  | -   | -   | -  | -            |
|                  | Amaranthus     | 30 ± 3.0             | 90                                 | 10  | 17 | 4 | -  | -   | -   | -  | -            |
| Kharif-2         | T. Aman        | 5.0 ± 0.5            | 90                                 | 7   | 33 | - | -  | -   | -   | -  | -            |
| Rabi             | Cabbage        | 90 ± 9.0             | 180                                | 45  | 40 | 8 | -  | 1.5 | 1.0 | -  | 3.0          |
|                  | Cauliflower    | 50 ± 5.0             | 120                                | 60  | 60 | 7 | -  | 1.5 | 1.0 | -  | 3.0          |
|                  | Country bean   | 20 ± 2.0             | 45                                 | 20  | 30 | 6 | -  | 1.0 | 1.0 | -  | 3.0          |
|                  | Tomato         | 75 ± 7.5             | 120                                | 30  | 40 | 5 | -  | 1.0 | 1.0 | -  | 3.0          |
|                  | Radish         | 60 ± 6.0             | 135                                | 30  | 80 | 6 | -  | 1.5 | 1.0 | -  | 3.0          |
|                  | Potato         | 30 ± 3.0             | 135                                | 20  | 90 | 5 | -  | 2.0 | 1.0 | -  | 3.0          |
| Kharif-1         | Okra           | 16 ± 1.6             | 90                                 | 20  | 26 | 5 | -  | -   | -   | -  | -            |
|                  | Indian spinach | 45 ± 4.5             | 105                                | 11  | 22 | 5 | -  | -   | -   | -  | -            |
|                  | Bottle gourd   | 30 ± 3.0             | 60                                 | 20  | 20 | 6 | -  | -   | -   | -  | -            |
|                  | Brinjal        | 60 ± 6.0             | 135                                | 24  | 46 | 5 | -  | -   | -   | -  | -            |
|                  | Amaranthus     | 30 ± 3.0             | 90                                 | 9.9 | 17 | 4 | -  | -   | -   | -  | -            |
| Kharif-2         | Fallow         | -                    | -                                  | -   | -  | - | -  | -   | -   | -  | -            |

## AEZ 29: Northern And Eastern Hills

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT  |
|-----------------|---------|--|
| Highland        | 92      | Mainly in Khagrachhari, Chittagong Hill Tracts, Bandarban, Chittagong, Cox's Bazar, Habiganj and Moulvibazar districts. Small areas occur along the northern border of Sherpur, Mymensingh, Sunamganj and Sylhet districts, in central and south-eastern Sylhet and in the east of B. baria, Comilla and Feni districts. |

| Cropping pattern |              | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |     |    |     |    |     |     |    | OF (t/ha) |
|------------------|--------------|-------------------|---------------------------------|-----|----|-----|----|-----|-----|----|-----------|
| Season           | Crop         |                   | N                               | P   | K  | S   | Mg | Zn  | B   | Mo |           |
| Rabi             | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.50        | 90                              | 10  | 50 | 4   | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 16  | 76 | 6   | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.50        | 90                              | 6.5 | 50 | 4   | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro         | 6.0 ± 0.60        | 144                             | 14  | 60 | 4   | -  | 1.5 | -   | -  | -         |
| Kharif-1         | T. Aus       | 4.0 ± 0.40        | 72                              | 5   | 40 | 3   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 4.0 ± 0.40        | 72                              | 5   | 40 | 3   | -  | 1.0 | -   | -  | -         |
| Rabi             | Cowpea       | 1.4 ± 0.14        | 15                              | 10  | 12 | 1.5 | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.50        | 90                              | 7   | 50 | 4   | -  | 1.0 | -   | -  | -         |
| Rabi             | Sweet gourd  | 40 ± 4.0          | 75                              | 24  | 40 | 7   | -  | 1.0 | 1.0 | -  | -         |
|                  | Bottle gourd | 25 ± 2.5          | 75                              | 20  | 30 | 5   | -  | 1.0 | -   | -  | -         |
|                  | Cucumber     | 35 ± 3.5          | 75                              | 16  | 40 | 6   | -  | 1.0 | 1.0 | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.50        | 90                              | 7   | 33 | 2   | -  | 1.0 | -   | -  | -         |
| Rabi             | Sugarcan     | 100 ± 0.40        | 180                             | 40  | 90 | 15  | 10 | 3.0 | -   | -  | -         |
| Kharif-1         | -            | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | -            | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-1         | T. Aus       | 4.0 ± 0.40        | 72                              | 8   | 40 | 3   | -  | 1.0 | -   | -  | -         |
| Kharif-2         | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Chilli       | 2.5 ± 0.25        | 96                              | 30  | 50 | 5   | -  | -   | 1.0 | -  | -         |
| Kharif-1         | T. Aus       | 4.0 ± 0.4         | 72                              | 5   | 40 | 3   | -  | 1.0 | -   | -  | -         |
| Kharif-2         | T. Aman      | 4.0 ± 0.4         | 72                              | 5   | 40 | 3   | -  | 1.0 | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 16  | 76 | 6   | -  | -   | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow       | -                 | -                               | -   | -  | -   | -  | -   | -   | -  | -         |
| Rabi             | Sweet gourd  | 40 ± 4.0          | 75                              | 24  | 40 | 7   | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Country bean | 20 ± 2.0          | 45                              | 20  | 30 | 3   | -  | 1.0 | -   | -  | 3.0       |
|                  | Bitter gourd | 25 ± 2.5          | 75                              | 20  | 30 | 5   | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Cucumber     | 35 ± 3.5          | 75                              | 16  | 40 | 6   | -  | 1.0 | 1.0 | -  | 3.0       |

| Cropping pattern |                | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |     |     |    | OF (t/ha) |
|------------------|----------------|-------------------|---------------------------------|----|----|---|----|-----|-----|----|-----------|
| Season           | Crop           |                   | N                               | P  | K  | S | Mg | Zn  | B   | Mo |           |
| Kharif-1         | Indian spinach | 45 ± 4.5          | 105                             | 11 | 22 | 5 | -  | -   | -   | -  | -         |
|                  | Bitter gourd   | 25 ± 2.5          | 75                              | 20 | 20 | 5 | -  | -   | -   | -  | -         |
|                  | Pointed gourd  | 20 ± 2.0          | 90                              | 12 | 16 | 5 | -  | -   | -   | -  | -         |
|                  | Cucumber       | 35 ± 3.5          | 75                              | 16 | 26 | 6 | -  | -   | -   | -  | -         |
| Kharif-2         | Brinjal        | 60 ± 6.0          | 135                             | 24 | 46 | 5 | -  | 1.0 | 1.0 | -  | 1.5       |

### AEZ 30: Akhaura Terrace

| MAJOR LAND TYPE | PERCENT | LOCATION AND EXTENT                            |
|-----------------|---------|--|
| Highland        | 55      | B. Baria and minor area in Habiganj districts. |
| Medium highland | 11      |  |
| Medium lowland  | 10      |  |
| Lowland         | 15      |  |

| Cropping pattern |              | Yield goal (t/ha) | Nutrient Recommendation (kg/ha) |    |     |    |    |     |     |    | OF (t/ha) |
|------------------|--------------|-------------------|---------------------------------|----|-----|----|----|-----|-----|----|-----------|
| Season           | Crop         |                   | N                               | P  | K   | S  | Mg | Zn  | B   | Mo |           |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 114 | 18 | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.50        | 90                              | 8  | 75  | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | Mustard      | 1.8 ± 0.18        | 90                              | 32 | 50  | 13 | 4  | -   | 1.0 | -  | 3.0       |
|                  | Boro         | 6.0 ± 0.60        | 144                             | 12 | 90  | 6  | -  | 2.0 | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Kharif-2         | T. Aman      | 5.0 ± 0.50        | 90                              | 8  | 75  | 6  | -  | 1.0 | -   | -  | -         |
| Rabi             | Fallow       | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Kharif-1         | B. Aman      | 2.5 ± 0.25        | 36                              | 9  | 30  | 6  | -  | 1.0 | -   | -  | -         |
| Kharif-2         |              | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Rabi             | Sugarcane    | 100 ± 10          | 180                             | 60 | 135 | 45 | 10 | 3.0 | -   | -  | -         |
| Kharif-1         |              | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Kharif-2         |              | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Rabi             | Boro         | 7.5 ± 0.75        | 180                             | 24 | 114 | 18 | -  | 1.5 | -   | -  | -         |
| Kharif-1         | Fallow       | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Kharif-2         | Fallow       | -                 | -                               | -  | -   | -  | -  | -   | -   | -  | -         |
| Rabi             | Cabbage      | 90 ± 9.0          | 180                             | 45 | 50  | 20 | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Cauliflower  | 50 ± 5.0          | 120                             | 60 | 75  | 18 | -  | 1.5 | 1.0 | -  | 3.0       |
|                  | Country bean | 20 ± 2.0          | 45                              | 30 | 38  | 8  | -  | 1.0 | -   | -  | 3.0       |
|                  | Tomato       | 75 ± 7.5          | 120                             | 45 | 50  | 18 | -  | 1.0 | 1.0 | -  | 3.0       |
|                  | Radish       | 60 ± 6.0          | 135                             | 45 | 100 | 15 | -  | 1.5 | -   | -  | 3.0       |
|                  | Potato       | 30 ± 3.0          | 135                             | 30 | 113 | 13 | 8  | 2.0 | 1.0 | -  | 3.0       |

| Cropping pattern |                | Yield goal<br>(t/ha) | Nutrient Recommendation<br>(kg/ha) |     |    |   |    |     |   |    | OF<br>(t/ha) |
|------------------|----------------|----------------------|------------------------------------|-----|----|---|----|-----|---|----|--------------|
| Season           | Crop           |                      | N                                  | P   | K  | S | Mg | Zn  | B | Mo |              |
| Kharif-1         | Okra           | 16 ± 1.6             | 90                                 | 205 | 33 | 7 | -  | -   | - | -  | -            |
|                  | Indian spinach | 45 ± 4.5             | 105                                | 17  | 28 | 7 | -  | -   | - | -  | -            |
|                  | Bottle gourd   | 30 ± 3.0             | 60                                 | 13  | 20 | 6 | -  | -   | - | -  | -            |
|                  | Brinjal        | 60 ± 6.0             | 135                                | 23  | 57 | 7 | -  | -   | - | -  | -            |
|                  | Cucumber       | 35 ± 3.5             | 75                                 | 16  | 33 | 8 | -  | -   | - | -  | -            |
|                  | Amaranthus     | 30 ± 3.0             | 90                                 | 16  | 21 | 5 | -  | -   | - | -  | -            |
| Kharif-2         | Brinjal        | 60 ± 6.0             | 135                                | 23  | 57 | 7 | -  | 1.5 | - | -  | 2.0          |

### 11.3 Fertilizer Recommendation For Multiple Cropping Systems

#### POINTED GOURD + RED AMARANTH + GINGER INTERCROPPING

| Land and soil characteristics           | Cropping pattern     |                | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |     |     |    |    |    | OF (t/ha) |   |
|---|----------------------|----------------|-------------------|---------------------------------|-----|-----|----|----|----|-----------|---|
|   | Season               | Crops          |                   | N                               | P   | K   | S  | Mg | Zn |           | B |
| High & medium highland<br>AEZ: 8, 9, 11 | <i>Rabi + Kharif</i> | Pointed gourd  | 35                | 250                             | 160 | 200 | 40 |    | 2  | 1         | 5 |
|   |                      | + Red amaranth | 3                 | 60                              | 20  | 30  | 5  |    | -  | -         | - |
|   |                      | + Ginger       | 20                | 150                             | 60  | 130 | 20 |    | -  | -         | - |

Sowing time : Pointed gourd: Mid October to mid November

Red amaranth : Mid October to mid November

Ginger : Mid March to end of March

Spacing : Pointed gourd: Pit- pit: 1m × 1m

Red amaranth: Broadcast

Ginger: 30 cm × 25 cm spacing (2 rows of ginger between 2 rows of pointed gourd)

Fertilizer application method :

Pointed gourd: 1/4<sup>th</sup> N and all P, K, S and cowdung should be applied in pit at 5-7 DAT. Rest N should be applied in 3 equal splits at 40, 80 and 120 DAP.

Red amaranth: All N, P, K, S should be applied as basal during sowing of seed.

Ginger : Half N, K and all P, S should be applied as basal during planting. Rest N and K should be applied at 60-80 DAP.

#### HYBRID MAIZE + INDIAN SPINACH INTERCROPPING

| Land and soil characteristics               | Cropping pattern |                  | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |     |     |    |    |    | OF (t/ha) |   |
|---|------------------|------------------|-------------------|---------------------------------|-----|-----|----|----|----|-----------|---|
|   | Season           | Crops            |                   | N                               | P   | K   | S  | Mg | Zn |           | B |
| High & medium highland<br>AEZ: 8, 9, 11, 25 | <i>Kharif</i>    | Hybrid maize     | 6                 | 260                             | 180 | 115 | 70 |    | 3  | 1         | 3 |
|   |                  | + Indian spinach | 18                | 25                              | -   | -   | -  |    | -  | -         | - |

Sowing time: Last week of February to Last week of March

Spacing : Maize paired row ( 37.5cm/150cm/37.5cm × 20cm) + 3 line Indian spinach.  
Maize single row (75cm × 20cm + 1line Indian spinach.

Fertilizer application method:

- One third of N and all of cow dung P, K, S, Zn and B should be applied as basal during final land preparation.

- b) Rest 2/3rd N should be applied in two equal splits as side dressing between maize rows at 20-25 DAS and 40-45 DAS. At the same time N should also be applied in two equal splits in Indian spinach (20-25 DAS and 40-45 DAS) as side dressing.

#### SWEETGOURD + CABBAGEINTERCROPPING

| Land and soil characteristics            | Cropping pattern |              | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |     |    |    |    | OF (t/ha) |   |
|--|------------------|--------------|-------------------|---------------------------------|----|-----|----|----|----|-----------|---|
|  | Season           | Crops        |                   | N                               | P  | K   | S  | Mg | Zn |           | B |
| High & medium highland<br>AEZ: 9, 11, 18 | Rabi             | Sweet gourd  | 30                | 80                              | 35 | 100 | 25 |    | 2  | 1         | 5 |
|  |                  | +<br>Cabbage | 43                | 90                              | 50 | 90  | 18 |    | -  | -         | - |

Sowing time : November (Sweet gourd transplant 15 DAT of cabbage)

Spacing : Sweet gourd: 2m × 2m  
Cabbage: 80cm × 50cm  
(3 row cabbage in between 2 rows of sweet gourd)

Fertilizer application method:

- In sweet gourd, all of cowdung, P, K, S, Zn should be applied in pit at 5-7 DBT (days before transplanting) and mixed with the soil. ) N should be applied around the plant as the side dressing at 30 and 50 DAT.
- In cabbage, all of cowdung/manure, P, S and B should be applied as basal during final land preparation.
- N and K should be applied in two equal splits at 15, 30, 45 DAT as ring method.

