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 admiringly 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, Amloki, 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 Ahmmed)
Member-Director (NRM)
BARC

FERTILIZER RECOMMENDATION GUIDE-2018

CONTENT

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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 $\mu g\ g^{-1}$. 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 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 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 $mg\ kg^{-1}$ and in soil solution is 10^{-6} $mol\ L^{-1}$. 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 $mg\ kg^{-1}$.

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) Hydrogen (H) Oxygen (O)	Nitrogen (N) Phosphorus (P) Potassium (K)	Calcium (Ca) Magnesium (Mg) Sulphur (S)	Iron (Fe) Manganese (Mn) Zinc (Zn) Copper (Cu)	Boron (B) Molybdenum (Mo) 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_1, and coenzyme A; helps in nodulation of legumes; present in glucosides (mustard oil)
Iron	Component of cytochromes, ferrodoxins and leghaemoglobin; involved in the nitrogenase and nitrate reductase enzymatic reactions, associated with chlorophyll formation, protein sinthesis
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_2 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_2 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 (blossomend 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 the 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.

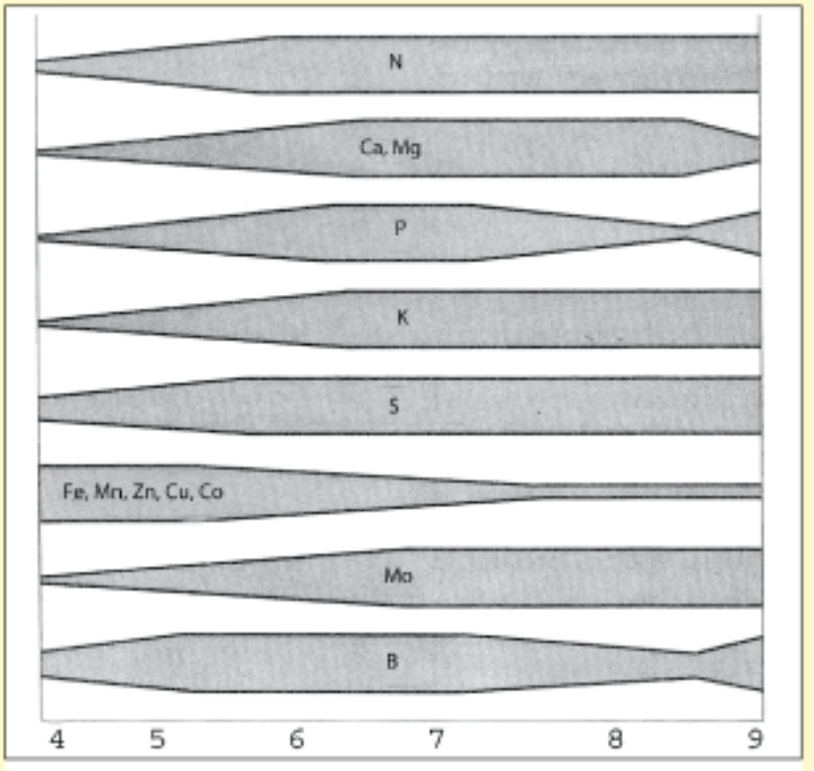

Fig. 1 Effect of soil pH on nutrient availability in soils

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 manuremay help reduce negative balances; the magnitude depends on the types and amounts of manureused. 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.

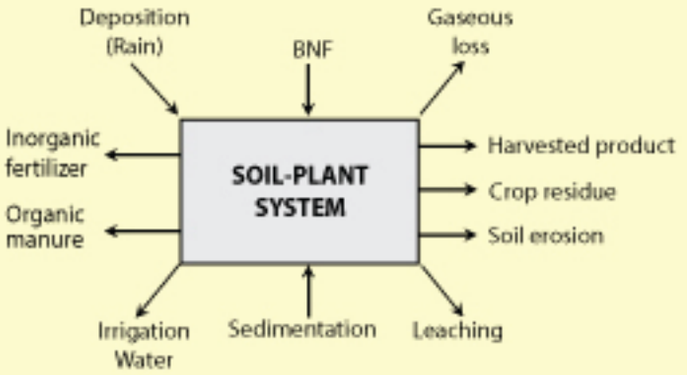

Fig. 2 Nutrient input-output system

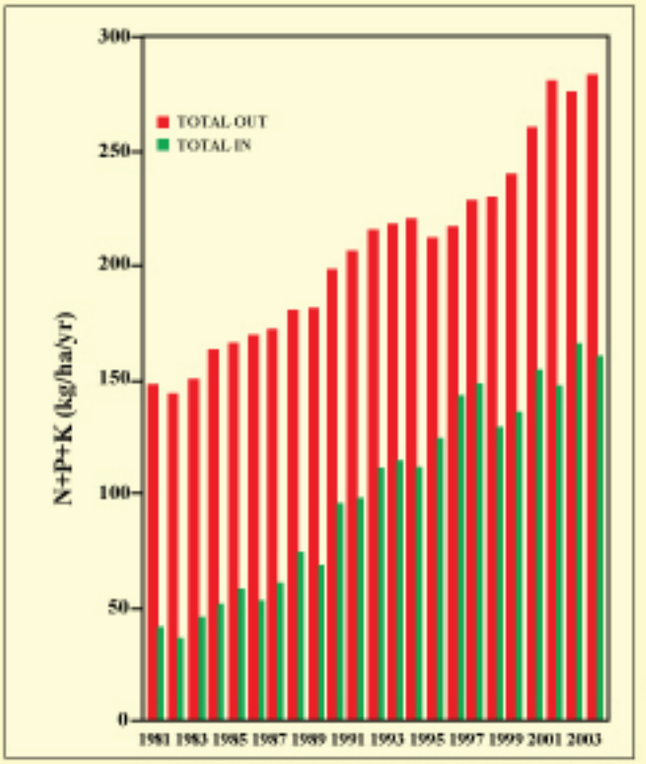

Fig. 3 ./Total N+P+K Inpot and Output in Bangladesh

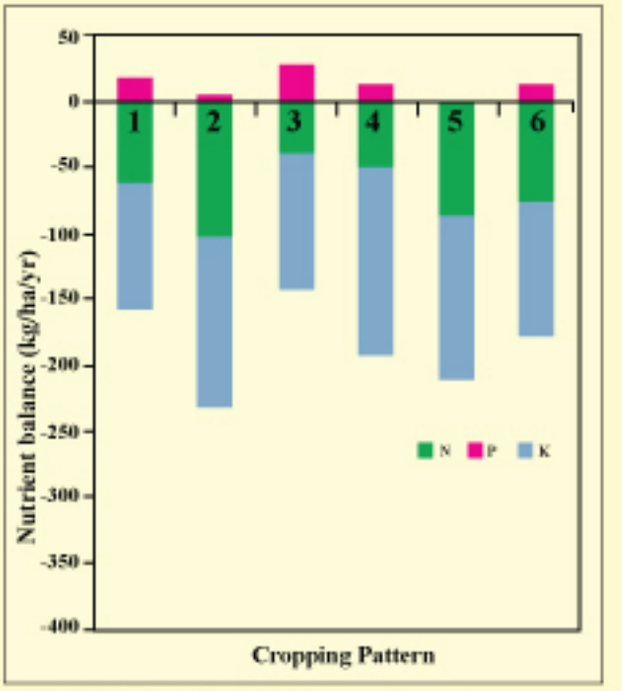

Fig. 4 ./Nutrient balance in different cropping pattrens:
1=Boro - Follow -T. Aman, 2= Boro - T. Aus-T.Aman
3=Boro - T. Aus -T.Aman, 3= Mustard - Boro T.Aman
5= Wheat - T.Aus - T.Aman, 6= Wheat - Mungbean -T.Amn

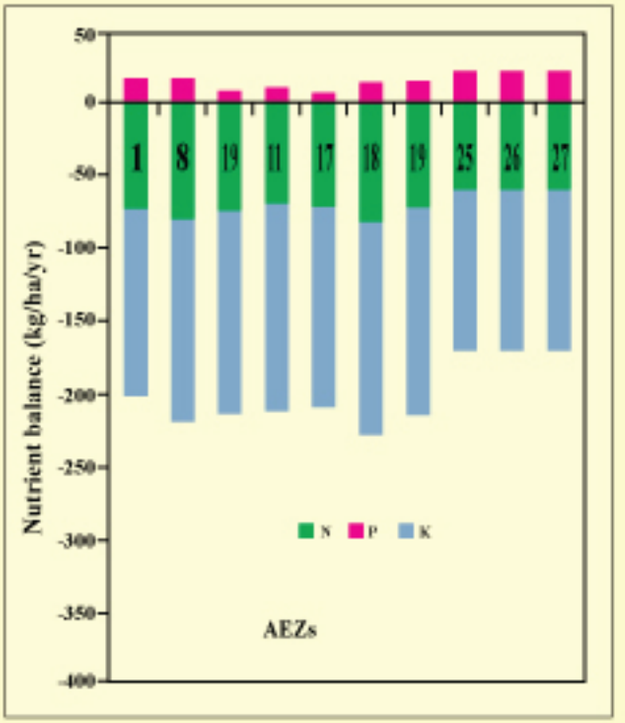

Fig. 5 ./Nutrient balance in Boro-Follow-T.Aman rice cropping pattern of different AEZs