#### BRINJAL + CORIANDER INTERCROPPING

| Land and soil characteristics           | Cropping pattern |                | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |     |    |    |    | OF (t/ha) |   |
|---|------------------|----------------|-------------------|---------------------------------|----|-----|----|----|----|-----------|---|
|   | Season           | Crops          |                   | N                               | P  | K   | S  | Mg | Zn |           | B |
| High & medium highland<br>AEZ: 8, 9, 11 | Rabi             | Brinjal        | 15                | 190                             | 40 | 140 | 20 | -  | 2  | 1         | 5 |
|   |                  | +<br>Coriander | 0.60              |                                 |    |     |    |    |    |           |   |

Sowing time : Mid October to November

Spacing : Brinjal : 70cm × 60cm  
Coriander: 10cm × continuous sowing  
(Two rows coriander between two rows of brinjal )

Fertilizer application method:

- Two third of N, K and all of organic manure, P, S should be applied as basal during final land preparation.
- Rest N and K should be applied in three equal splits at 20, 40 and 60 DAT as side dressing.

### HYBRID MAIZE + SOYBEAN INTERCROPPING

| Land and soil characteristics                      | Cropping pattern |   | Yield Goal (t/ha)       | Nutrient Recommendation (kg/ha) |    |     |    |     |    | OF (t/ha) |   |
|--|------------------|---|-------------------------|---------------------------------|----|-----|----|-----|----|-----------|---|
|  | Season           | Crops                                     |                         | N                               | P  | K   | S  | Mg* | Zn |           | B |
| High and medium highland<br>AEZ: 3a, 3b, 3c, 11, 1 | Rabi             | Hybrid Maize (100%)<br>+<br>Soybean (33%) | 7.5-8.0<br>+<br>1.0-1.2 | 263                             | 70 | 160 | 45 | 10  | 7  | 2.5       | - |

\*Mg for AEZ 3 only

Sowing time : December 1st week to 2nd week of December

Sowing method : Four rows of Soybean (30 cm x 10cm) in between maize paired rows (30 cm - 120 cm/ 25 cm) or 2 rows of Soybean in between maize normal row (75 cm x 25 cm)

Fertilizer : 1/3rd N top dressed at 35 & rest 1/3 at 65 DAS in maize rows only + 1/3rd N & other fertilizer as basal

### HYBRID MAIZE + CARROT INTERCROPPING

| Land and soil characteristics              | Cropping pattern |  | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |     |    |     |    | OF (t/ha) |     |
|--|------------------|--|-------------------|---------------------------------|----|-----|----|-----|----|-----------|-----|
|  | Season           | Crops                                    |                   | N                               | P  | K   | S  | Mg* | Zn |           | B   |
| High and medium highland<br>AEZ: 3, 11, 23 | Rabi             | Hybrid maize (100%)<br>+<br>Carrot (33%) | 8.0<br>+<br>5.0   | 295                             | 73 | 170 | 48 | 10  | 6  | 2         | 3-5 |

\*Mg for AEZ 3 only

Sowing time : Mid November to 1st week of December

Sowing method : 4 rows of carrot 25 cm apart in between maize paired rows (30 cm - 120 cm/ 25 cm)

Fertilizer : 2/3rd N as top dressed at 30 and 65 DAS + 1/3rd N & other fertilizer as basal

**Note** : The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

### ONION + HYBRID MAIZE INTERCROPPING

| Land and soil characteristics              | Cropping pattern |   | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |    | OF (t/ha) |   |
|--|------------------|---|-------------------|---------------------------------|----|----|----|----|----|-----------|---|
|  | Season           | Crops                                   |                   | N                               | P  | K  | S  | Mg | Zn |           | B |
| High and medium highland<br>AEZ: 4, 11, 12 | Rabi             | Onion (100%)<br>+<br>Hybrid Maize (10%) | 12.0<br>+<br>1.5  | 128                             | 51 | 68 | 23 | -  | 2  | 1         | - |

Sowing time : Mid December  
 Sowing method : One row of maize (140 cm) in between onion rows (30 cm apart)  
 Fertilizer : All basal except 50% N top dressed 3 & 5 weeks after transplantation

### HYBRID MAIZE + SPINACH/ LALSHAK/GIMAKALMI INTERCROPPING

| Land and soil characteristics     | Cropping pattern |  | Yield Goal (t/ha)                    | Nutrient Recommendation (kg/ha) |    |    |    |                 |    | OF (t/ha) |     |
|-----------------------------------|------------------|--|--------------------------------------|---------------------------------|----|----|----|-----------------|----|-----------|-----|
|                                   | Season           | Crops  |                                      | N                               | P  | K  | S  | Mg <sup>a</sup> | Zn |           | B   |
| Medium highland<br>AEZ: 3, 8, 11, | Rabi             | Hybrid Maize (100%) +<br>Spinach /<br>Lalshak /<br>Gimakalmi | 8.0<br>+<br>4-5 + 3-<br>4 +<br>10-11 | 260                             | 65 | 90 | 30 | -               | 4  | 1         | 3-5 |

\*Mg for AEZ 3 only

Sowing time : Mid November to Last week of November  
 Sowing method : Maize 75cm x 25cm, two rows of lalshak/spinach/gimakalmi at a spacing of 25 cm  
 Fertilizer : 1/3rd N and all fertilizers as basal. Rest urea at 30 and 60 DAS as band placement in maize rows  
 Note : The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

### CHICKPEA + LINSEED MIXEDCROPPING

| Land and soil characteristics  | Cropping pattern |                                      | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |     | OF (t/ha) |   |
|--------------------------------|------------------|--------------------------------------|-------------------|---------------------------------|----|----|---|----|-----|-----------|---|
|                                | Season           | Crops                                |                   | N                               | P  | K  | S | Mg | Zn  |           | B |
| Medium highland<br>AEZ: 11, 26 | Rabi (Rainfed)   | Chickpea (67%)<br>+<br>Linseed (33%) | 1.0<br>+<br>0.30  | 33                              | 17 | 24 | 8 | -  | 1.0 | 1.0       | - |

Sowing time : Mid October to Mid November  
 Sowing method : One row of linseed in between two rows of chickpea (30cm x 10cm)  
 Fertilizer : All fertilizer as basal

### CHICKPEA + MUSTARD MIXED CROPPING

| Land and soil characteristics  | Cropping pattern |                                      | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |    | OF (t/ha) |   |
|--------------------------------|------------------|--------------------------------------|-------------------|---------------------------------|----|----|---|----|----|-----------|---|
|                                | Season           | Crops                                |                   | N                               | P  | K  | S | Mg | Zn |           | B |
| Medium highland<br>AEZ: 11, 26 | Rabi (Rainfed)   | Chickpea (50%)<br>+<br>Mustard (50%) | 0.75<br>+<br>0.8  | 59                              | 23 | 42 | 9 | 1  | 1  | 1         | - |

Sowing time : Mid October to last week of November

Sowing method : Two rows of chickpea alternate with two rows of mustard at 30cm apart

Fertilizer : All fertilizer as basal

### WHEAT + CHICKPEA MIXED CROPPING

| Land and soil characteristics      | Cropping pattern |                                    | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |   |    |    | OF (t/ha) |   |
|------------------------------------|------------------|------------------------------------|-------------------|---------------------------------|----|----|---|----|----|-----------|---|
|                                    | Season           | Crops                              |                   | N                               | P  | K  | S | Mg | Zn |           | B |
| Medium highland<br>AEZ: 11, 16, 26 | Rabi (Rainfed)   | Wheat (67%)<br>+<br>Chickpea (33%) | 3.00<br>+<br>0.70 | 90                              | 22 | 68 | 9 | 3  | 1  | 1         | - |

Sowing time : Mid November to last week of November

Sowing method : Two rows of wheat (20cm apart) alternate with one row of chickpea

Fertilizer : All fertilizer as basal

### JUTE (SEED) + RADISH INTERCROPPING

| Land and soil characteristics    | Cropping pattern |                            | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |    | OF (t/ha) |     |
|----------------------------------|------------------|----------------------------|-------------------|---------------------------------|----|----|----|----|----|-----------|-----|
|                                  | Season           | Crops                      |                   | N                               | P  | K  | S  | Mg | Zn |           | B   |
| Rainfed highland<br>AEZ: 11a, 19 | Kharff-II        | Jute (seed)<br>+<br>Radish | 1.0<br>+<br>16.0  | 155                             | 40 | 50 | 15 | 0  | 5  | 2         | 155 |

Sowing time : Mid September

Spacing (jute) : 30cm x 10cm

Fertilizer : 45 kg N at 20 DAE, 45 kg N at 35 DAE

### GROUNDNUT + SESAME INTERCROPPING

| Land and soil characteristics             | Cropping pattern |                          | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |     | OF (t/ha) |   |
|---|------------------|--------------------------|-------------------|---------------------------------|----|----|----|----|-----|-----------|---|
|   | Season           | Crops                    |                   | N                               | P  | K  | S  | Mg | Zn  |           | B |
| High & Medium highland<br>AEZ: 12, 18, 19 | Rabi             | Groundnut<br>+<br>Sesame | 1.50<br>+<br>0.50 | 60                              | 35 | 45 | 25 | -  | 1.0 | 1.0       | - |

Sowing time : Middle of February to end of March (Kharif-I), Middle of August to September (Kharif-II)

Sowing method : Three rows of groundnut (25cm x 10cm) in between paired rows of sesame (30cm in continuous)

Fertilizer : All fertilizer as basal except 9 kg/ha of N as top dressed in sesame row 25 DAS.

### POTATO + VEGETABLES (LALSHAK/SPINACH) INTERCROPPING

| Land and soil characteristics                      | Cropping pattern |  | Yield Goal (t/ha)         | Nutrient Recommendation (kg/ha) |    |    |   |     |    | OF (t/ha) |     |
|--|------------------|--|---------------------------|---------------------------------|----|----|---|-----|----|-----------|-----|
|  | Season           | Crops                                      |                           | N                               | P  | K  | S | Mg* | Zn |           | B   |
| Medium highland & Medium land<br>AEZ: 1, 3, 15, 25 | Rabi             | Potato (100%)<br>+<br>Vegetables (Lalshak) | 25.0-30.0<br>+<br>2.0-3.0 | 180                             | 25 | 95 | 5 | 0   | 2  | 1         | 2-6 |

\*Mg for AEZ 3 only

Sowing time : 1st week of November - 3rd week of November

Sowing method : Potato 60cm x 30cm, two rows of lalshak/spinach (30cm apart) in between paired cotton rows

Fertilizer : 1/3rd N and other fertilizers as basal, 1/3rd N 25 at DAS & rest N at 45-55 DAS in potato rows

Note : The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

### POTATO + LALSHAK + SWEETGOURD INTERCROPPING

| Land and soil characteristics              | Cropping pattern |  | Yield Goal (t/ha)             | Nutrient Recommendation (kg/ha) |    |     |   |     |    | OF (t/ha) |     |
|--|------------------|--|-------------------------------|---------------------------------|----|-----|---|-----|----|-----------|-----|
|  | Season           | Crops                                      |                               | N                               | P  | K   | S | Mg* | Zn |           | B   |
| Rainfed highland<br>AEZ: 3, 8d, 15, 25, 28 | Rabi             | Potato<br>+<br>Lalshak<br>+<br>Sweet gourd | 25.0<br>+<br>2.0<br>+<br>2.50 | 190                             | 30 | 100 | 5 | -   | 2  | 1         | 2-6 |

\*Mg for AEZ 3 only

- Sowing time : Mid December  
 Spacing : Potato 60cm x 25cm  
 Sowing method : Red amaranth: Broadcast, Sweet gourd in pit  
 Fertilizer : 2/3rd N & other fertilizer as basal and rest 1/3rd N at 30 DAP in potato rows  
 Note : The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

#### BANANA + DHAINCHA INTERCROPPING

| Land and soil characteristics           | Cropping pattern |                     | Yield Goal (t/ha) | Nutrient Recommendation* |    |     |    |    |     |      | OF (t/ha) |
|---|------------------|---------------------|-------------------|--------------------------|----|-----|----|----|-----|------|-----------|
|   | Season           | Crops               |                   | N                        | P  | K   | S  | Mg | Zn  | B    |           |
| Medium highland<br>AEZ: 3, 7, 11, 9, 28 | Rabi             | Banana              | 20-25             | 230                      | 40 | 300 | 36 | -  | 1.2 | 0.34 | 12        |
|   |                  | +<br>Indian spinach | 20-25<br>(Green)  | 105                      | 15 | 30  | 5  | -  | -   | -    |           |

\*Note: Fertilizer for banana should be considered as g/plant; and for Indian spinach as kg/ha

- Spacing : Banana pit size: 0.6m x 0.6m x 0.4m  
 Fertilizer : In Banana: Two weeks before planting/pit: cowdung 5 kg, TSP 25 g, MoP 25 g, Three month after planting/pit: Urea 25 g, MoP 25 g as topdress  
 Fertilizer for Indian spinach: Half of N all of other fertilizers should be applied as basal before final land preparation. The rest urea should be topdressed at 25 DAP

#### SUGARCANE + ONION INTERCROPPING

| Land and soil characteristics               | Cropping pattern |                     | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |    |   | OF (t/ha) |
|---|------------------|---------------------|-------------------|---------------------------------|----|----|----|----|----|---|-----------|
|   | Season           | Crops               |                   | N                               | P  | K  | S  | Mg | Zn | B |           |
| High & medium highland<br>AEZ: 1a, 11a, 25a | Rabi             | T. Sugarcane (100%) | 100               | 180                             | 60 | 90 | 30 | -  | -  | - | -         |
|   |                  | +<br>Onion (50%)    | 10.0              | 50                              | 20 | 30 | 10 | -  | 2  | 1 | -         |

- Spacing : Sugarcane: 100cm x 45cm, Onion: 30cm x 10cm  
 Sowing method : Five rows of onion (bulb) planted in between two rows of sugarcane  
 Fertilizer : For Sugarcane: 50 kg N 20 DAT, 65 N 45 K kg at 4-6 tiller stage, 65 N 45 K at earthing up and other fertilizers should be applied as basal before final land preparation.  
 For Onion, all fertilizer as basal.

### SUGARCANE (PAIRED ROW) + POTATO + LALSHAK INTERCROPPING

| Land and soil characteristics            | Cropping pattern |                        | Yield Goal (t/ha) | Nutrient Recommendation (kg/ha) |    |    |    |    |    |   | OF (t/ha) |
|--|------------------|------------------------|-------------------|---------------------------------|----|----|----|----|----|---|-----------|
|  | Season           | Crops                  |                   | N                               | P  | K  | S  | Mg | Zn | B |           |
| High & medium highland AEZ: 1a, 11a, 25a | Rabi + Kharif    | Sugarcane (paired row) | 100               | 180                             | 40 | 90 | 30 | 20 | -  | - | -         |
|  |                  | + Potato               | 10                | 70                              | 10 | 45 | 8  | 3  | 1  | 1 | -         |
|  |                  | + Lalshak              | 6                 | 40                              | 7  | 15 | 2  | -  | -  | - | -         |

Sowing time : Sugarcane: Mid October to Mid November Potato: Mid October to Mid November  
Red amaranth: February to March

Spacing : Sugarcane: 60 cm-140 cm x 45 cm.

Fertilizer : For Sugarcane: 50 kg N 20 DAT, 65 N 45 K kg at 4-6 tiller stage, 65 N 45 K at earthing up and other fertilizers should be applied as basal in sugarcane rows.

For Potato: Half of N and K and all of other fertilizers should be applied as basal and N and K during earthing up at 30-35 DAP.

Red amaranth : All as basal

## Appendices

### Appendix-1

#### Trend of fertilizer use in Bangladesh

| Year    | Urea      | TSP     | SSP     | DAP     | MOP      | Gypsum  | Zinc   | AS     | Others  | Total     |
|---------|-----------|---------|---------|---------|----------|---------|--------|--------|---------|-----------|
| 1980-81 | 559,766   | 215,061 | -       | 41,736  | 45,204   | -       | 183    | -      | 13,229  | 875,179   |
| 1981-82 | 518,775   | 208,478 | -       | 48,518  | 44,836   | -       | 810    | -      | 7,906   | 829,323   |
| 1982-83 | 629,058   | 205,999 | -       | 73,161  | 50,420   | 393     | 498    | -      | 8,889   | 968,418   |
| 1983-84 | 708,070   | 260,730 | -       | 93,831  | 63,222   | 1,267   | 745    | -      | 1,196   | 1,129,061 |
| 1984-85 | 831,801   | 345,670 | -       | 403     | 69,271   | 1,379   | 1,217  | -      | 10,480  | 1,260,221 |
| 1985-86 | 794,496   | 297,418 | -       | 53      | 59,867   | 3,269   | 706    | -      | 178     | 1,155,987 |
| 1986-87 | 915,019   | 335,659 | -       | -       | 65,850   | 2,824   | 1,353  | -      | 238     | 1,320,943 |
| 1987-88 | 1,029,077 | 390,159 | -       | -       | 86,139   | 1,390   | 1,639  | 6,796  | -       | 1,515,191 |
| 1988-89 | 1,135,062 | 415,993 | -       | -       | 94,172   | 60,745  | 2,800  | 93     | 173     | 1,709,038 |
| 1989-90 | 1,369,237 | 479,767 | 718     | -       | 1 18,663 | 67,808  | 5,180  | 1,785  | 18      | 2,043,176 |
| 1990-91 | 1,323,397 | 514,761 | 12,120  | -       | 149,761  | 101,782 | 2,743  | 2,763  | 211     | 2,107,538 |
| 1991-92 | 1,533,481 | 456,672 | 36,201  | -       | 137,135  | 115,334 | 3,805  | 4,797  | -       | 2,287,425 |
| 1992-93 | 1,547,407 | 407,002 | 119,828 | 2,010   | 126,083  | 108,140 | 722    | 4,992  | -       | 2,316,184 |
| 1993-94 | 1,578,955 | 234,185 | 170,608 | 28,675  | 103,875  | 86,051  | 5,200  | 10,036 | 97      | 2,217,682 |
| 1994-95 | 1,748,459 | 122,947 | 533,485 | 1,837   | 154,240  | 77,161  | -      | 2,491  | -       | 2,640,620 |
| 1995-96 | 2,045,535 | 111,095 | 596,881 | -       | 155,881  | 103,577 | 1,029  | 8,692  | -       | 3,022,690 |
| 1996-97 | 2,119,883 | 72,629  | 525,285 | -       | 219,302  | 86,611  | 1,161  | 11,692 | -       | 3,036,563 |
| 1997-98 | 1,872,725 | 62,382  | 473,295 | 6,778   | 193,496  | 113,430 | 661    | 9,716  | -       | 2,732,483 |
| 1998-99 | 1,902,024 | 170,247 | 362,370 | 38,633  | 210,784  | 128,215 | 269    | 12,418 | -       | 2,824,924 |
| 1999-00 | 2,151,233 | 259,263 | 237,201 | 109,171 | 239,464  | 189,398 | 1,170  | 26,003 | -       | 3,212,903 |
| 2000-01 | 2,121,096 | 399,428 | 138,589 | 90,077  | 123,788  | 102,260 | 3,006  | 13,020 | -       | 2,991,264 |
| 2001-02 | 2,247,422 | 401,464 | 127,126 | 127,033 | 233,249  | 115,578 | 238    | 20,083 | 12,876  | 3,285,069 |
| 2002-03 | 2,247,000 | 375,130 | 132,527 | 122,010 | 270,620  | 150,520 | 500    | 10,000 | 26,000  | 3,338,807 |
| 2003-04 | 2,324,080 | 361,000 | 148,000 | 90,000  | 240,000  | 140,000 | 7,000  | 9,000  | 45,000  | 3,364,080 |
| 2004-05 | 2,523,395 | 420,029 | 170,931 | 140,718 | 260,385  | 135,704 | 8,000  | 5,592  | 90,000  | 3,754,754 |
| 2005-06 | 2,451,370 | 436,470 | 130,390 | 145,000 | 290,670  | 104,950 | 7,500  | 6,320  | 110,000 | 3,682,670 |
| 2006-07 | 2,515,000 | 340,000 | 122,000 | 115,000 | 230,000  | 72,000  | 26,000 | 6,000  | 125,000 | 3,551,000 |
| 2007-08 | 2,762,783 | 381,970 | 57,949  | 89,000  | 274,000  | 82,731  | 6,500  | 3,147  | 100,000 | 3,758,080 |
| 2008-09 | 2,533,000 | 161,000 | -       | 18,000  | 82,000   | 100,000 | 30,000 | 5,400  | 50,000  | 2,979,400 |
| 2009-10 | 2,406,000 | 420,000 | -       | 136,000 | 263,000  | 120,000 | 38,000 | 8,500  | 65,000  | 3,456,500 |
| 2011-12 | 22,96,000 | 641,000 | -       | 403,000 | 603,000  | 135,000 | 42,000 | 8,800  | 82,000  | 4,333,800 |
| 2012-13 | 22,47,000 | 654,000 | -       | 434,000 | 571,000  | 185,000 | 48,000 |        | 45,000  |           |
| 2013-14 | 24,62,000 | 685,000 | -       | 543,000 | 576,000  | 128,000 | 42,000 |        | 16,000  |           |
| 2014-15 | 26,39,000 | 722,000 | -       | 597,000 | 640,000  | 122,000 | 39,000 |        | 16,000  |           |
| 2015-16 | 22,91,000 | 730,000 | -       | 658,000 | 727,000  | 286,281 | 62,785 |        |         |           |
| 2016-17 | 23,65,000 | 740,000 | -       | 609,000 | 781,000  | 250,000 | 57,000 | 10,000 |         |           |

*Source: Monthly report FDI-11 and ATDP/IFDC and MOA, MMI/DAE*

## Appendix-2

### Nutrient compositions of fertilizers

| Source                                      | Formula  | N    | P  | K  | S    | Zn | Mn | Ca | Mg  | B  | Mo |
|---|--|------|----|----|------|----|----|----|-----|----|----|
| Urea  | CO(NH <sub>2</sub> ) <sub>2</sub>  | 46   | -  | -  | -    | -  | -  | -  | -   | -  | -  |
| Ammonium Sulphate                           | (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>                                    | 21.1 | -  | -  | 23.5 | -  | -  | -  | -   | -  | -  |
| Triple Super Phosphate                      | Ca(H <sub>2</sub> PO <sub>4</sub> ) <sub>2</sub>                                   | -    | 20 | -  | 1.3  | -  | -  | 14 | -   | -  | -  |
| Monoammonium phosphate                      | NH <sub>4</sub> H <sub>2</sub> PO <sub>4</sub>                                     | 11   | 20 | -  | -    | -  | -  | -  | -   | -  | -  |
| Diammonium phosphate                        | (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub>                                   | 18   | 20 | -  | -    | -  | -  | -  | -   | -  | -  |
| Potassium chloride                          | KCl  | -    | -  | 50 | -    | -  | -  | -  | -   | -  | -  |
| Potassium sulphate                          | K <sub>2</sub> SO <sub>4</sub>   | -    | -  | 42 | 17   | -  | -  | -  | -   | -  | -  |
| Gypsum                                      | CaSO <sub>4</sub> ·2H <sub>2</sub> O   | -    | -  | -  | 18   | -  | -  | 20 | -   | -  | -  |
| Magnesium sulphate                          | MgSO <sub>4</sub> ·H <sub>2</sub> O  | -    | -  | -  | 12.5 | -  | -  | -  | 9.5 | -  | -  |
| Zinc sulphate, Monohydrate (granular grade) | ZnSO <sub>4</sub> ·H <sub>2</sub> O  | -    | -  | -  | 17.5 | 36 | -  | -  | -   | -  | -  |
| Zinc sulphate, Heptahydrate                 | ZnSO <sub>4</sub> ·7H <sub>2</sub> O   | -    | -  | -  | 10.5 | 21 | -  | -  | -   | -  | -  |
| Zinc oxide                                  | ZnO  | -    | -  | -  | -    | 78 | -  | -  | -   | -  | -  |
| Boric acid                                  | H <sub>3</sub> BO <sub>3</sub>   | -    | -  | -  | -    | -  | -  | -  | -   | 17 | -  |
| Solubor                                     | Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·10H <sub>2</sub> O                  | -    | -  | -  | -    | -  | -  | -  | -   | 20 | -  |
| Managanese sulphate                         | MnSO <sub>4</sub> ·H <sub>2</sub> O  | -    | -  | -  | 21   | -  | 36 | -  | -   | -  | -  |
| Ammonium molybdate                          | (NH <sub>4</sub> ) <sub>6</sub> Mo <sub>7</sub> O <sub>24</sub> ·2H <sub>2</sub> O | 6.8  | -  | -  | -    | -  | -  | -  | -   | -  | 54 |
| Sodium molybdate                            | Na <sub>2</sub> MoO <sub>4</sub> ·2H <sub>2</sub> O                                | -    | -  | -  | -    | -  | -  | -  | -   | -  | 39 |

## Appendix-3

### Maximum allowable limits of different toxic metals in chemical and organic fertilizers

| Sl No. | Toxic metal   | Chemical fertilizer <sup>1</sup> (ppm) | Organic fertilizer <sup>2</sup> (ppm) |
|--------|---------------|--|---------------------------------------|
| 1.     | Arsenic (As)  | 50                                     | 20                                    |
| 2.     | Cadmium (Cd)  | 10                                     | 5                                     |
| 3.     | Lead (Pb)     | 100                                    | 30                                    |
| 4.     | Mercury (Hg)  | 5                                      | 0.1                                   |
| 5.     | Chromium (Cr) | 500                                    | 50                                    |
| 6.     | Nickel (Ni)   | 50                                     | 30                                    |
| 7.     | Zinc (Zn)     | NA*                                    | 0.1(%)                                |
| 8.     | Copper (Cu)   | NA                                     | 0.05 (%)                              |

\*Not applicable

Source: <sup>1</sup>Fertilizer (Management) Regulation, 2007; Published in Bangladesh Gazette on 30 May 2007; &

<sup>2</sup>কৃষি মন্ত্রণালয় প্রজ্ঞাপন নং: কৃম/উপ-২/সাক-১/২০০৮/১৫৬, তারিখ: ০২ এপ্রিল ২০০৮

## Appendix-4

**Nutrient composition of manure/materials**

| <i>Manure</i>               | <b>Moisture (%)</b> | <b>N (%)</b> | <b>P (%)</b> | <b>K (%)</b> |
|-----------------------------|---------------------|--------------|--------------|--------------|
| Cowdung (decomposed)        | 35±3.5              | 1.0±0.1      | 0.3±0.03     | 0.46±0.05    |
| Farmyard manure             | 67±6.7              | 1.6±0.16     | 0.83±0.08    | 1.7±0.17     |
| Poultry manure (decomposed) | 35±3.5              | 1.25±0.13    | 0.70±0.07    | 0.95±0.10    |
| Bio-slurry (cowdung)        | 20±2.0              | 1.10±0.01    | 0.59±0.06    | 0.28±0.03    |
| Bio-slurry (poultry manure) | 20±2.0              | 1.48±0.01    | 0.69±0.07    | 0.36±0.04    |
| Compost (rural)             | 40±4.0              | 0.75±0.07    | 0.6±0.06     | 1.0±0.1      |
| Compost (urban)             | 40±4.0              | 1.5±0.15     | 0.6±0.06     | 1.5±0.5      |
| Compost (water hyacinth)    | 70±7.0              | 1.5±0.15     | 0.8±0.08     | 3.0±0.3      |
| Mustard oilcake             | 15±1.5              | 5.0±0.5      | 1.8±0.18     | 1.2±0.12     |
| Linseed oilcake             | 15±1.5              | 5.5±0.55     | 1.4±0.14     | 1.2±0.12     |
| Sesame oilcake              | 15±1.5              | 6.2±0.62     | 2.0±0.2      | 1.2±0.12     |
| Pressmud                    | 55±5.5              | 1.85±0.18    | 0.13±0.02    | 0.54±0.05    |
| Bone meal (raw)             | 8±0.8               | 3.5±0.35     | 9±0.9        | NA*          |
| Bone meal (steamed)         | 7±0.7               | 1.5±0.15     | 10±1.0       | NA           |
| Dried blood                 | 10±1.0              | 11±1.1       | 1.1±0.11     | 0.7±0.07     |
| Fishmeal                    | 10±1.0              | 7±0.70       | 3.5±0.35     | 1.0±0.10     |

\*Not applicable

## Appendix-5

**Nutrient composition of in green manure and crop residues**

| <b>Green manure/ crop residues</b> | <b>Moisture (%)</b> | <b>N (%)</b> | <b>P (%)</b> | <b>K (%)</b> | <b>S (%)</b> |
|------------------------------------|---------------------|--------------|--------------|--------------|--------------|
| Dhaincha ( <i>Sesbania</i> )       | 80±8                | 0.7±0.07     | 0.4±0.04     | 0.4±0.04     | 0.2±0.02     |
| Mungbean                           | 70±7                | 0.8±0.08     | 0.2±0.02     | 0.5±0.05     | 0.3±0.03     |
| Blackgram                          | 70±7                | 0.8±0.08     | 0.2±0.02     | 0.5±0.05     | 0.3±0.03     |
| Cowpea                             | 70±7                | 0.7±0.07     | 0.15±0.01    | 0.5±0.05     | -            |
| Sunhemp                            | 70±7                | 0.7±0.07     | 0.12±0.01    | 0.5±0.05     | -            |
| Rice straw                         | 30±3                | 0.4±0.04     | 0.1±0.01     | 1.5±0.15     | -            |
| Wheat straw                        | 20±2                | 0.5±0.05     | 0.3±0.03     | 0.9±0.09     | -            |
| Sugarcane leaves                   | 20±2                | 1.0±0.1      | 0.5±0.05     | 1.4±0.14     | -            |

## Appendix-6

### Nutrient supply from organic materials

| <i>Organic material</i>      | Nutrient supply (kg) from 1 ton material |      |     |
|------------------------------|--|------|-----|
|                              | N  | P    | K   |
| Cowdung (decomposed)         | 5.0                                      | 1.5  | 2.3 |
| Farmyard Manure              | 3.0                                      | 0.7  | 2.5 |
| Poultry Manure (decomposed)  | 6.0                                      | 3.5  | 4.8 |
| Compost (rural)              | 2.5                                      | 1.0  | 3.0 |
| Mustard oilcake              | 25.5                                     | 4.0  | 5.0 |
| Linseed oilcake              | 28.0                                     | 3.0  | 5.0 |
| Sesame oilcake               | 31.5                                     | 4.5  | 5.0 |
| Groundnut oilcake            | 36.0                                     | 3.5  | 5.5 |
| Bone meal                    | 19.5                                     | 52.0 | NA  |
| Dried blood                  | 59.5                                     | 2.5  | 3.0 |
| Dhaincha ( <i>Sesbania</i> ) | 2.5                                      | 0.3  | 2.0 |
| Mungbean residues            | 4.5                                      | 0.5  | 4.5 |
| Rice straw                   | 2.0                                      | 0.5  | 6.5 |
| Wheat straw                  | 3.0                                      | 0.5  | 5.5 |

Note : The values estimated considering the nutrient concentration in the material (Appendix-5 & 6) and their mineralization.