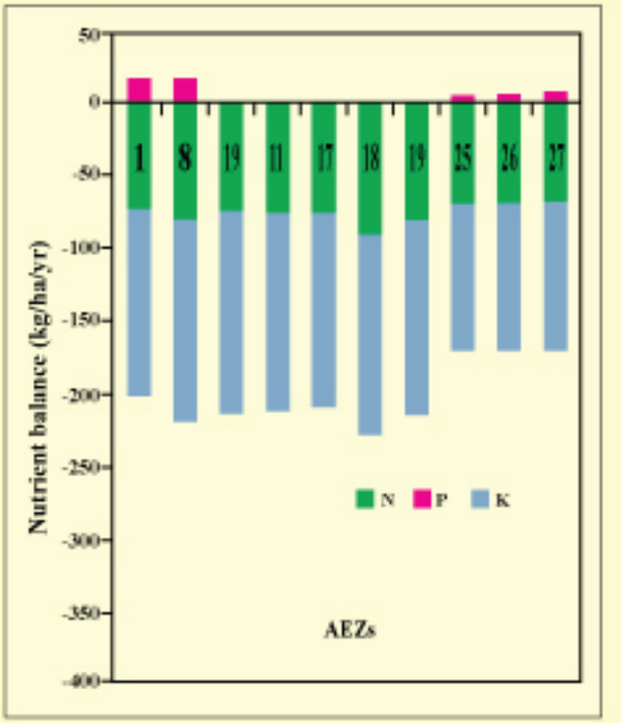

Fig. 6 ./ Nutrient balance in Wheat-Follow-T.Aman rice cropping pattern of different AEZs

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 tempera ture (<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 (85105 ha)	Naogaon	374	HL	2
	Natore	354	MHL	8
	Sirajganj	72	MLL	21
			LL	65
			HS+WB	4
6. Lower purnabhaba Floodplain (12896 ha)	Naogaon	72	MLL	10
	Chapai	57	LL	60
	Nawabganj		HS+WB	30
7. Active Brahmaputra-Jamuna Floodplain (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 Floodplain (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 (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 (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* type	Extent (%)
	Chandpur	159		
	Dhaka	134		
	Natore	82		
	Madaripur	52		
11. High Ganges River Floodplain (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 (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 (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 (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 (14436 ha)	Munshiganj	103	MLL	13
	Dhaka	41	LL	73
			HS+WB	14
16. Middle Mehgna River Floodplain (155464 ha)	Comilla	331	MHL	8
	Narshingdi	293	MLL	29
	B.Baria	278	LL	25
	Chandpur	233	VLL	11
	Munshiganj	152	HS+WB	27
	Kishorganj	141		
	Narayanganj	128		
17. Lower Meghna River Floodplain (90934 ha)	Chandpur	552	HL	14
	Laxmipur	275	MHL	28
	Noakhali	83	MLL	31
			HS+WB	27
18. Young Meghna Estuarine Floodplain (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 Floodplain (774026 ha)	Comilla	2251	HL	2
	B.Baria	1168	MHL	24
	Habigonj	817	MLL	33
	Chandpur	720	LL	21
	Noakhali	627	VLL	3
	Kishorganj	434	HS+WB	17
	Feni	307		
	Barishal	288		
	Munshiganj	275		
	Shariatpur	221		
	Laxpipur	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 Kushiyara 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	55
			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, Mc-Ch*, Mc-St, Mc-Vt*-Kt, Mc-Ch-Vt*, Mc-Mx-Kt, Kt-Mc, Mc-Kt-Vt* and Mc-Kt-Vt, where the symbols Mc, 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 Purnabhaba 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* Norther 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* Norther 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	L-M	L-M	L-M	L-M	L-M	L-M	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	L-M	L-M	L-M.	L-M	L-M	L-M	L-M
Medium highland (51%)	3.5-7.0	L-M	VL-L	L-M	L-M	L-M	L-M	L-M	L-M	L-M	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	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 Purnabhaba 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 caly 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 starts. 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 overlie 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.

Majorland 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[H]	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	L-M	L-M	L-M	L-M	L-M	L-M
Medium highland (55%)	4.4-7.2	L	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	L-M	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 under lying 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	≤ 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.

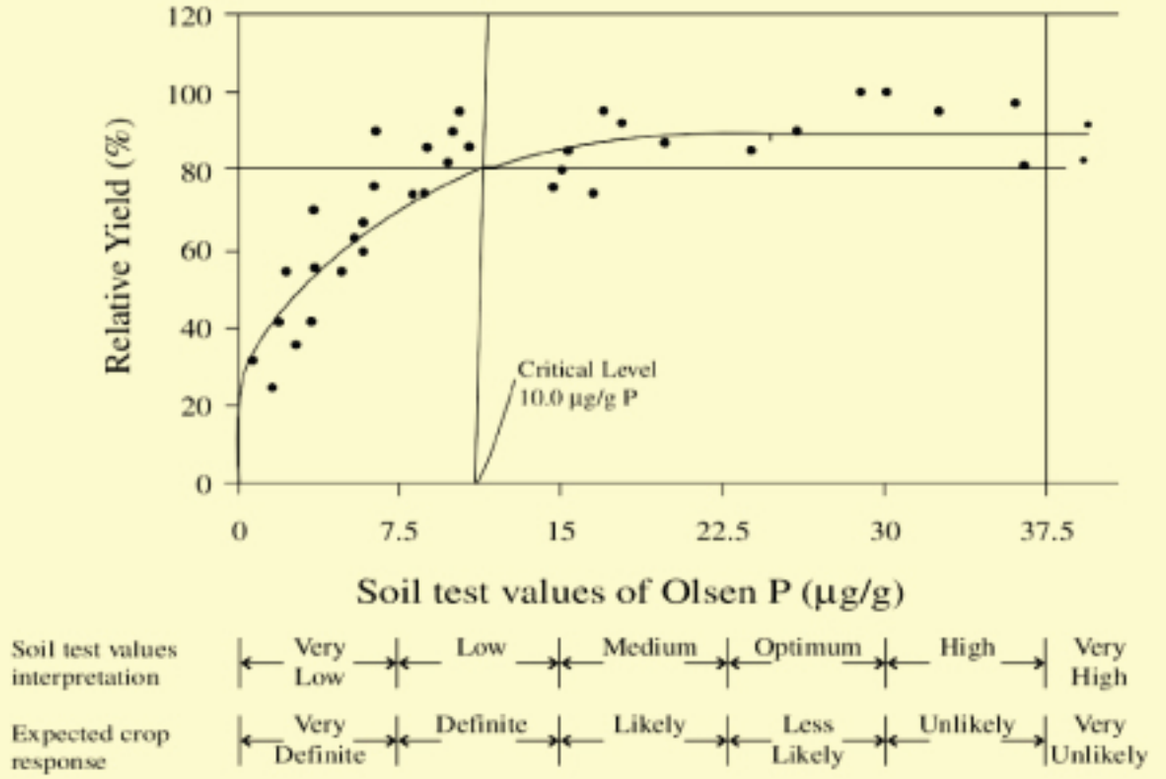


Fig. 7 Soil test interpretation and expected crop response based on critical limit (example for Phosphorus).

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:

$\acute{Y} = a+bx+cx^2$

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 (Ny) can be computed from the above equation as

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

Now, the nutrient rate that maximizes profit:

$$Np = \frac{1}{2c}\left(\frac{Pf}{Py} - b\right)$$

Where, Pf = Price of nutrient and Py = price of crop product

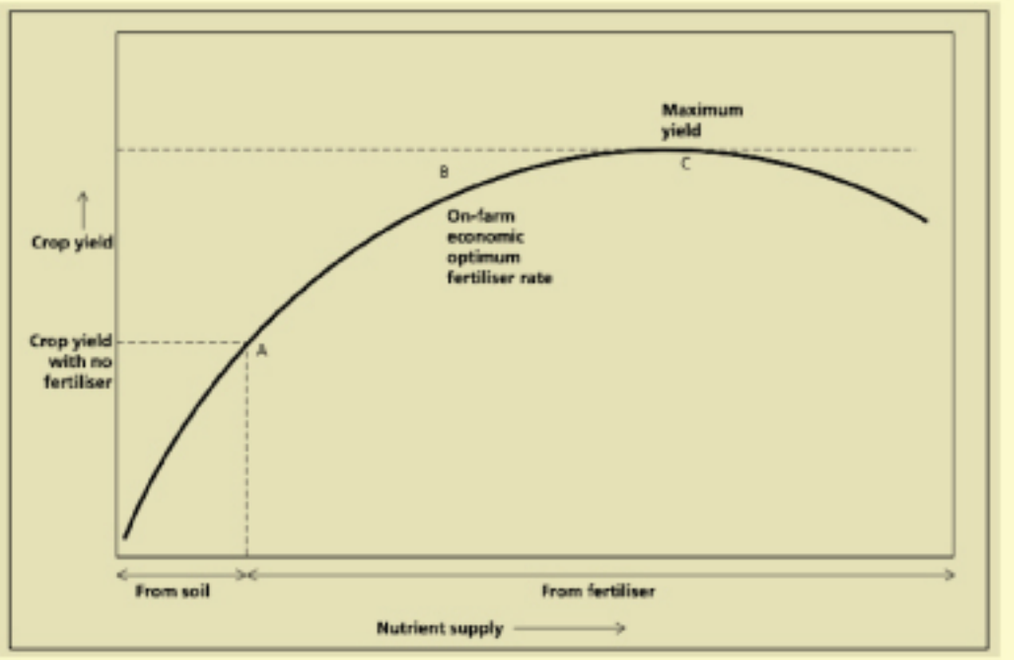


Fig. 8 Crop yield as influenced bynutrient supply from soil and fertilizer sources

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.