## Appendix-7

### Inoculant and seed requirement of different legumes

| <i>Crop</i>         | Seed rate<br>(kg/ha) | Inoculum rate |       |
|---------------------|----------------------|---------------|-------|
|                     |                      | g/kg seed     | kg/ha |
| Lentil              | 30                   | 50            | 1.5   |
| Chickpea            | 50                   | 40            | 2.0   |
| Mungbean            | 30                   | 50            | 1.5   |
| Blackgram           | 30                   | 50            | 1.5   |
| Cowpea              | 40                   | 40            | 1.6   |
| Grasspea            | 50                   | 40            | 2.0   |
| Groundnut (shelled) | 72                   | 30            | 2.2   |
| Soybean             | 60                   | 20            | 1.2   |

## Interpretation of soil test values based on critical limits

## A: Loamy to Clayey Soils of Upland Crops

| Nutrient element*       | Very Low | Low        | Medium      | Optimum    | High       | Very high |
|-------------------------|----------|------------|-------------|------------|------------|-----------|
| N (%)                   | ≤ 0.09   | 0.091-0.18 | 0.181-0.27  | 0.271-0.36 | 0.361-0.45 | >0.45     |
| P (µg/g soil) (Olsen)   | ≤ 7.5    | 7.51-15.0  | 15.1-22.5   | 22.51-30   | 30.1-37.5  | >37.5     |
| P (µg/g) (Bray & Kurtz) | ≤ 5.25   | 5.25-10.5  | 10.51-15.75 | 15.76-21.0 | 21.1-26.25 | >26.25    |
| S (µg/g) soil           | ≤ 7.5    | 7.51-15.0  | 15.1-22.5   | 22.51-30   | 30.1-37.5  | >37.5     |
| K (meq/100g)            | ≤ 0.09   | 0.091-0.18 | 0.181-0.27  | 0.271-0.36 | 0.361-0.45 | >0.45     |
| Ca (meq/100g)           | ≤ 1.5    | 1.51-3.0   | 3.1-4.5     | 4.51-6.0   | 6.1-7.5    | >7.5      |
| Mg (meq/100g)           | ≤ 0.375  | 0.376-0.75 | 0.751-1.125 | 1.126-1.5  | 1.51-1.875 | >1.875    |
| Cu (µg/g)               | ≤ 0.15   | 0.151-0.3  | 0.31-0.45   | 0.451-0.6  | 0.61-0.75  | >0.75     |
| Zn (µg/g)               | ≤ 0.45   | 0.451-0.9  | 0.91-1.35   | 1.351-1.8  | 1.81-2.25  | >2.25     |
| Fe (µg/g)               | ≤ 3.0    | 3.1-6.0    | 6.1-9.0     | 9.1-12.0   | 12.1-15.0  | >15.0     |
| Mn (µg/g)               | ≤ 0.75   | 0.756-1.5  | 1.51-2.25   | 2.256-3.0  | 3.1-3.75   | >3.75     |
| B (µg/g)                | ≤ 0.15   | 0.151-0.3  | 0.31-0.45   | 0.451-0.6  | 0.61-0.75  | >0.75     |
| Mo (µg/g)               | ≤ 0.075  | 0.076-0.15 | 0.151-0.225 | 0.226-0.30 | 0.31-0.375 | >0.375    |

| Nutrient Element* | Critical limit | Method of extraction                               |
|-------------------|----------------|--|
| N (%)             | 0.12           | Kjeldahl method                                    |
| Organic C(%)      | C:N=10:1       | Wet oxidation method                               |
| P (µg/g)          | 10.0           | Modified Olsen method (Neutral + Calcareous soils) |
| P (µg/g)          | 7.0            | Bray & Kurtz method (Acid soils)                   |
| S (µg/g)          | 10.0           | Calcium dihydrogen phosphate extraction            |
| K (meq/100g)      | 0.12           | N NH <sub>4</sub> OAc method                       |
| Ca (meq/100g)     | 2.0            | N NH <sub>4</sub> OAc method                       |
| Mg (meq/100g)     | 0.5            | N NH <sub>4</sub> OAc method                       |
| Zn (µg/g)         | 0.6            | DTPA extraction                                    |
| Cu (µg/g)         | 0.2            | DTPA extraction                                    |
| Fe (µg/g)         | 4.0            | DTPA extraction                                    |
| Mn (µg/g)         | 1.0            | DTPA extraction                                    |
| B (µg/g)          | 0.2            | Calcium chloride extraction                        |
| Mo (µg/g)         | 0.1            | NH <sub>4</sub> -oxalate extraction                |

\*indicates total status for N and available status for others

**B: Sandy Soils for Upland Crops**

| Nutrient element*            | Very Low | Low        | Medium      | Optimum    | High        | Very high |
|------------------------------|----------|------------|-------------|------------|-------------|-----------|
| N (%)                        | ≤ 0.075  | 0.076-0.15 | 0.151-0.226 | 0.227-0.30 | 0.31-0.375  | >0.375    |
| P (µg/g) (Olsen)             | ≤ 6.0    | 6.1-12.0   | 12.1-18.0   | 18.1-24.0  | 24.1-30.0   | >30.0     |
| P (µg/g soil) (Bray & Kurtz) | ≤ 5.25   | 5.25-10.5  | 10.51-15.75 | 15.76-21.0 | 21.1-26.25  | >26.25    |
| S (µg/g)                     | ≤ 6.0    | 6.1-12.0   | 12.1-18.0   | 18.1-24.0  | 24.1-30.0   | >30.0     |
| K (meq/100g)                 | ≤ 0.06   | 0.061-0.12 | 0.121-0.18  | 0.181-0.24 | 0.241-0.3   | >0.3      |
| Ca (meq/100g)                | ≤ 1.5    | 1.51-3.0   | 3.1-4.5     | 4.51-6.0   | 6.1-7.5     | >7.5      |
| Mg (meq/100g)                | ≤ 0.375  | 0.376-0.75 | 0.751-1.125 | 1.126-1.5  | 1.51-1.875  | >1.875    |
| Cu (µg/g)                    | ≤ 0.15   | 0.151-0.3  | 0.31-0.45   | 0.451-0.6  | 0.61-0.75   | >0.75     |
| Zn (µg/g)                    | ≤ 0.375  | 0.376-0.75 | 0.751-1.125 | 1.126-1.5  | 1.51-1.875  | >1.875    |
| Fe (µg/g)                    | ≤ 2.25   | 2.26-4.5   | 4.51-6.75   | 6.76-9.0   | 9.1-11.25   | >11.25    |
| Mn (µg/g)                    | ≤ 0.75   | 0.756-1.5  | 1.51-2.25   | 2.256-3.0  | 3.1-3.75    | >3.75     |
| B (µg/g)                     | ≤ 0.12   | 0.121-0.24 | 0.241-0.36  | 0.361-0.48 | 0.481-0.6   | >0.6      |
| Mo (µg/g)                    | ≤ 0.045  | 0.046-0.09 | 0.091-0.135 | 0.136-0.18 | 0.181-0.225 | >0.225    |

| Nutrient Element* | Critical limit | Method of extraction                               |
|-------------------|----------------|--|
| N (%)             | 0.10           | Kjeldahl method                                    |
| Organic C(%)      | C:N=10:1       | Wet oxidation method                               |
| P (µg/g)          | 8.0            | Modified Olsen method (Neutral + Calcareous soils) |
| P (µg/g)          | 7.0            | Bray & Kurtz method (Acid soils)                   |
| S (µg/g)          | 8.0            | Calcium dihydrogen phosphate extraction            |
| K (meq/100g)      | 0.08           | N NH <sub>4</sub> OAc method                       |
| Ca (meq/100g)     | 2.0            | N NH <sub>4</sub> OAc method                       |
| Mg (meq/100g)     | 0.5            | N NH <sub>4</sub> OAc method                       |
| Zn (µg/g)         | 0.5            | DTPA extraction                                    |
| Cu (µg/g)         | 0.2            | DTPA extraction                                    |
| Fe (µg/g)         | 3.0            | DTPA extraction                                    |
| Mn (µg/g)         | 1.0            | DTPA extraction                                    |
| B (µg/g)          | 0.16           | Calcium chloride extraction                        |
| Mo (µg/g)         | 0.06           | NH <sub>4</sub> -oxalate extraction                |

\*indicates total status for N and available status for others

**C: Loamy to Clayey Soils of Wetland Rice Crops**

| Nutrient element*       | Very Low | Low        | Medium      | Optimum    | High       | Very high |
|-------------------------|----------|------------|-------------|------------|------------|-----------|
| N (%)                   | ≤ 0.09   | 0.09-0.18  | 1.18-0.27   | 0.27-0.36  | 0.36-0.45  | >0.45     |
| P (µg/g) (Olsen)        | ≤ 6.0    | 6.1-12.0   | 12.1-18.0   | 18.1-24.0  | 24.1-30.0  | >30.0     |
| P (µg/g) (Bray & Kurtz) | ≤ 3.75   | 3.76-7.5   | 7.6-11.25   | 11.26-15.0 | 15.1-18.75 | >18.75    |
| S (µg/g)                | ≤ 9.0    | 9.1-18.0   | 18.1-27.0   | 27.1-36.0  | 36.1-45.0  | >45.0     |
| K (meq/100g)            | ≤ 0.075  | 0.076-0.15 | 0.151-0.225 | 0.226-0.30 | 0.31-0.375 | >0.375    |
| Ca (meq/100g)           | ≤ 1.5    | 1.51-3.0   | 3.1-4.5     | 4.51-6.0   | 6.1-7.5    | >7.5      |
| Mg (meq/100g)           | ≤ 0.375  | 0.376-0.75 | 0.751-1.125 | 1.126-1.5  | 1.51-1.875 | >1.875    |
| Cu (µg/g)               | ≤ 0.15   | 0.151-0.3  | 0.31-0.45   | 0.451-0.6  | 0.61-0.75  | >0.75     |
| Zn (µg/g)               | ≤ 0.45   | 0.451-0.9  | 0.91-1.35   | 1.351-1.8  | 1.81-2.225 | >2.25     |
| Fe (µg/g)               | ≤ 3.0    | 3.1-6.0    | 6.1-9.0     | 9.1-12.0   | 12.1-15.0  | >15.0     |
| Mn (µg/g)               | ≤ 0.75   | 0.756-1.5  | 1.51-2.25   | 2.256-3.0  | 3.1-3.75   | >3.75     |
| B (µg/g)                | ≤ 0.15   | 0.151-0.3  | 0.31-0.45   | 0.451-0.6  | 0.61-0.75  | >0.75     |
| Mo (µg/g)               | ≤ 0.075  | 0.076-0.15 | 0.151-0.225 | 0.226-0.30 | 0.31-0.375 | >0.375    |

| Nutrient Element* | Critical limit | Method of extraction                               |
|-------------------|----------------|--|
| N (%)             | 0.12           | Kjeldahl method                                    |
| Organic C(%)      | C:N=10:1       | Wet oxidation method                               |
| P (µg/g)          | 8.0            | Modified Olsen method (Neutral + Calcareous soils) |
| P (µg/g)          | 5.0            | Bray & Kurtz method (Acid soils)                   |
| S (µg/g)          | 10.0           | Calcium dihydrogen phosphate extraction            |
| K (meq/100g)      | 0.12           | N NH <sub>4</sub> OAc method                       |
| Ca (meq/100g)     | 2.0            | N NH <sub>4</sub> OAc method                       |
| Mg (meq/100g)     | 0.5            | N NH <sub>4</sub> OAc method                       |
| Zn (µg/g)         | 0.6            | DTPA extraction                                    |
| Cu (µg/g)         | 0.2            | DTPA extraction                                    |
| Fe (µg/g)         | 4.0            | DTPA extraction                                    |
| Mn (µg/g)         | 1.0            | DTPA extraction                                    |
| B (µg/g)          | 0.2            | Calcium chloride extraction                        |
| Mo (µg/g)         | 0.1            | NH <sub>4</sub> -oxalate extraction                |

\*indicates total status for N and available status for others

## Appendix-9

### Location specific and yield goal basis fertilizer recommendation for crops based on soil test values

For example: Crop-Wheat (High Yield Goal; HYG) = 4.5 ± 0.45 t/ha

Location: Village ..... Upazila ..... District

| Soil analysis             | Soil test value | Soil test value interpretation (Appendix- 8A) | Range of values used within the interpretation class (Appendix- 8A) |
|---------------------------|-----------------|---|---|
| Texture                   | Loam            | -   | -   |
| Total N (%)               | 0.1             | Low   | 0.091-0.18  |
| Available P (µg/g)        | 18              | Medium  | 15.1-22.5   |
| Exchangeable K (meq/100g) | 0.15            | Low   | 0.091-0.18  |
| Available S (µg/g)        | 10              | Low   | 7.51-15.0   |
| Available Zn (µg/g)       | 1.0             | Medium  | 0.91-1.35   |
| Available B (µg/g)        | 0.2             | Low   | 0.151-0.3   |

**Step-I :** Consult the Appendix-8A to see the position of given soil test value within the range of the interpretation class.

**Step-II:** Consult the Table 1 under wheat (page # 71) to see the range of fertilizer nutrient recommended for the same soil test value interpretation class.

**Step-III:** Compute the exact fertilizer nutrient required for making the recommendation following the formula given below:

$$F_r = U_f - \frac{C_i}{C_s} \times (S_r - L_s)$$

Where,

$F_r$  : Fertilizer nutrient required for given soil test value

$U_f$  : Upper limit of the recommended fertilizer nutrient for the respective STVI class

$C_i$  : Units of class intervals used for fertilizer nutrient recommendation

$C_s$  : Units of class intervals used for STVI class

$S_r$  : Soil test value

$L_s$  : Lower limit of the soil test value within STVI class

**Example:**

$$\begin{aligned} \text{N (kg/ha)} &= 120 - \frac{40}{0.09} \times (0.1 - 0.091) \\ &= 120 - \frac{40}{0.09} \times (0.009) \\ &= 120 - 4 = 116 \text{ N (kg/ha)} \\ &= 116 \times \frac{100}{46} = 252.24 \text{ kg Urea/ha} \end{aligned}$$

$$\begin{aligned} \text{P (kg/ha)} &= 20 - \frac{10}{7.5} \times (18 - 15.1) \\ &= 20 - \frac{10}{7.5} \times (2.9) \\ &= 20 - 3.9 = 16.1 \text{ kg P /ha} \\ &= 16.1 \times \frac{100}{20} = 80.5 \text{ kg TSP/ha} \end{aligned}$$

$$\begin{aligned} \text{K (kg/ha)} &= 90 - \frac{30}{0.09} \times (0.15 - 0.091) \\ &= 90 - \frac{30}{0.09} \times (0.059) \\ &= 90 - 19.7 = 70.3 \text{ kg K/ha} \\ &= 70.3 \times \frac{100}{50} = 140.6 \text{ kg MoP/ha} \end{aligned}$$

$$\begin{aligned} \text{S (kg/ha)} &= 15 - \frac{5}{7.5} \times (10 - 7.51) \\ &= 15 - \frac{5}{7.5} \times 2.49 \\ &= 15 - 1.66 = 13.34 \text{ kg S/ha} \\ &= 13.34 \times \frac{100}{18} = 74.11 \text{ kg Gypsum/ha} \end{aligned}$$

$$\begin{aligned} \text{Zn (kg/ha)} &= 1.3 - \frac{1.3}{0.45} \times (1.0 - 0.91) \\ &= 1.3 - \frac{1.3}{0.45} \times 0.09 \\ &= 1.04 \text{ kg Zn/ha} \\ &= 1.04 \times \frac{100}{21} = 4.95 \text{ kg Zinc sulphate (hepta-hydrate)/ha} \end{aligned}$$

$$\begin{aligned} \text{B (kg/ha)} &= 0.6 - \frac{0.3}{0.15} \times (0.2 - 0.151) \\ &= 0.6 - \frac{0.3}{0.15} \times 0.049 \\ &= 0.502 \text{ kg B/ha} \\ &= 0.502 \times \frac{100}{17} = 2.95 \text{ kg Boric acid/ha} \end{aligned}$$

**Note:**

When zinc sulphate (heptahydrate) is used sulphur is also supplied (10.5% S in  $ZnSO_4 \cdot 7H_2O$ ). Thus, if 4.95 kg of zinc sulphate (heptahydrate) is used

$$\frac{4.95 \times 10.5}{100} = 0.52 \text{ kg of S will be added per hectare}$$

Thus the S requirement from the above example can be reduced to  $(13.34 - 0.52) = 12.82$  S/ha. The new calculation for sulphur from gypsum would then be -

$$\frac{100 \times 12.82}{18} = 71.2 \text{ kg S gypsum per hectare}$$

**The Final Recommendation**

From the above example, the final recommendation would be -

| Nutrient (kg/ha) | Fertilizer (kg/ha)                 | Fertilizer/Nutrient Ratio |
|------------------|------------------------------------|---------------------------|
| N = 116          | Urea = 252.24                      | 2.17                      |
| P = 16.1         | TSP = 80.5                         | 5.00                      |
| K = 70.3         | MoP = 140.6                        | 2.00                      |
| S = 12.82        | Gypsum = 71.2                      | 5.55                      |
| Zn = 1.04        | Zinc sulphate, heptahydrate = 4.95 | 4.75                      |
| B = 0.502        | Boric acid = 2.95                  | 5.88                      |

## Appendix-10

Site specific fertilizer recommendation for crops and cropping patterns on the basis of soil test, yield goal and rationales

Example 1: Boro (MV)-Fallow-T.Aman (MV)

| Soil Analysis Interpretation | Texture   | pH      | N %      | P (µg/g) | K (meq/100 g) | S (µg/g) | Zn (µg/g) |
|------------------------------|-----------|---------|----------|----------|---------------|----------|-----------|
|                              | Silt loam | 7.0     | 0.08     | 11       | 0.17          | 12       | 3.0       |
|                              |           | Neutral | Very Low | Low      | Medium        | Low      | Very high |

| Crops and Yield Goal        | Fertilizer recommendation (kg/ha) |    |    |    |    |
|-----------------------------|-----------------------------------|----|----|----|----|
|                             | N                                 | P  | K  | S  | Zn |
| Boro (HYG) 6.0±0.6 (t/ha)   | 158                               | 18 | 38 | 11 | -  |
| Fallow                      | -                                 | -  | -  | -  | -  |
| T.Aman (HYG) 5.0±0.5 (t/ha) | 105                               | 7  | 24 | 11 | -  |

Example 2: Mustard (MV) - T.Aus (MV)- T.Aman (MV)

| Soil Analysis Interpretation | Texture   | pH      | N %      | P (µg/g) | K (meq/100)           | S (µg/g) | Zn (µg/g) | B (µg/g) |
|------------------------------|-----------|---------|----------|----------|-----------------------|----------|-----------|----------|
|                              | Silt loam | 7.0     | 0.08     | 11       | 0.17                  | 12       | 3.0       | 0.4      |
|                              |           | Neutral | Very Low | Low      | Low: for Upland Crops | Low      | Very high | Medium   |
|                              |           |         |          |          | Medium: for rice      |          |           |          |

| Crop and Yield Goal          | Fertilizer recommendation (kg/ha) |    |    |    |    |     |
|------------------------------|-----------------------------------|----|----|----|----|-----|
|                              | N                                 | P  | K  | S  | Zn | B   |
| Mustard (HYG) 2.0±0.2 (t/ha) | 140                               | 30 | 75 | 23 | -  | 0.4 |
| T.Aus (HYG) 3.5±0.35 (t/ha)  | 60                                | 6  | 15 | 8  | -  | -   |
| T.Aman (HYG) 5.0±0.5 (t/ha)  | 105                               | 7  | 24 | 11 | -  | -   |

## Appendix-11

Symbols and atomic weights of some elements

| Element  | Symbol | Atomic Weight | Element    | Symbol | Atomic Weight |
|----------|--------|---------------|------------|--------|---------------|
| Aluminum | Al     | 26.98         | Magnesium  | Mg     | 24.30         |
| Boron    | B      | 10.81         | Manganese  | Mn     | 54.94         |
| Calcium  | Ca     | 40.08         | Molybdenum | Mo     | 95.94         |
| Carbon   | C      | 12.01         | Nitrogen   | N      | 14.01         |
| Chlorine | Cl     | 35.453        | Oxygen     | O      | 16.00         |
| Cobalt   | Co     | 58.94         | Phosphorus | P      | 30.98         |
| Copper   | Cu     | 63.55         | Potassium  | K      | 39.102        |
| Fluorine | F      | 19.00         | Silicon    | Si     | 28.09         |
| Hydrogen | H      | 1.008         | Sodium     | Na     | 22.99         |
| Iodine   | I      | 126.92        | Sulfur     | S      | 32.06         |
| Iron     | Fe     | 55.85         | Zinc       | Zn     | 65.38         |

## Appendix-12

Useful chemical conversion factors

|                          |                                |
|--------------------------|--------------------------------|
| $N \times 1.22 = NH_3$   | $HNO_3 \times 0.22 = N$        |
| $P \times 2.29 = P_2O_5$ | $H_3PO_4 \times 0.32 = P$      |
| $P_2O_5 \times 0.44 = P$ | $Ca_3(PO_4)_2 \times 0.20 = P$ |
| $K \times 1.20 = K_2O$   | $KCl \times 0.52 = K$          |
| $K_2O \times 0.83 = K$   | $K_2SO_4 \times 0.45 = K$      |
| $Ca \times 1.40 = CaO$   | $CaSO_4 \times 0.29 = Ca$      |
| $MgO \times 0.60 = Mg$   | $MgCO_3 \times 0.28 = Mg$      |
| $S \times 3.00 = SO_4$   | $H_2SO_4 \times 0.33 = S$      |
| $SO_4 \times 0.33 = S$   | $CaSO_4 \times 0.24 = S$       |

## Appendix-13

### Some useful conversion factors

| <i>Chemicals &amp; fertilizers</i>                    | <i>Metric/Imperial</i>        | <i>Solid manure</i>  |
|---|-------------------------------|--|
| $\% P = \% P_2O_5 \times 0.437$                       | 1 ha = 10000 sqm              | $\text{kg t FW} = \frac{\text{mg kg nutrient}}{1000} \times \frac{\% \text{ DM}}{100}$ |
| $P_2O_5 = \% P \times 2.29$                           | 1 sqm = $1 \times 10^{-4}$ ha | $\text{kg t FW} = \text{g kg nutrient} \times \frac{\% \text{ DM}}{100}$               |
| $\% K = \% K_2O \times 0.83$                          | 1 kg = 2.24 lb                | $\text{kg t FW} = \% \text{ nutrient} \times \frac{\% \text{ DM}}{10}$                 |
| $\% K_2O = \% K \times 1.21$                          | 1 lb = 0.454 kg               | <i>Example:</i>  |
| Urea (kg) = kg N $\times$ 2.17                        | 1 lb/acre = 1.12 kg/ha        | Manure with 27% DM and 4.0% N & 3.0% P in DM.  |
| DAP (kg) = kg N $\times$ 5.56, kg P $\times$ 5.0      | 1 kg/ha = 0.89 lb/acre        | 4.0% N $\times$ (27% DM /10) = 10.8 kg N/t FW  |
| TSP (kg) = kg P $\times$ 5.0                          | 1 ha = 2.47 acre              | 3.0% P $\times$ (27% DM/10) = 8.1 kg P/t FW  |
| MoP (kg) = kg K $\times$ 2.0                          | 1 acre = 0.40 ha              | FW means fresh weight<br>DM means dry matter   |
| Gypsum (kg) = kg S $\times$ 5.56                      | 1 acre = 100 decimal          |  |
| Zinc sulphate heptahydrate (kg) = kg Zn $\times$ 4.35 | 1 decimal = 40.48 sqm         |  |
| Boric acid (kg) = kg B $\times$ 5.88                  | 1 inch = 2.54 cm              |  |

## Appendix-14

### Classification of soils on the basis of organic matter content and cation exchange capacity

| Class     | Organic Matter (%) | Cation Exchange Capacity (meq/100 g) |
|-----------|--------------------|--------------------------------------|
| Very high | >5.5               | >30                                  |
| High      | 3.5-5.5            | 16-30                                |
| Medium    | 1.8-3.4            | 7.6-15                               |
| Low       | 1.0-1.7            | 3-7.5                                |
| Very low  | <1.0               | <3                                   |

## Appendix-15

### Classification of soils on the basis of soil pH values

| <i>Soil reaction class</i> | <b>pH</b> |
|----------------------------|-----------|
| Very strongly acidic       | <4.5      |
| Strongly acidic            | 4.6-5.5   |
| Slightly acid              | 5.6-6.5   |
| Neutral                    | 6.6-7.3   |
| Slightly alkaline          | 7.4-8.4   |
| Strongly alkaline          | 8.5-9.0   |
| Very strongly alkaline     | >9.0      |

Source: SRDI

## Appendix-16

### Classification of soils on the basis of soil salinity values

| <i>Soil salinity class</i>          | <b>Salinity range (dS/m)*</b> |
|-------------------------------------|-------------------------------|
| S <sub>0</sub> Non saline           | 0 – 2.0                       |
| S <sub>1</sub> Very slightly saline | 2.1 – 4.0                     |
| S <sub>2</sub> Slightly saline      | 4.1 – 8.0                     |
| S <sub>3</sub> Moderately saline    | 8.1 – 12.0                    |
| S <sub>4</sub> Strongly saline      | 12.1 – 16.0                   |
| S <sub>5</sub> Very strongly saline | > 16.0                        |

\* 1 dS/m = 640 ppm (Approx.)

## Appendix-17

### Classification of land type

|                 |  |
|-----------------|--|
| Highland        | Land which is above normal flood-level   |
| Medium highland | Land which normally is flooded up to about 90 cm deep during the flood season      |
| Medium lowland  | Land which normally is flooded between 90 and 180 cm deep during the flood season  |
| Lowland         | Land which normally is flooded between 180 and 300 cm deep during the flood season |
| Very lowland    | Land which normally is flooded above 300 cm during the flood season                |

## Available forms of plant nutrients

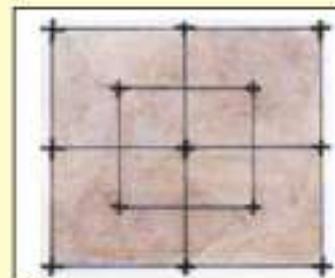
| <i>Nutrient</i> | <i>Available Forms</i>   | <i>Sources</i>                             |
|-----------------|--|--|
| Carbon          | CO <sub>2</sub>  | Atmosphere                                 |
| Hydrogen        | H <sub>2</sub> O   | Soil water                                 |
| Oxygen          | H <sub>2</sub> O, O <sub>2</sub> , CO <sub>2</sub>   | Soil water, Atmosphere                     |
| Nitrogen        | NO <sub>3</sub> <sup>-</sup> , NH <sub>4</sub> <sup>+</sup>  | Soil organic matter, Fertilizers           |
| Phosphorus      | H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> , HPO <sub>4</sub> <sup>2-</sup>                                 | Soil organic matter, Minerals, Fertilizers |
| Potassium       | K <sup>+</sup>   | Minerals, Fertilizers                      |
| Sulphur         | SO <sub>4</sub> <sup>2-</sup>  | Soil organic matter, Minerals, Fertilizers |
| Calcium         | Ca <sup>2+</sup>   | Minerals, Fertilizers                      |
| Magnesium       | Mg <sup>2+</sup>   | Minerals, Fertilizers                      |
| Iron            | Fe <sup>2+</sup> , Fe <sup>3+</sup>  | Minerals, Fertilizers                      |
| Manganese       | Mn <sup>2+</sup> , Mn <sup>4+</sup>  | Minerals, Fertilizers                      |
| Zinc            | Zn <sup>2+</sup>   | Minerals, Fertilizers                      |
| Copper          | Cu <sup>+</sup> , Cu <sup>2+</sup>   | Minerals, Fertilizers                      |
| Boron           | H <sub>3</sub> BO <sub>3</sub> , H <sub>2</sub> BO <sub>3</sub> <sup>-</sup> , HBO <sub>2</sub> <sup>-</sup> | Minerals, Fertilizers                      |
| Molybdenum      | MoO <sub>4</sub> <sup>2-</sup>   | Minerals, Fertilizers                      |
| Chlorine        | Cl <sup>-</sup>  | Minerals, Fertilizers                      |

### Methods of soil sample collection

For continuing sustainable crop harvest from a piece of land, maintenance of soil health is a must. Soil sample analysis can be done of the important criteria for understanding the present status of particular field and adjustment of fertilizer recommendation as per need of the soil. As such correct soil sampling is of great importance.