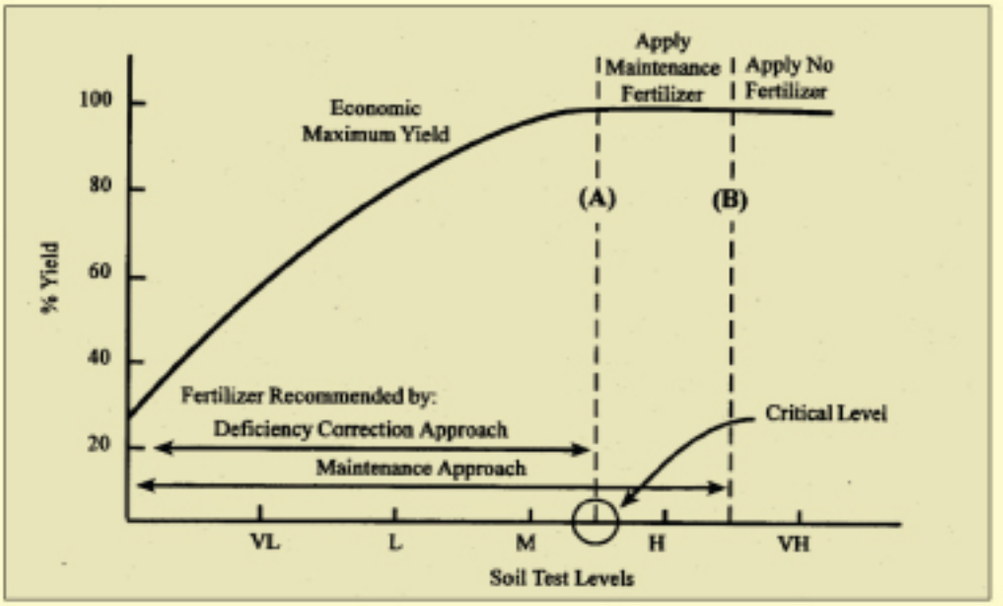


Fig. 9: Yield response as influenced by soil test level and soil test recommendation approach (Hergert, 1997)

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.

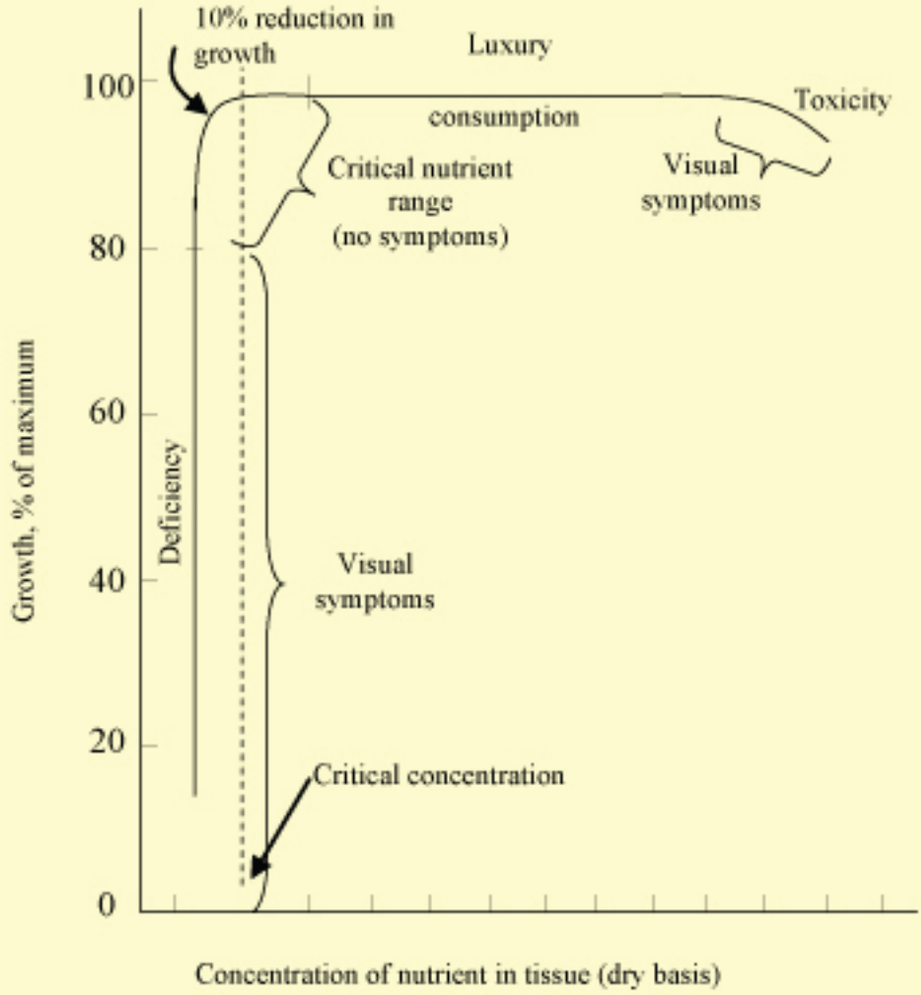


Fig. 10: Relationship between plant nutrient concentration and crop yield.Critical nutrient range (CNR) represents an economic yield loss withoutvisual deficiency symptoms.

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

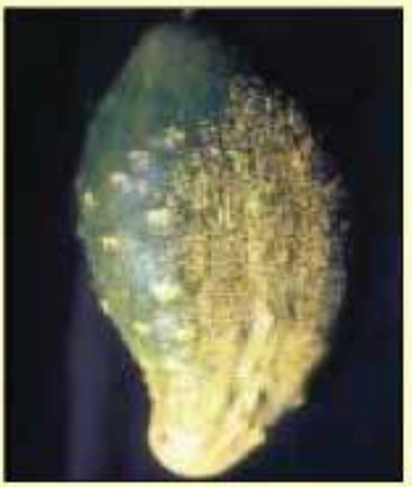
N deficient wheat field (Middle)

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

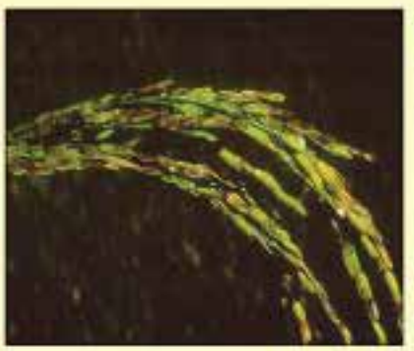
P deficient cabbage seedling

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 [$CaMg(CO_3)_2$] 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 Mayanmar. 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,

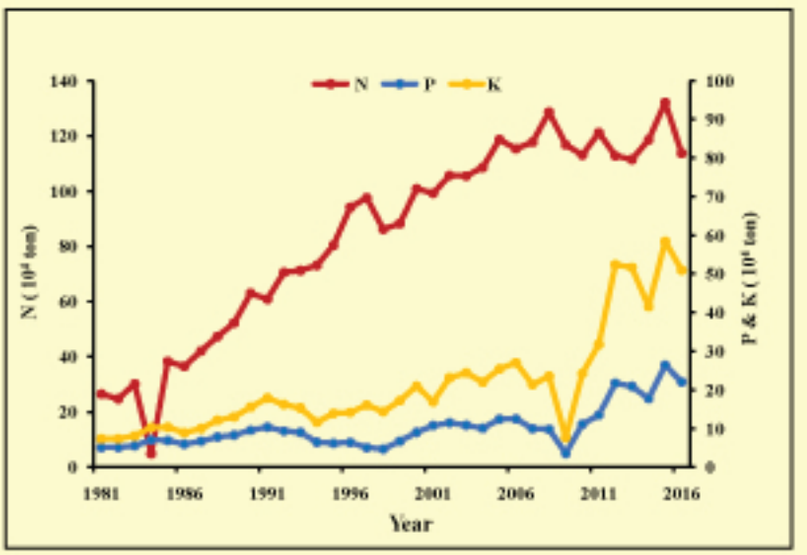


Fig. 11: Consumption of N, P and K fertilizers in Bangladesh during 1981 to 2016.

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:

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

AE = Agronomic efficiency

GY_{NA} = Grain yield (kg/ha) with addition of nutrient

GY_{No} = Grain yield (kg/ha) without addition of nutrient

N_R = 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 NH3 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_2 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_2 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-1 if 12-15 tons green biomass of dhaincha (Sesbania) is incorporated. This reduction could be 8-10 kg ha-1 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 recom mended 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-vege tables 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 dololime ($CaCO_3.MgCO_3$) 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 born 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^{-1})
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_2 fixing bacteria (e.g *Rhizobium, Azobtobacter*), 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 (BRRI 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_2 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_4), 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	-

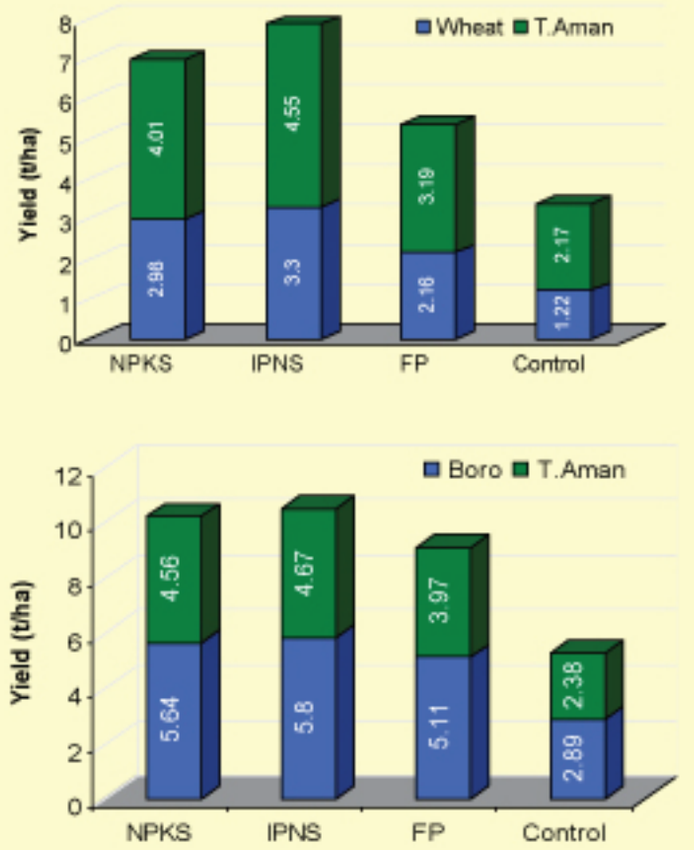


Fig. 9.1 Effects of different nutrient management packages on the yield of crops grown in sequence