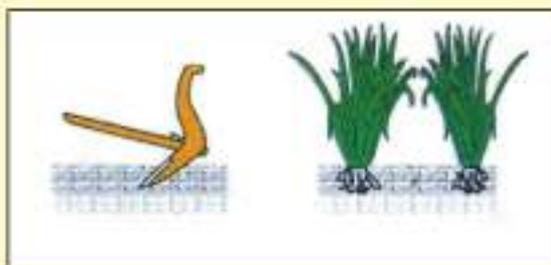
**Step 1:** Collection of equipment and stationeries for soil sampling: Considering the field condition and the availability the following equipments are needed for soil sampling.

- Country spade, shovel, push anger, weeding tools, Dutch auger, etc (any one).
- Plastic bucket or polyethylene sheet.
- Thick poly bag and thread ball.
- Level (tag), pencil or pen, towel, permanent marker.



**Step 2:** Leave 1.0-1.5 meter distance along the 4 field boundary (ails) of the sample field and demarcate minimum of 9 sampling spots irrespective of plot size as shown in the figure above. But it is better to collect more samples for accurate and precise results.

**Step 3:** Before start sampling identify the ploughing depth through digging hole in the field. Plough pan should be avoided for sampling. Plough pan generally exists just beneath the plough layer (within 8-10 cm depth).



**Step 4:** Dig a 'V' shaped hole up to the plough pan with a clean country spade/spade/ shovel etc. Take a slice of soil of about 7-8 cm uniform thickness from one side of the hole. Size the sub-samples by discarding excess soil from both the sides of the slice and plough pan at the bottom. Put the soil slice in the bucket or on the plastic sheet. Collect sub-samples from all the pre-demarcated spots in the same way. Take care that all the sub-samples you have taken are almost of the same volume.

**Step 5:** Mix up the sub-samples thoroughly and make a composite soil sample for a field. The samples should be made free from stubbles, grasses, rubbish, plant roots and stems etc. at this stage.

**Step 6:** Divide the mixed composite sample into 4 components on a plastic sheet. Discard any two component samples from the opposite corners and mix up the remaining two samples again. Continue this process until the volume of the sample reaches to about 400-500 grams.



**Step 7:** From the composite sample take 400-500 grams into a plastic bag. The samples should be dried in shady place and pulverized with a wooden hammer.

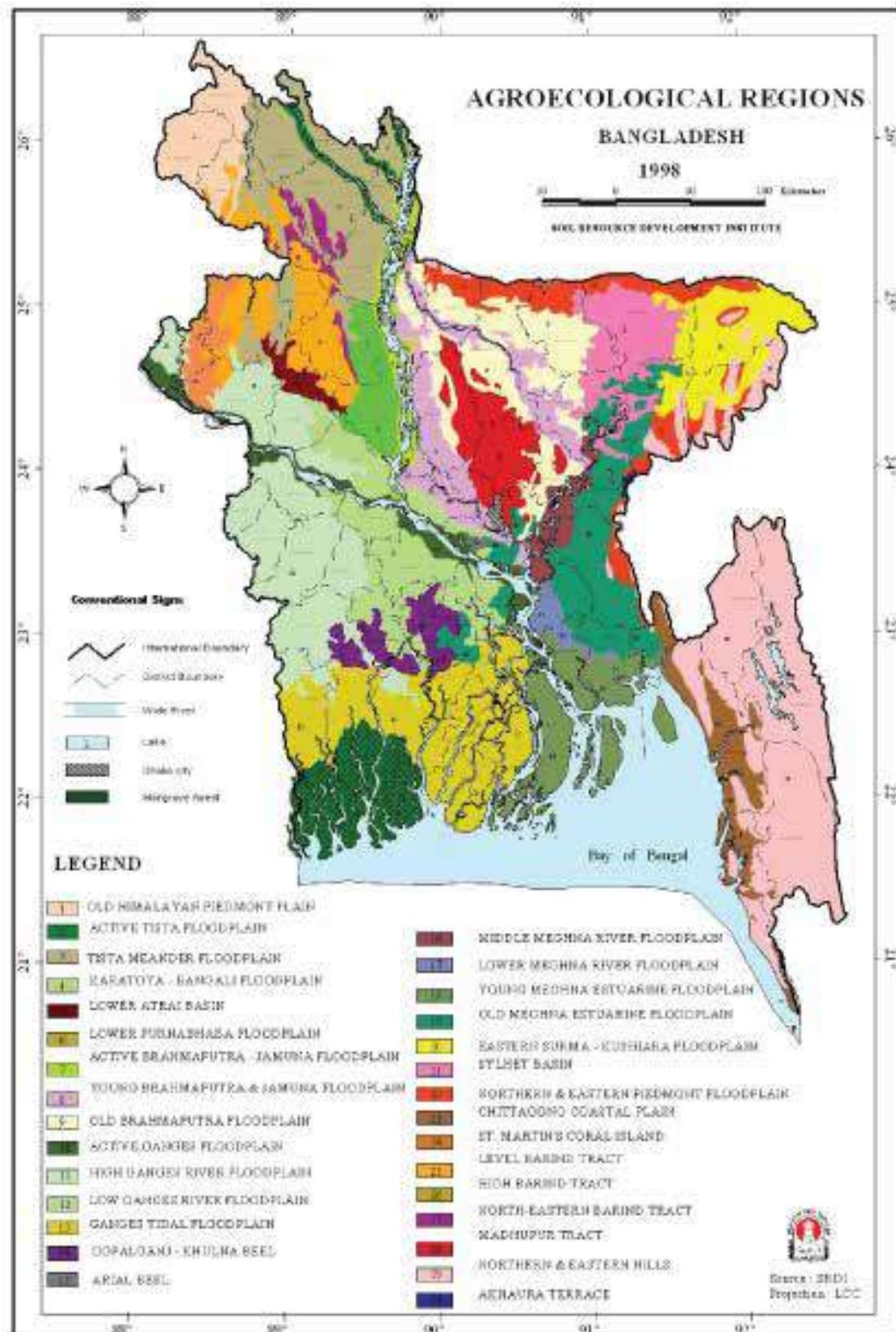


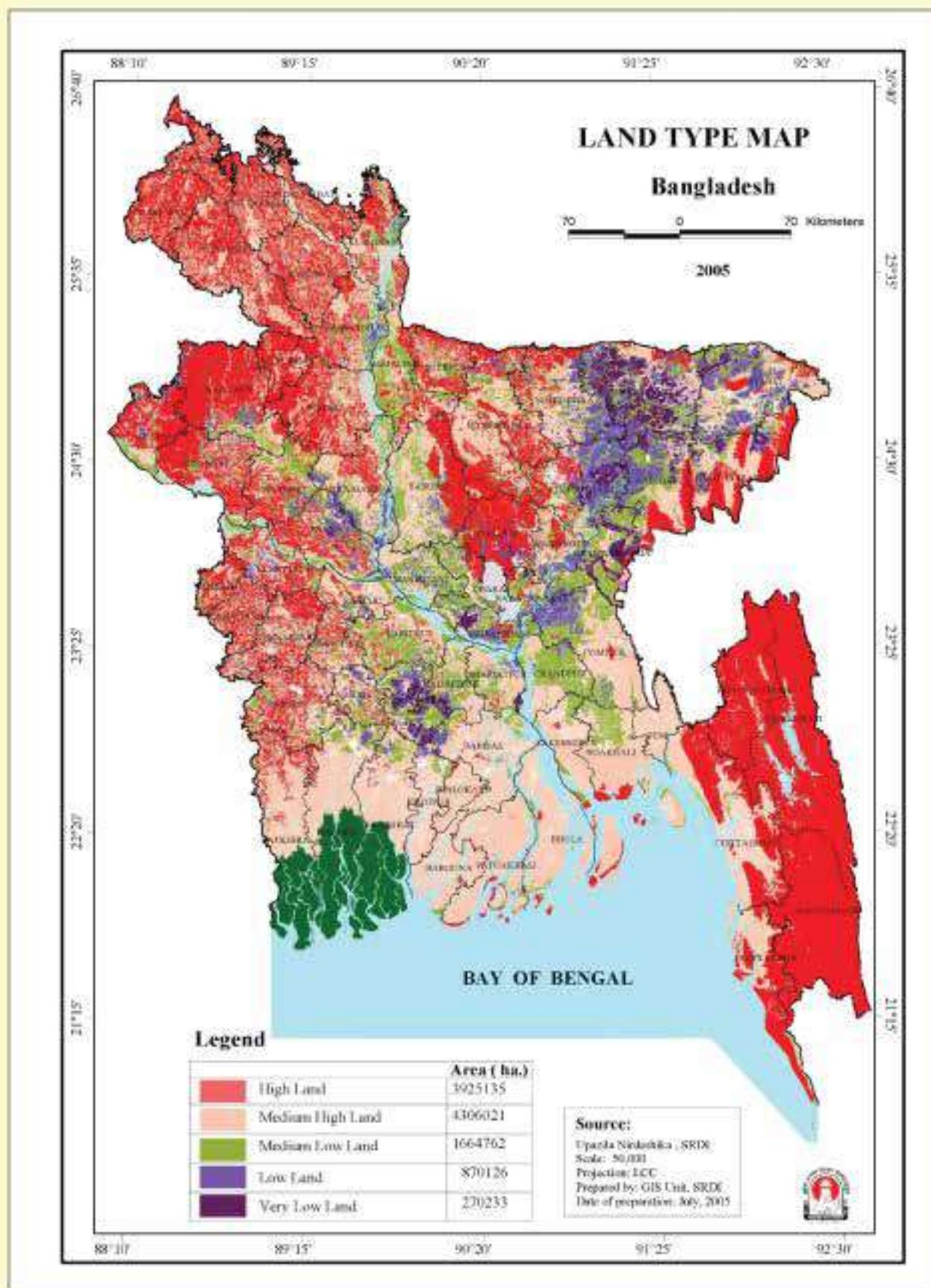
**Step 8:** The plastic bag with soil sample should be tightly closed with thread and placed inside another plastic bag. An information sheet (Tag) should be placed between two plastic bags and again the bag should be tightly closed with thread. An additional information sheet (Tag) should be tied at the neck of the bag. The sample should be sent immediately to the laboratory for analysis.

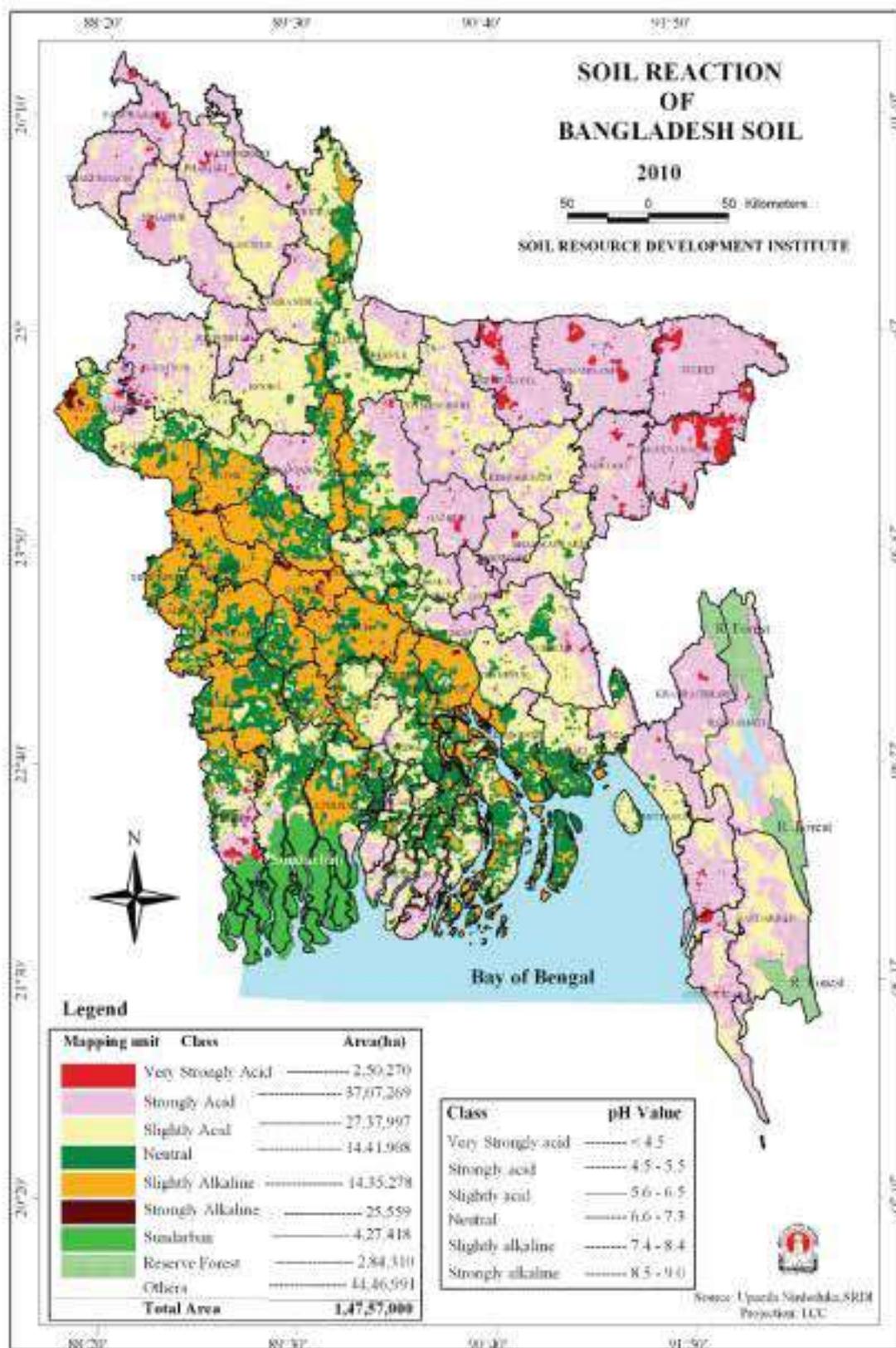
**Note:** Samples should not be collected from the nearby places to the road/embankment, brick field, compost/cowdung heap, straw burned area etc. and from very recently fertilized land. Do not wipe out the grasses or other plants from the surface of the sampling spots before collecting soil samples. This will create errors in having representative samples through losing top soils. Only top soils have to be collected. Further information on soil sampling and analytical facilities can be obtained from the Upazila Agriculture office, SRDI office and Agricultural Research Institutes.