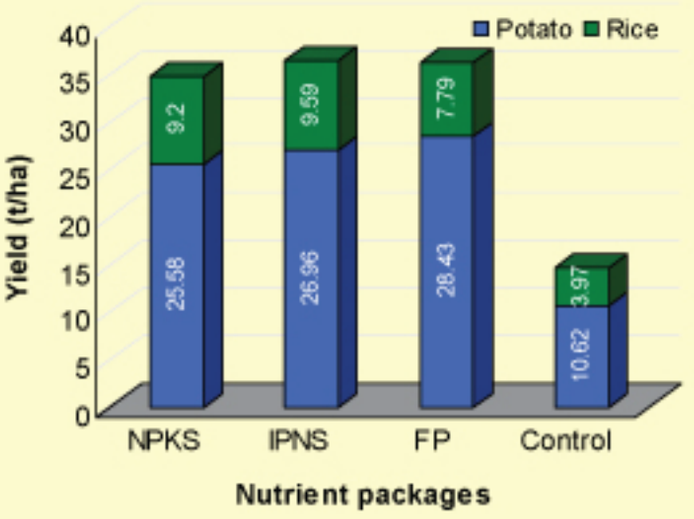


Fig. 12 Effects of different nutrient management packages on the yield of crops grown in sequence

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_2 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_2) 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^{2+}, Mg^{2+}, K^+ and Na^+) and continuous use of urea application are the principal causes of soil acidity in this country. Urea acidifies soils through the process of nitrification ($NH_4^+ + 2O_2 = NO_3^- + 2H^+ + H_2O$). Inputs of S as elemental S or as SO_2 from the atmosphere can also produce acidity when they are oxidized: (i) $2S + 3O_2 + 2H_2O = 2H_2SO_4$ (ii) $2SO_2 + O_2 + 2H_2O = 2H_2SO_4$. When microorganisms decompose soil organic matter they produce CO_2, which dissolves in soil water to form H_2CO_3 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 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^{3+}, Fe^{3+} and Mn^{2+}, deficient concentrations of P and Mo, and low availability of bases (Ca^{2+}, Mg^{2+}) 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.

Limimg 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 limimg 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.

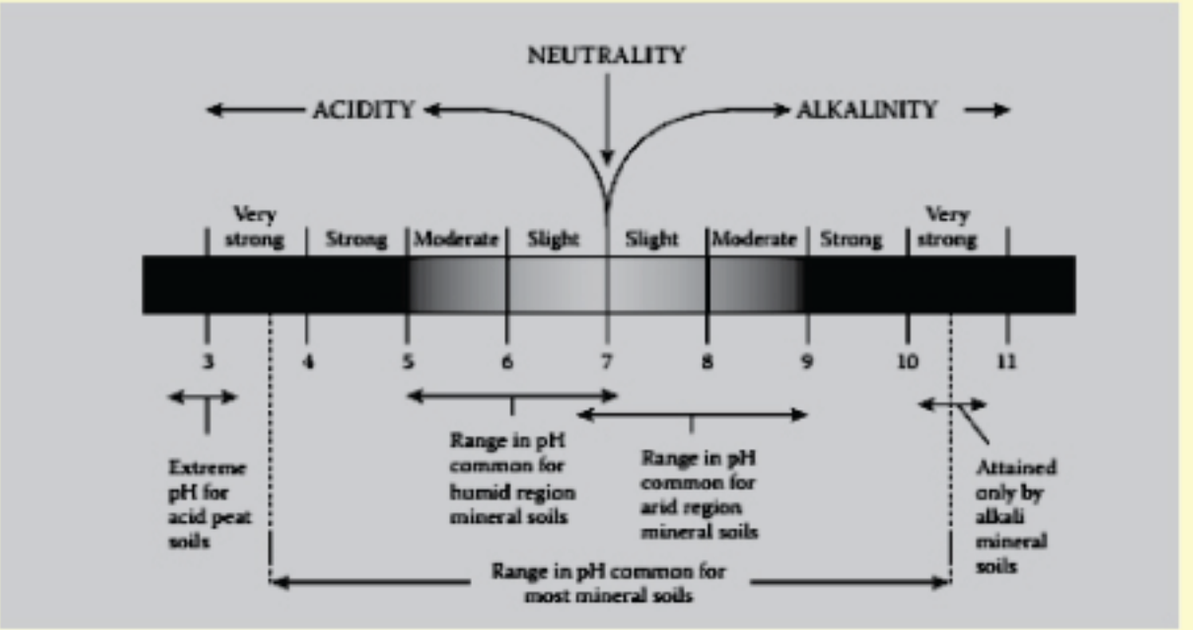


Fig. .... Soil pH interpretation scale for agricultural soils

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 section11.3 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 cons erve 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-tillageP 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 (Hazirhat, 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 tarro (Kalakachu)		
7. Backyard			Papaya, Banana, Guava, Lemon		
8.Partially shady place		:	Ginger, Turmeric, Moulovi 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 m2)

Vegetables	Fertilizer rate (g) and time of application (day)											
	Cow dung (kg)	TSP	Gypsum	$ZnSO_4$	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

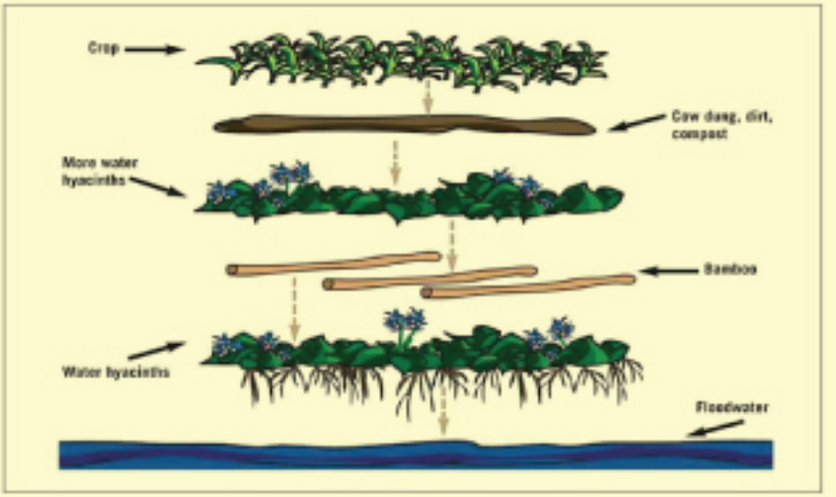
8.4 Fertilizer management for roof top gardening

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^2 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 andthe 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 section11.2 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 Patuakhili 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 250C, 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 Marh-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 landsoccur 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. Course 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

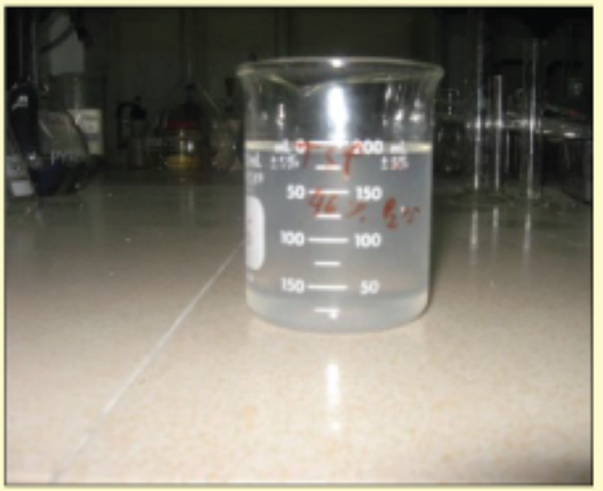
Adulteration of urea is very rare. In few cases misbranding *i.e.* packaging of other fertilizer in the bag of urea is observed. Urea fertilizer never exists in crystalline form.

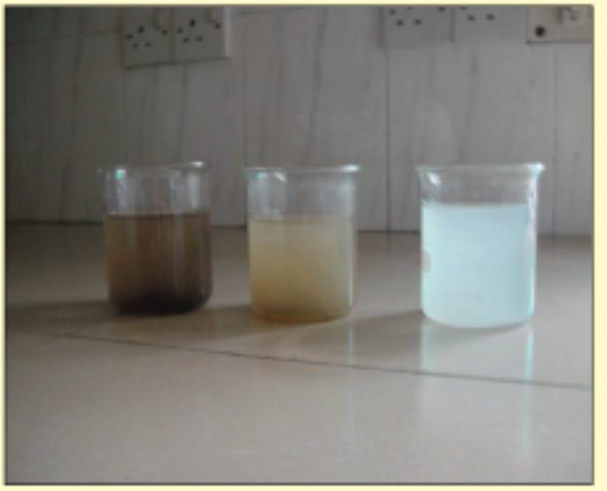
For quality testing, pour one teaspoonful of urea into two teaspoonful (10 ml) of water and stir them. Urea will be dissolved quickly and a clear solution will be developed. The solution will be felt cool as urea is hygroscopic. If other materials like lime are mixed with urea it will produce a pungent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

10.4.2 Identification of adulterated Triple Super Phosphate (TSP)

Triple Super Phosphateis 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 (BaCl2) into the solution. In case of good quality DAP, BaCl2 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 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 ($N:P_2O_5:K_2O:S$) 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 identity 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

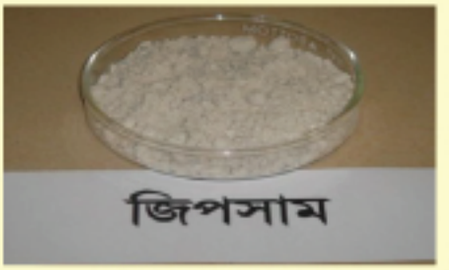
If adulteration is done by mixing with soil or gypsum along with black coating, the material will be broken down into powder by little pressing between two fingers. The color of outside and inside the granules will not be same or uniform in case of adulterated fertilizers.

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 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.



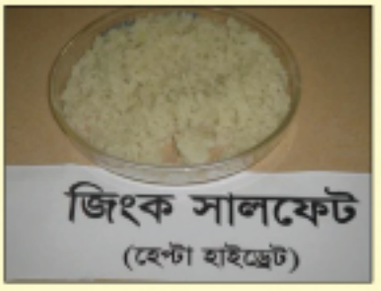
Good quality Gypsum

10.4.8 Identification of adulterated Zinc Sulphate, heptahydrate ($ZnSO_4.7H_2O$)

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

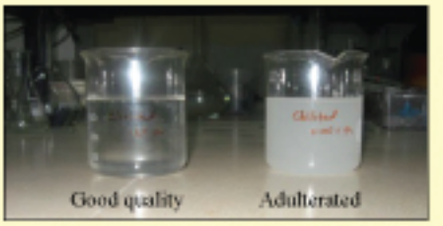
totally dissolved and no sediment will be found at the bottom of the beaker or glass container. But in case of adulterated zinc sulphate, heptahydrate there will be sediment at the bottom of the beaker or glass container.

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

10.4.9 Identification of adulterated Zinc Sulphate, monohydrate ($ZnSO_4.H_2O$)

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.

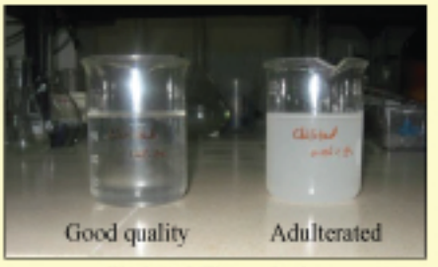


Good quality and adulterated Zinc sulphate, mono hydrate solution

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.

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

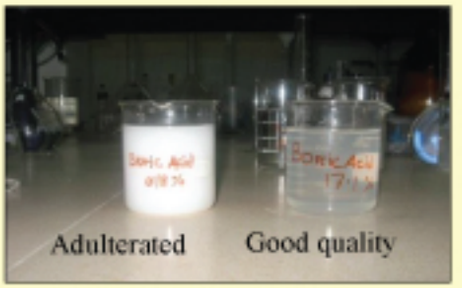
Boric acid and Solubor are used as boron fertilizers in Bangladesh.

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

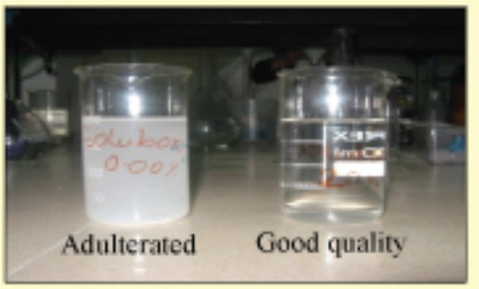
Solubor is white, fine powder, light weight, contains 20% B, dissolves fully in cold water and leaves no sediment in solution at the bottom.

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.

11 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 ± 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, BRRIdhan28, BRRI dhan45, BRRIdhan47, 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 ± 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 ± 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:

a) 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).

b) For light textured soils, half of K should be applied as basal and the rest half should be applied with last N topdressing.

c) N should be applied in three equal splits, the first one as basal/immediately after seedling establish ment, 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.

d) 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 ± 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 ± 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 discribed above

B. Aman rice

(Var. LIV under Broadcast Culture)

Yield Goal: 2.5 ± 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, BRRI dhan40, BRRI dhan41, BRRI dhan44, BRRI dhan46, BRRI dhan49, BRRI dhan51, BRRI dhan52, BRRI dhan53, BRRI dhan54, BRRI dhan56, BRRI dhan62, BRRI dhan66, BRRI dhan70, BRRI dhan71, BRRI dhan72, BRRI dhan73, BRRI dhan75, BRRI dhan76, BRRI dhan78, BRRI dhan79, BRRI dhan80, BRRI hybrid dhan4, BRRI 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 ± 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, BRRI dhan33, BRRI dhan34, BRRI dhan37, BRRI dhan38, BRRI dhan39, BRRI dhan56, BRRI dhan57 and Binadhan-12, Binadhan-13

Table 1. Yield Goal: 4.0± 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 methodas described in page – 76

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

Table 1. Yield Goal: 3.0 ± 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 forriceseedbed. For lowfertilesoils, manure at the rate of 2 kg/m2 can be applied. In case of Sulphur deficiency gypsum should be applied at the rate of 10 g/m2 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 Gom30, 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 ofP, K, S, Mg, Zn, B and organic manure (if used) should be applied as basalduring 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/hais recommended; if appliedthe 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 OFat 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 Varities. 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 taselling stage(50–60 DAS)and mixed thoroughly with the soil as soon as possible for better utilization.

d) In kharifseason,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 taselling 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 ± 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 ± 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 ± 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

a) Half of N and all of P, K, S, and Zn should be applied as basalduring final land preparation.

b) Remaining N should be applied as topdress in two equal splits after irrigation at 55-60 DAS for burley and foxtail millet and 30-35 DAS for proso millet.

c) 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 ± 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 BJRITossa-4 (O-72)]

Yield Goal: 4.5 ± 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

a) Half of N and all of P, K, S, Zn and organic fertilizer (if used) should be applied as basal during final land preparation.

b) Remaining N should be top dressed at 40–45 DAS under moist soil condition.

c) 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:

a) All of phosphorus, potassium, sulphur, Zinc, boron and organic manaure (if used) should be applied as basal during final land preparation.

b) Nitrogen fertilizer should be applied as topdress in three equal splits, the first one last one-third at 40-45- DAS

c) 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 tate of application of organic manure as per Apendix-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:

a) All of P, K, S,Zn, OF (if used) should be applied as basalduring final land preparation.

b) N fertilizer should be applied astopdress in three equal splits at final land preparation, 20–25 DAS and 40–45 DAS.

c) 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 harbaceum*)

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	

Methodof 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 dressingduring 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 dressingduring 40-45 DAS.
- 30% of N, 30% of K, 30% of S, 30% of Zn and 40% of B should be applied as side dressingduring 60-65 DAS.
- 15% of N and 10% of K should be applied as side dressingduring 75-80 DAS.
- After application the fertilizers should be mixed thoroughly with the soil as soon as possible for better utilization.

COTTON (*Gossypium harbaceum*)

(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 ± 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 ± 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

a) All fertilizers should be applied as basalduringfinal land preparation.

b) 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 ± 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 ± 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

a) All fertilizers should be applied as basalduring final land preparation.

b) 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

a) All of N, P, K and S should be applied as basalduring final land preparation.

b) 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

c) All of P, K and S should be applied as basal in the standing aman rice crop 2-3 days before sowing of the grasspeaseed. Nitrogen should be topdressedat 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

a) All fertilizers should be applied as basal during final land preparation.
b) 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 juncia 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		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

a) HalfofN and all of P, K, S, Mg, Zn, Band OF should be applied as basal during final land prepara tion.Remaining half N should be applied as top dress at the time of flower initiation stage (25 days after sowing).

b) Underrainfed condition, all fertilizers should be applied as basal during final land preparation.

c) 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).

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 prepara tion.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 prepara tion. RemainingN 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-1Binasoybean-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

a) All fertilizers should be applied as basal during final land preparation.

b) Inoculum (at the rate of 20 g/kg seed) must be used if available and in that case N fertilizer should not be used.

c) Application of OFat 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

a) Half of N and all P, K, S, Mg, Zn, B, and OFshould be applied as basal during final land prepara tion. Remaining half N should 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.

b) Application of OFat 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 (*Carthenus tintorious*)

(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 abyssincia*)

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)

a) 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.

b) 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 (Barselona), 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

a) All of OF,P, K, S, Mg, Zn, and B and half of N and Kshould be applied as basal during final land preparation.

b) Remaining half N and K should be applied as side dressing at30–35 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

a) 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.

b) Remaininghalf N and K should be applied as side dressing at 30–35 days after planting during earthing up operation.

c) 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

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) 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.

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.

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

a) 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.

b) 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

a) All of OF and all of P, K, and S and one third of N should be applied as basal during final land preparation.

b) Remaining N should applied as top dress after each harvest under moist soil conditionandmixed 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 Kshould be applied in two equal splits at 14 and 28 days after planting under moist soil conditionandmixed 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

a) All of OF, P, K, and S; 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 15 and 35 DAS under moist soil conditionand 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

a) All of OF, P, K, and S; and half of N should be applied as basalduring final land preparation.

b) 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 (Apurbo), 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 HybridTomato-6, BARI Hybrid Tomato-7, Roma VF, Binatomato-4, Binatomato-5, Binatomato-6, Binatomato-7, Binatomato-8, Binatomato-9, Binatomato-10, Binatomato-11and 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 OFand all of P, S, Zn, and B should be applied as basal during final land preparation. Remaining OF should be applied in pits beforeplantingof 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, BARITomato-19, BARI HybridTomato-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 OFand all of P, S, Zn, and B should be applied as basal during final land preparation. Remaining OFshould be applied in pits beforeplantingof seedlings.

b) N and K should be applied in three equal splits at 20, 40 and60 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 OFand all of P, S, Zn, and B should be applied as basal during final land preparation. Remaining OFshould 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 OFand all of P, S, Zn, and B; and one-fourth of N should be applied as basal during final land preparation.

b) Remaining three-fourthN should be applied at 20, 40 and 60 DASunder moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

RADISH (*Raphnus sativus*)