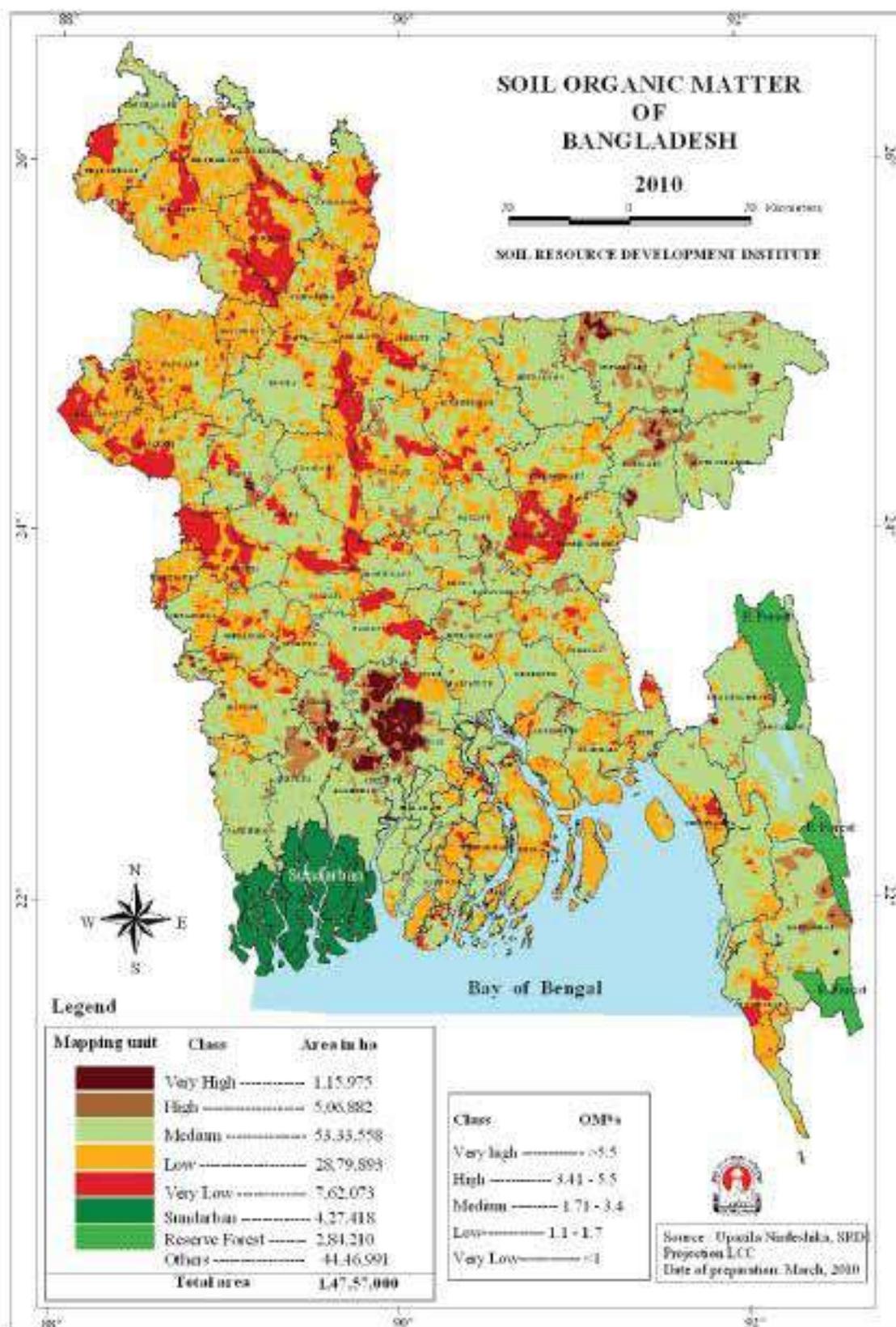
### **Information Sheet**

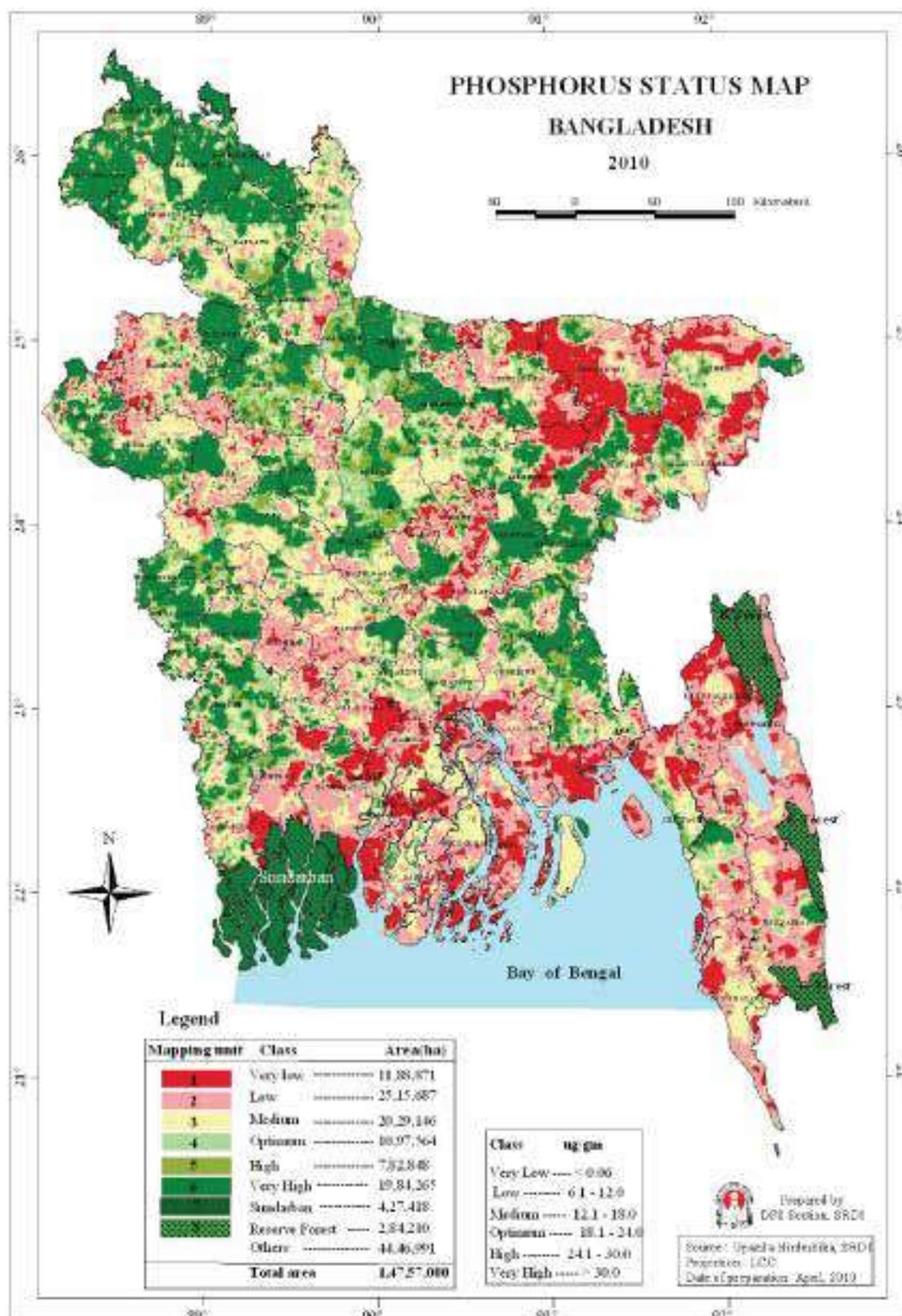
|                    |   |                           |   |
|--------------------|---|---------------------------|---|
| Name of the farmer | : | Soil sample No.           | : |
| Father's Name      | : | Land type                 | : |
| Mother's Name      | : | Flooding Depth(cm)        | : |
| Vill/Mouza         | : | Soil series/Dal           | : |
| Union/Block        | : | Existing cropping pattern | : |
| Upazila & District | : | Crops to be cultivated    | : |
| Date of Collection | : | Lab. Code No.             | : |

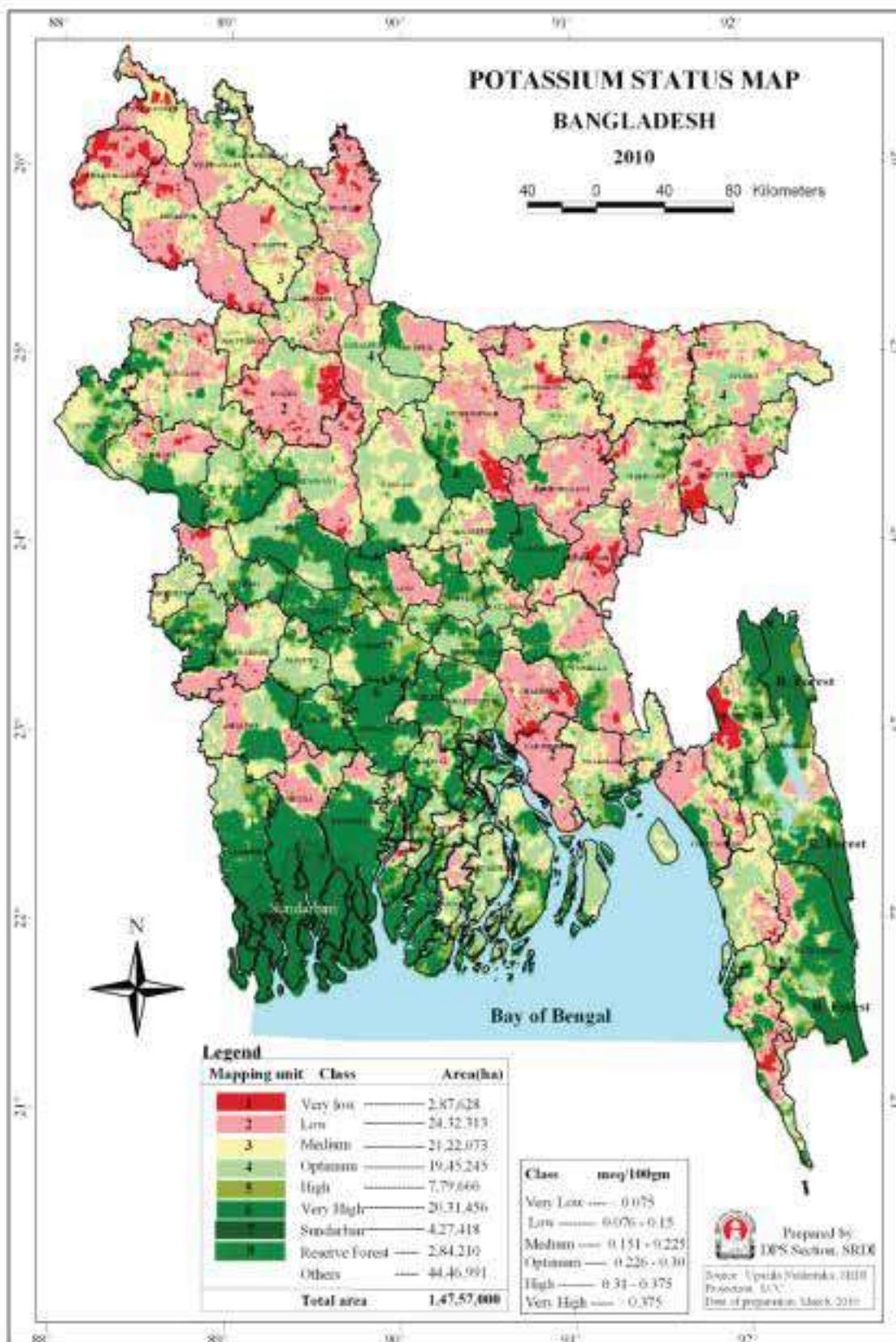


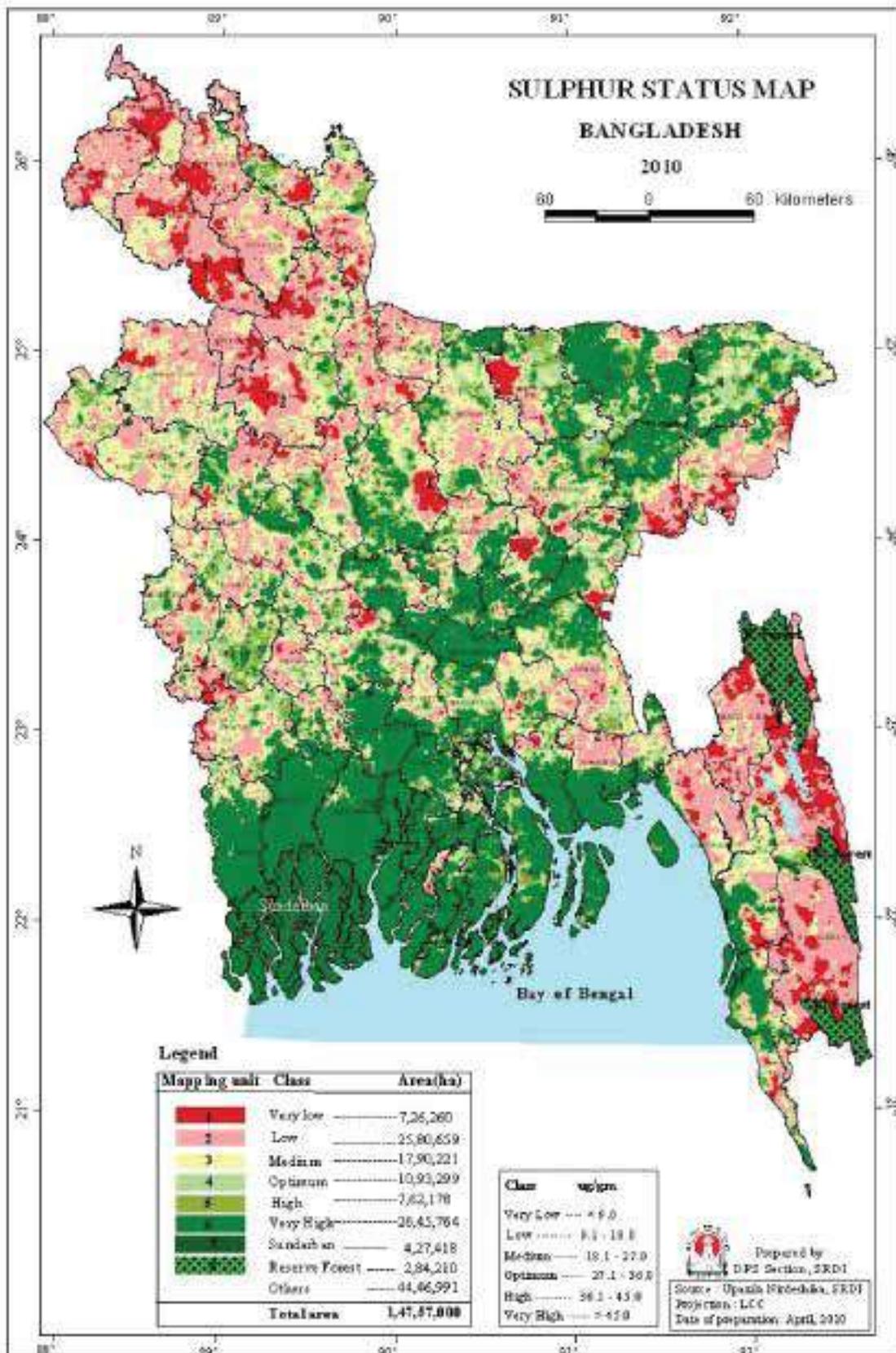


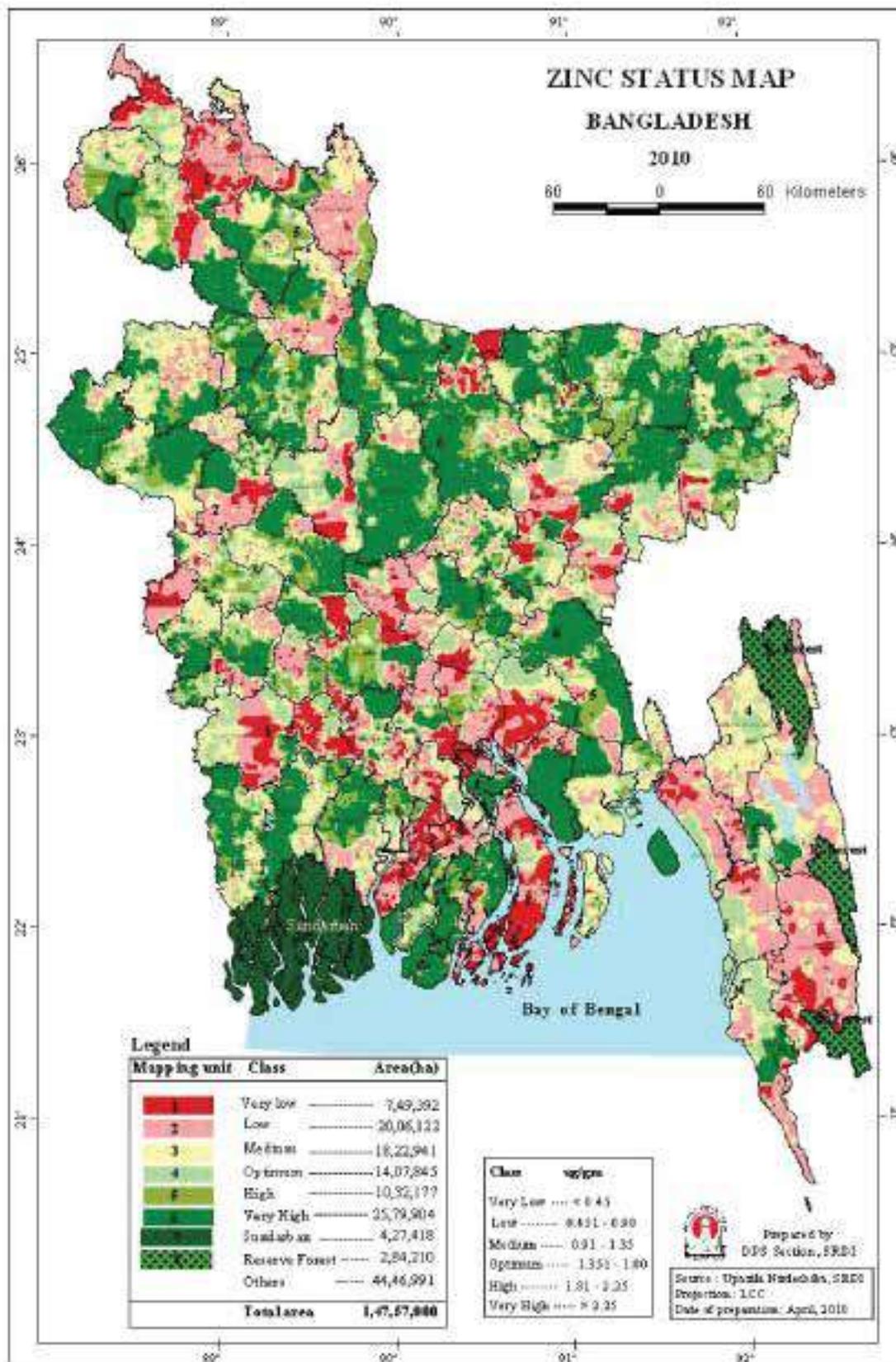


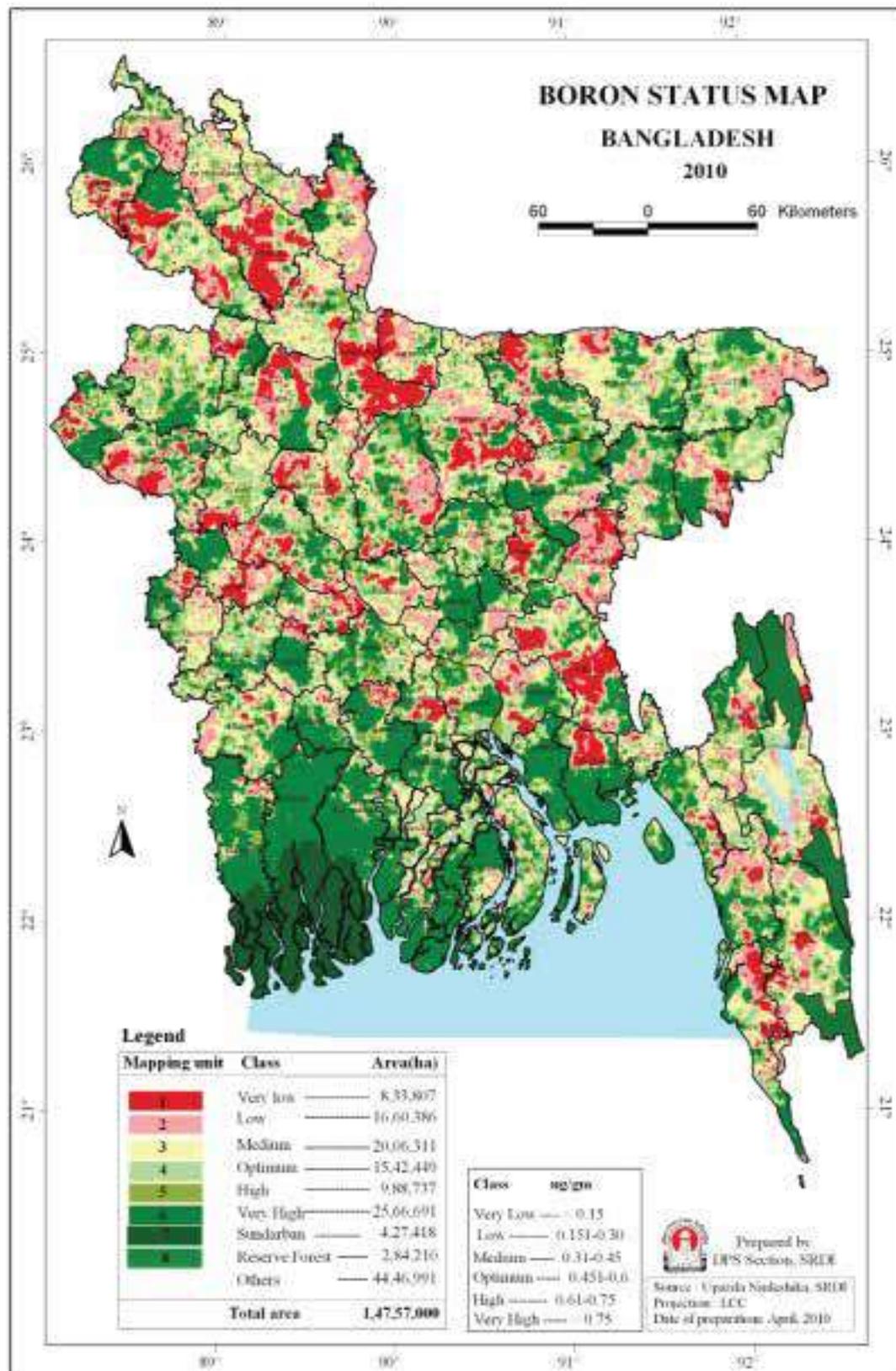


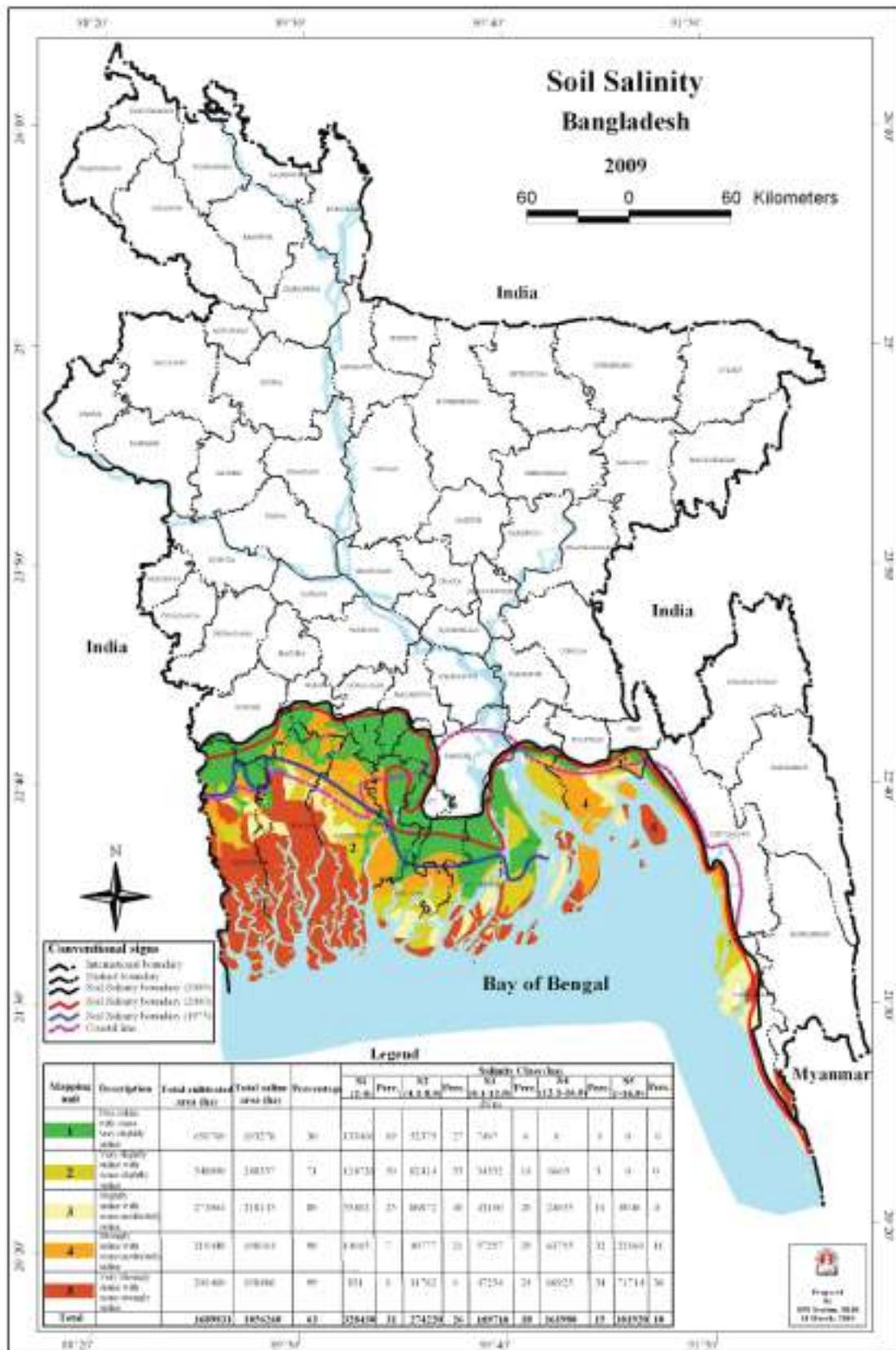












## ACRONYNS

|       |   |
|-------|---|
| AAO   | : Additional Agriculture Officer                            |
| ADP   | : Adenosine Diphosphate                                     |
| AEO   | : Agriculture Extension Officer                             |
| AEZ   | : Agro-ecological zone                                      |
| ATDP  | : <i>Agricultural Technology Development project</i>        |
| ATP   | : Adenosine Triphosphate                                    |
| BARC  | : Bangladesh Agricultural Research Council                  |
| BARI  | : Bangladesh Agricultural Research Institute                |
| BAU   | : Bangladesh Agricultural University                        |
| BCSIR | : Bangladesh Council for Scientific and Industrial Research |
| BFRI  | : Bangladesh Forest Research Institute                      |
| BINA  | : Bangladesh Institute of Nuclear Agriculture               |
| BJRI  | : Bangladesh Jute Research Institute                        |
| BRRRI | : Bangladesh Rice Research Institute                        |
| BSRI  | : Bangladesh Sugarcane Research Institute                   |
| BSTI  | : Bangladesh Standard Testing Institute                     |
| C.L.  | : Critical Limit  |
| CEC   | : Cation Exchange Capacity                                  |
| CHT   | : Chittagong Hill Tracts                                    |
| CNC   | : Critical Nutrient Concentration                           |
| DAE   | : Department of Agriculture Extension                       |
| DAP   | : Di-ammonium Phosphate                                     |
| DAP   | : Days after Planting                                       |
| DAS   | : Days after Sowing   |
| DAT   | : Days after Transplanting                                  |
| EC    | : Electrical Conductivity                                   |
| ESP   | : Exchangeable Sodium Percentage                            |
| FAO   | : Food and Agriculture Organization                         |
| GM    | : Green Manure  |
| HYG   | : High Yield Goal   |
| HYV   | : High Yielding Variety                                     |
| IFDC  | : International Fertilizer Development Centre               |
| IPNS  | : Integrated Plant Nutrient System                          |
| KUET  | : Khulna University of Engineering and Technology           |
| MoA   | : Ministry of Agriculture                                   |
| NRM   | : Natural Resources Management                              |
| NUE   | : Nutrient Use Efficiency                                   |
| OF    | : Organic Fertilizer  |
| SRDI  | : Soil Resource Development Institute                       |
| STVI  | : Soil Test Value Interpretation                            |
| UAO   | : Upazila Agriculture Officer                               |
| UNDP  | : United Nations Development Program                        |

The nation that destroys its soil destroys itself

-Franklin D. Roosevelt, 1937