[Var. BARI Mula-1 (Tasakisan), 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 OFand 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 ±v 1.0 t/ha[1] and 12.0 ± 1.2 t/ha[2]

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 basalduring 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 Motorshoti-1, BARI Motorshoti-2, BARI Motorshoti-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

a) All of OF, P, S, Zn, and B should be applied in pit 5–7 days before planting and mixed thoroughly with the soil.

b) N should be applied around the plant as side dressing at 15, 35, 55 and 75 DATunder 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 Potol-1 and BARI Potol-2, BARI Hybrid Potol-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)

a) All of OF, P, S, Zn, and B should be applied in pit 5–7 days before planting and mixed thoroughly with the soil.

b) 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

a) All of OF, P, S, Zn, and B should be applied in pit 5–7 days before planting and mixed thoroughly with the soil.

b) Nitrogen should be applied around the plant as side dressing at 15, 35, 55 and 75 DA Tunder 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

a) 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.

b) 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, BARIPeyaz-2,BARIPeyaz-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		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. BARIPeyaz-2, BARIPeyaz-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

a) All of OF, P, S, Zn, and B and half of N and K should be applied as basal during final land preparation.

a) 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 Kshould be applied at the time of first mulchingunder moist soil conditionand 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 bytopdressing 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:

a) All of OF, P, K, S, Zn, and B; and half of N should be applied as basalduring final land preparation.

b) Remaining N should be applied at the 6th week of planting under moist soil conditionandmixed 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

a) All of OF, P, K, S, Zn, and B; and half of N should be applied as basal during final land preparation.

b) Remaining N should be applied in two equal splits at 80 and 110 DAPunder moist soil conditionandmixed 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

a) All of OF, P, K, S, Zn, and B; and half of N should be applied as basal during final land preparation.

b) Remaining N should be applied in three equal splits at 25, 50 and 70 DAPunder moist soil condi tionandmixed 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

a) All of OF, P, K, S, Zn, and B; and half of N should be applied as basalduring final land preparation.

b) Remaining N should be applied as top dress at 30 DAS under moist soil conditionand 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 ± 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 ± 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

a) All of OF, P, K, S, Zn, and B should be applied as basalduring final land preparation.

b) 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:

a) 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.

b) For growing plant N, P and K should be applied in two equal splits during April–May and Septem ber–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
1st TD*	46	–	60	–	–	–	–
2nd TD	46	–	60	–	–	–	–
3rd TD	46	–	60	–	–	–	–
4th TD	92	–	120	–	–	–	–
Total	**230**	**80**	**300**	**36**	**1.2**	**0.34**	**5**

***TD: Top dressing**

Method of application

a) Half of OFand P, and all of S, Zn, and B, recommendedfor basal application should be applied in pit 10-15 days before planting of sucker and mixed thoroughly with the soilfollowed by irrigation. The remaining half manure and P should be applied as broadcastbefore final land preparation.

b) 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 twom onthsinter valandthe 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
1st TD*	25	–	25	–	–	–	–
2nd TD	25	–	25	–	–	–	–
3rd TD	25	–	25	–	–	–	–
4th TD	50	–	50	–	–	–	–
5th TD	50	–	50	–	–	–	–
6th TD	50	–	50	–	–	–	–
Total	**225**	**100**	**225**	**45**	**2.5**	**4**	**5**

Method of application:

a) The basal dose should be applied in pit 10-15 days before planting seedlings and mixed thoroughly with the soil followed by irrigation.

b) The first top dressing of N and K should be done around the plant after 30 days of seedling estab lishment and mixed thoroughly with the soil followed by irrigation.

c) 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 soilfollowed 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

a) All of OF, P, S, and Znshould be applied as basal during final land preparation.

b) The N and K should be applied in five equal splits as side dressing at onemonth 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

a) All of OF, P, S, Zn, and B should be applied in pit 5–7 days prior to seedlingplantingand mixed thoroughly with the soil.

b) 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-9and 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

a) Before planting,OF, P, S, Zn, and B should be applied in pit as basal dose15-20 days before plant ing of sapling and mixed thoroughly with the soil followed by irrigation.

b) For the growing trees, fertilizers should be applied annually in two equal splits, one .half immedi ately 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 leav ing1.0–1.5 m from the tree baseand 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 (KaziPayara), 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 dose15-20 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

a) Before planting,recommendedOF, 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.

b) For growing trees, the recommended fertilizers includingOFshould be applied in two equal splits, during April–May and September–October around the trees up to 2–3 metersleaving 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.

c) For the orchard, fertilizers may be broadcast and mixed with the soil by ploughingshallowlywith power tillerfollowed 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

a) 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.

b) 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.

c) 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

a) 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.

b) For growing trees, the recommended fertilizers should be applied in three equal splits, during February, MayandSeptember (for Mandarin) – October (for Pummelo). Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree baseand mixed gently with the soil followed by irrigation. Under hill condition, drilling method should be followed.

c) 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 ± 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 ± 1.5kg/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

a) 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.

b) 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-Mayand 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.

c) 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

a) Before planting, recommended OF and Pshould 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 Febru ary, Mayand October. Fertilizer should be applied around the tree up to the canopy spread leaving50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

c) 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

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 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

a) Before planting, recommended OF and Pshould 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 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 leaving50-100 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 (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 (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

a) Before planting, recommended OF and Pshould 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 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 leaving50-100 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 splitsdurin 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

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 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 spreadleaving1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

AONLA (*Emblica officinalis*)

(Var. BARI Amloki-1, BAU Amloki-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

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.

c) 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 spreadleaving1.0-1.5 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 (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 ± 50fruits/tree (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				OF (kg/tree/year)
	N	P	K	S	
Beforeplanting	-	-	-	-	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 splitsduring May and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving0.5-1.0 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

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 three equal splits during February, May and October (just after harvesting of fruit) for Elephant's Foot Apple; and during April-MayandSeptember-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 ± 0.25 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				OF (kg/tree/year)
	N	P	K	S	
Beforeplanting (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 ± 12 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)	-	-	-	-	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

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 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 variet ies (80 ± 8 kg/tree/year); and in two equal splits during May-June and September-October forlow 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

a) All of OF, P,S, Zn and B; and half of potassium should be applied as basal during final land preparation.

b) 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

a) Before planting, recommended OFshould 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 leaving0.5-1.0 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

a) Before planting, recommended OFshould 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 leaving0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

STAR GOOSE BERRY (*Phylanthus 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

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.

d) 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 spreadleaving1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

Fig (*Ficus carica*)

(Var. BAU Dumur-1)

Yield Goal: 5 ± 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 ± 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 spreadleaving1.0-1.5 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 (kg/tree/year)
	N	P	K	
Before 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

a) Before planting, recommended OFshould 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 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

a) 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).

b) 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 soilbefore 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).

c) Top dressing of N and K in both the cases (a and b) should be done under moist soil condi tion. If the soil is dry, top dressing should be delayed for rainfall.

d) For transplanted sugarcane basal N should be applied 20–30 DAT.

e) 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

a) All of OF, P, S, Mg and 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 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

- 1st split : April – May
- 2nd split : August
- 3rd split : October – November

Mature tea*

Yield (kg/ha)		Nutrient Recommendation (kg/ha)					
	1st Split				2nd 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) Ureais generally used in tea cultivation as the source of nitrogen; and TSP/Rock phos phate/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(CO3)2] 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 ofplant (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

a) Fertilizers should be applied in two equal splits annually.

b) Rate of N is 90 kg/ha for the first to third year; and from fourth year onwards N rate is100 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 basalatthe 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 upto 1.0–1.5 meter in length.
c) N should be applied in 3 equal installments before the monsoonrain 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 11years 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 Srecommended for 'before planting' applicationshould be applied in pit as basal dose 15-20 days before planting of seedling and mixed thoroughly with the soilfollowed 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 ± 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

a) 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.

b) 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.

c) P should be applied in alternate year as broadcast and mixed thoroughly with the soil followed by irrigation.

d) 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

a) All of OF and chemical fertilizers except N should be applied as basal during final land preparation.
b) 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

a) All of organic and chemical fertilizers except N should be applied as basal during final land preparation.
b) 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

a) All of organic and chemical fertilizers except N should be applied as basal during final land preparation.
b) 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

a) All of organic and chemical fertilizers except N should be applied as basal during final land preparation.
b) 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

a) All of P, K, S and Zn and half of N should be applied as basal during final land preparation.
b) The rest half of N should be top dressed after 25 days of sowing/planting.
c) After each cut (at 30 – 40 days intervals), half of the recommended rate of N should be topdressed.

GERMAN GRASS (*Echinocloa 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

a) Full rate of P and K and half of N should be applied as basal during final land preparation.
b) The rest half of N should be top dressed after 25 days of sowing/planting.
c) 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

a) Full rate of P and K and half of N should be applied as basal during final land preparation.
b) The rest half of N should be top dressed after 25 days of sowing/planting.
c) 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 requirementof 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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Boro	6.0 ± 0.6	144	9	60	6	-	2	-	-	-
Kharif-2	T. Aman	5.0 ± 0.5	90	7	50	6	-	1	-	-	-
Rabi	Potato	30 ± 3.0	135	20	90	15	5	-	1.5	-	3.0
Kharif-1	Boro	6.0 ± 0.6	144	9	39	6	-	2	-	-	-
Kharif-2	T. Aman	3.0 ± 0.5	90	7	33	6	-	1	-	-	-
Rabi	Potato	30 ± 3.0	135	20	90	15	5	-	1.5	-	3.0
Kharif-1	Maize	6.0 ± 0.6	135	23	31	14	5	2	-	-	-
Kharif-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	-	-
Kharif-1	Maize	6.0 ± 0.6	135	36	31	27	5	2	-	-	-
Kharif-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	-	-
Kharif-1	Jute	3.5 ± 0.35	75	5	40	15	-	1.5	-	-	-
Kharif-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	-	-
Kharif-1	T. Aus	4.0 ± 0.4	72	5	40	9	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-
Kharif-1	M. bean	2.0 ± 0.20	18	8	16	12	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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 Gaibandha, 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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-2	Fallow	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8 ± 0.18	90	18	40	10	2.5	-	1.0	-	3.0
Kharif-1	Boro	6.0 ± 0.6	144	8	60	4	-	2.0	-	-	-
Kharif-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
Kharif-1	Boro	6.0 ± 0.6	144	8	39	4	-	2.0	-	-	-
Kharif-2	T. Aman	5.0 ± 0.5	90	6	33	4	-	1.0	-	-	-
Rabi	Potato	30 ± 3.0	135	20	90	10	5	-	1.5	-	3.0
Kharif-1	Maize	6.6 ± 0.6	135	16	31	18	-	2.0	-	-	-
Kharif-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	-	-
Kharif-1	Jute	3.5 ± 0.35	75	4	40	5	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Jute	3.5 ± 0.35	90	6	50	16	-	0	-	-	-
Kharif-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	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-
Kharif-1	T. Aus	4.0 ± 0.4	72	4	40	6	-	-	-	-	-
Kharif-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
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	75 ± 7.5	180	24	76	12	-	2.0	-	-	-
Kharif-1	B. Aman	2.5 ± 0.25	36	9	20		-	-	-	-	-
Kharrif-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 Purnabhaba 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	-	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-2	Fallow	-	-	-	-	-	-	-	-	-	-
Rabi	Wheat	4.5 ± 0.45	120	16	30	5.0	-	-	1.0	-	-
Kharif-1	T. Aus	4.0 ± 0.4	72	4	20	3.0	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	5.0 ± 0.5	90	6	25	4.0	-	-	-	-	-
Rabi	Cowpea	1.4 ± 0.14	15	10	6	3.0	-	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	5.0 ± 0.5	90	6	25	4.0	-	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-
	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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, Sirajaganj 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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-
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	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	Radish	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 adjoing 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	-	-	-
Kharif-1	T. Aus	4.0 ± 0.4	72	7	40	3.0	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	Jute (O)	4.5 ± 0.45	90	8	50	8.0	-	-	-	-	-
Kharif-2	T. Aman	5.0 ± 0.50	90	8	50	4.0	-	-	-	-	-
Rabi	Boro	7.5 ± 0.75	180	24	76	12	-	1.5	-	-	-
Kharif-1	B. Aman	2.5 ± 0.25	36	5	20	2.0	-	-	-	-	-
Kharif-2		-	-	-	-	-	-	-	-	-	-
Rabi	Boro	7.5 ± 0.75	180	24	76	12	-	1.5	-	-	-
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	4.0	-	1.5	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	B. Aman	2.5 ± 0.25	36	5	20	2.0	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	-	-	-	-	-	-	-	-	-	-	-
Kharif-2	Fallow	-	-	-	-	-	-	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-1	T. Aus	4.0 ± 0.4	72		40	6.0	-	1.5	-	-	-
Kharif-2	T. Aman	5.0 ± 0.5	90		50	4.0	-	1.0	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-2	Fallow	-	-	-	-	-	-	-	-	-	-
Rabi	Boro	6.0 ± 0.6	144	21	60	8	-	2.0	-	-	-
Kharif-1	T. Aus	4.0 ± 0.4	72	7	40	3	-	-	-	-	-
Kharif-2	T. Aman	4.0 ± 0.4	72	7	40	3	-	1.5	-	-	-
Rabi	Lentil	1.8 ± 0.18	21	18	14	6	-	1.0	-	-	-
Kharif-1	Jute (O)	4.5 ± 0.45	90	8	51	8	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Jute (O)	4.5 ± 0.45	90	8	51	8	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	T. Aus	4.0 ± 0.4	72	7	40	6	-	-	-	-	-
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	8	-	2.0	-	-	-
Kharif-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	-	-	-
Kharif-1	Jute (O)	4.5 ± 0.45	90	8	51	8	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Jute (O)	4.5 ± 0.45	90	8	51	8	-	-	-	-	-
Kharif-2	Fallow	-	-	-	-	-	-	-	-	-	-
Rabi	Maize	10 ± 1.0	225	60	80	30	-	4.0	1.0	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-
Kharif-1	M. bean	2.0 ± 0.2	18	12	16	4	-	-	-	-	-
Kharif-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 sourth-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, Barguna, 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	Falllow	-	-	-	-	-	-	-	-	-	-

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	75 ± 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
	Boro	7.5 ± 0.75	180	9	76	6	-	1.5	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-2	-	-	-	-	-	-	-	-	-	-	-
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 (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	-	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	40 ± 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
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	(t/ha)
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	Sugarcan	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
	Caulitflower	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	Sugarcan	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	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-	-
Kharif-1	T. Aus	4.0 ± 0.40	72	5	40	6	-	-	-	-	-
Kharif-2	T. Aman	4.0 ± 0.40	72	5	40	6	-	1.5	-	-	-
Rabi	Potato	30 ± 3.0	135	20	90	10	5	-	1.0	-	-
Kharif-1	T. Aus	4.0 ± 0.40	72	5	26	6	-	1.0	-	-	-
Kharif-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	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	5.0 ± 0.50	90	7	50	4	-	1.0	-	-	-
Rabi	Potato	30 ± 3.0	135	20	90	10	5	-	1.0	-	-
Kharif-1	Boro	6.0 ± 0.6	144	9	39	8	-	1.5	-	-	-
Kharif-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	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-
Kharif-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	-	-
Kharif-1	Jute (O)	4.5 ± 0.45	90	7	50	8	-	-	-	-	-
Kharif-2	T. Aman	5.0 ± 0.50	90	7	50	8	-	1.0	-	-	-
Rabi	Sugarcan	100 ± 10.0	180	40	90	30	20	2.5	-	-	-
Kharif-1	-	-	-	-	-	-	-	-	-	-	-
Kharif-2	-	-	-	-	-	-	-	-	-	-	-
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	-	-	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	-	-	3.0
	Potato	30 ± 3.0	135	20	90	10	5	2.0	1.0	-	3.0
Kharif-1	Okra	16 ± 1.6	90	20	39	5	-	-	-	-	-
	Indian spinach	45 ± 4.5	105	11	33	5	-	-	-	-	-
	Bottle gourd	30 ± 3.0	60	20	29	6	-	-	-	-	-
	Brinjal	60 ± 6.0	135	24	68	5	-	-	-	-	-
	Amaranthush	30 ± 3.0	90	10	25	8	-	-	-	-	-
Kharif-2	Brinjal	60 ± 6.0	135	24	46	5	-	1.0	-	-	1.5
	Bottle gourd	30 ± 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	Sugarcan	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 (t/ha)	Nutrient Recommendation (kg/ha)								OF (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	Falow		-	-	-	-	-	-	-	-	-
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	Sugarcan	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 (t/ha)	Nutrient Recommendation (kg/ha)								OF (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 AEZ: 8, 9, 11	*Rabi* + *Kharif*	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: 1/4th 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 AEZ: 8, 9, 11, 25	*Kharif*	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 (75cn × 20cm + 1line Indian spinach.

Fertilizer application method:

a) 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 AEZ: 9, 11, 18	*Rabi*	Sweet gourd + Cabbage	30 43	80 90	35 50	100 90	25 18		2 -	1 -	5 -

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:

a) 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.

b) In cabbage, all of cowdung/manure, P, S and B should be applied as basal during final land preparation.

c) 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 AEZ: 8, 9, 11	*Rabi*	Brinjal + Coriander	15 0.60	190	40	140	20	-	2	1	5

Sowing time : Mid October to November

Spacing : Brinjal : 70cm × 60cm
Coriander: 10cm × cotinuous sowing
(Two rows coriander between two rows of brinjal)

Fertilizer application method:

a) Two third of N, K and all of organic menure, P, S should be applied as basal during final land preparation.

b) Rest N and K should be applied in three equal splits at 20, 40 and 60 DAT as side dressing.

HYBRID MAIZE + SOYBEANINTERCROPPING

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 AEZ: 3a, 3b, 3c, 11, 1	Rabi	Hybrid Maize (100%) + Soybean (33%)	7.5-8.0 + 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)
				N	P	K	S	Mg*	Zn	B	
High and medium highland AEZ: 3, 11. 23	Rabi	Hybrid maize (100%) + Carrot (33%)	8.0 + 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 AEZ: 4, 11, 12	Rabi	Onion (100%) + Hybrid Maize (10%)	12.0 + 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/GIMAKALMIINTERCROPPING

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 AEZ: 3, 8, 11,	Rabi	Hybrid Maize (100%) + Spinach / Lalshak / Gimakalmi	8.0 + 4-5 + 3-4 + 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 AEZ: 11, 26	Rabi (Rainfed)	Chickpea (67%) + Linseed (33%)	1.0 + 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 AEZ: 11, 26	Rabi (Rainfed)	Chickpea (50%) + Mustard (50%)	0.75 + 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 AEZ: 11, 16, 26	Rabi (Rainfed)	Wheat (67%) + Chickpea (33%)	3.00 + 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 AEZ: 11a, 19	Kharff-II	Jute (seed) + Radish	1.0 + 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 AEZ: 12, 18, 19	Rabi	Groundnut + Sesame	1.50 + 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 AEZ: 1, 3, 15, 25	Rabi	Potato (100%) + Vegetables (Lalshak	25.0-30.0 + 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 AEZ: 3, 8d, 15, 25, 28	Rabi	Potato + Lalshak + Sweet gourd	25.0 + 2.0 + 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 AEZ: 3, 7, 11, 9, 28	Rabi	Banana + Indian spinach	20-25 20-25 (Green)	230 105	40 15	300 30	36 5	- -	1.2 -	0.34 -	 12

*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 AEZ: 1a, 11a, 25a	Rabi	T. Sugarcane (100%) + Onion (50%)	100 + 10.0	180 50	60 20	90 30	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	Nutrient Recommendation (kg/ha)							OF (t/ha)
	Season	Crops	(t/ha)	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	$CO(NH_2)_2$	46	-	-	-	-	-	-	-	-	-
Ammonium Sulphate	$(NH_4)_2SO_4$	21.1	-	-	23.5	-	-	-	-	-	-
Triple Super Phosphate	$Ca(H_2PO_4)_2$	-	20	-	1.3	-	-	14	-	-	-
Monoammonium phosphate	$NH_4H_2PO_4$	11	20	-	-	-	-	-	-	-	-
Diammonium phosphate	$(NH_4)_2HPO_4$	18	20	-	-	-	-	-	-	-	-
Potassium chloride	KCl	-	-	50	-	-	-	-	-	-	-
Potassium sulphate	K_2SO_4	-	-	42	17	-	-	-	-	-	-
Gypsum	$CaSO_4.2H_2O$	-	-	-	18	-	-	20	-	-	-
Magnesium sulphate	$MgSO_4.H_2O$	-	-	-	12.5	-	-	-	9.5	-	-
Zinc sulphate, Monohydrate (granular grade)	$ZnSO_4.H_2O$	-	-	-	17.5	36	-	-	-	-	-
Zinc sulphate, Heptahydrate	$ZnSO_4.7H_2O$	-	-	-	10.5	21	-	-	-	-	-
Zinc oxide	ZnO	-	-	-	-	78	-	-	-	-	-
Boric acid	H_3BO_3	-	-	-	-	-	-	-	-	17	-
Solubor	$Na_2B_8O_{13}.4H_2O$	-	-	-	-	-	-	-	-	20	-
Managanese sulphate	$MnSO_4.H_2O$	-	-	-	21	-	36	-	-	-	-
Ammonium molybdate	$(NH_4)_6Mo_7O_{24}.2H_2O$	6.8	-	-	-	-	-	-	-	-	54
Sodium molybdate	$Na_2MoO_4.2H_2O$	-	-	-	-	-	-	-	-	-	39

Appendix–3

Maximum allowable limits of different toxic metals in chemical and organic fertilizers

Sl. No.	Toxic metal	Chemical fertilizer[1] (ppm)	Organic fertilizer[2] (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: [1] Fertilizer (Management) Regulation, 2007; Published in Bangladesh Gazette on 30 May 2007; &
[2] কৃষি মন্ত্রণালয় প্রজ্ঞাপন নং: কৃম/উপ-২/সাই-১/২০০৮/১৫৬; তারিখ: ০২ এপ্রিল ২০০৮

Appendix-4

Nutrient composition of manure/materials

Manure	Moisture (%)	N (%)	P (%)	K (%)
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

Green manure/ crop residues	Moisture (%)	N (%)	P (%)	K (%)	S (%)
Dhaincha (*Sesbania*)	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

Organic material	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 (*Sesbania*)	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

Crop	Seed rate (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

Appendix-8

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_4OAc method
Ca (meq/100g)	2.0	N NH_4OAc method
Mg (meq/100g)	0.5	N NH_4OAc 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_4-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_4OAc method
Ca (meq/100g)	2.0	N NH_4OAc method
Mg (meq/100g)	0.5	N NH_4OAc 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_4-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	0.0910.18	1.181-0.27	0.271-0.36	0.361-0.45	>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_4OAc method
Ca (meq/100g)	2.0	N NH_4OAc method
Mg (meq/100g)	0.5	N NH_4OAc 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_4-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-1 : 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:

$$F_r = U_f - \frac{C_i}{C_s} \times (S_t - L_s)$$

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_t : Soil test value

L_s : Lower limit of the soil test value within STVI class

Example:

$$\text{N (kg/ha)} = 120 - \frac{40}{0.09} \times (0.1 - 0.091)$$

$$= 120 - \frac{40}{0.09} \times (0.009)$$

$$= 120 - 4 \quad = 116 \text{ N (kg/ha)}$$

$$= 116 \times \frac{100}{46} = 252.24 \text{ kg Urea/ha}$$

$$\text{P (kg/ha)} = 20 - \frac{10}{7.5} \times (18 - 15.1)$$

$$= 20 - \frac{10}{7.5} \times (2.9)$$

$$= 20 - 3.9 \quad = 16.1 \text{ kg P /ha}$$

$$= 16.1 \times \frac{100}{20} = 80.5 \text{ kg TSP/ha}$$

$$\text{K (kg/ha)} = 90 - \frac{30}{0.09} \times (0.15 - 0.091)$$

$$= 90 - \frac{30}{0.09} \times (0.059)$$

$$= 90 - 19.7 \quad = 70.3 \text{ kg K/ha)}$$

$$= 70.3 \times \frac{100}{50} = 140.6 \text{ kg MoP/ha}$$

$$\text{S (kg/ha)} = 15 - \frac{5}{7.5} \times (10 - 7.51)$$

$$= 15 - \frac{5}{7.5} \times 2.49$$

$$= 15 - 1.66 = 13.34 \text{ kg S/ha)}$$

$$= 13.34 \times \frac{100}{18} = 74.11 \text{ kg Gypsum/ha}$$

$$\text{Zn (kg/ha)} = 1.3 - \frac{1.3}{0.45} \times (1.0 - 0.91)$$

$$= 1.3 - \frac{1.3}{0.45} \times 0.09$$

$$= 1.04 \text{ kg Zn/ha}$$

$$= 1.04 \times \frac{100}{21} = 4.95 \text{ kg Zinc sulphate (hepta-hydrate)/ha}$$

$$\text{B (kg/ha)} = 0.6 - \frac{0.3}{0.15} \times (0.2 - 0.151)$$

$$= 0.6 - \frac{0.3}{0.15} \times 0.049$$

$$= 0.502 \text{ kg B/ha}$$

$$= 0.502 \times \frac{100}{17} = 2.95 \text{ kg Boric acid/ha}$$

Note:

When zinc sulphate (heptahydrate) is used sulphur is also supplied (10.5% S in $ZnSO_4.7H_2O$). 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 Neutral	0.08 Very Low	11 Low	0.17 Medium	12 Low	3.0 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* Medium: *for rice*	Low	Very high	Medium

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 x 1.22 = NH_3	HNO_3x 0.22 = N
P x 2.29 = P_2O_5	H_3PO_4x 0.32 = P
P_2O_5x 0.44 = P	$Ca_3(PO_4)2$ x 0.20 = P
K x 1.20 = K_2O	KCl x 0.52 = K
K_20 x 0.83 = K	K_2SO4 x 0.45 = K
Ca x 1.40 = CaO	$CaSO_4$x 0.29 = Ca
MgO x 0.60 = Mg	$MgCO_3$ x 0.28 = Mg
S x 3.00 = SO_4	H_2SO_4x 0.33 = S
SO_4x 0.33 = S	$CaSO_4$x 0.24 = S

Appendix-13

Some useful conversion factors

Chemicals & fertilizers	*Metric/Imperial*	*Solid manure*
% P = % P_2O_5 × 0.437	1 ha = 10000 sqm	kg t FW = $\frac{\text{mg kg nutrient}}{1000} \times \frac{\%\ \text{DM}}{100}$
P_2O_5 = % P × 2.29	1 sqm = 1 × 10^{-4} ha	kg t FW = g kg nutrient × $\frac{\%\ \text{DM}}{100}$
% K = % K_2O × 0.83	1 kg = 2.24 lb	kg t FW = % nutrient × $\frac{\%\ \text{DM}}{10}$
% K_2O = % K × 1.21	1 lb = 0.454 kg	*Example:*
Urea (kg) = kg N × 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 × 5.56, kg P × 5.0	1 kg/ha = 0.89 lb/acre	4.0% N x (27% DM /10) = 10.8 kg N/t FW
TSP (kg) = kg P × 5.0	1 ha = 2.47 acre	3.0% P x (27% DM/10) = 8.1 kg P/t FW
MoP (kg) = kg K × 2.0	1 acre = 0.40 ha	FW means fresh weight DM means dry matter
Gypsum (kg) = kg S × 5.56	1 acre = 100 decimal	
Zinc sulphate heptahydrate (kg) = kg Zn × 4.35	1 decimal = 40.48 sqm	
Boric acid (kg) = kg B × 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

Soil reaction class	pH
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

Soil salinity class	Salinity range (dS/m)*
S_0 Non saline	0 – 2.0
S_1 Very slightly saline	2.1 – 4.0
S_2 Slightly saline	4.1 – 8.0
S_3 Moderately saline	8.1 – 12.0
S_4 Strongly saline	12.1 – 16.0
S_5 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

Appendix-18

Available forms of plant nutrients

Nutrient	*Available Forms*	**Sources**
Carbon	CO_2	Atmosphere
Hydrogen	H_2O	Soil water
Oxygen	H_2O, O_2, CO_2	Soil water, Atmosphere
Nitrogen	NO_3^-, NH_4^+	Soil organic matter, Fertilizers
Phosphorus	$H_2PO_4^-$, HPO_4^{2-}	Soil organic matter, Minerals, Fertilizers
Potassium	K^+	Minerals, Fertilizers
Sulphur	SO_4^{2-}	Soil organic matter, Minerals, Fertilizers
Calcium	Ca^{2+}	Minerals, Fertilizers
Magnesium	Mg^{2+}	Minerals, Fertilizers
Iron	Fe^{2+}, Fe^{3+}	Minerals, Fertilizers
Manganese	Mn^{2+}, Mn^{4+}	Minerals, Fertilizers
Zinc	Zn^{2+}	Minerals, Fertilizers
Copper	Cu^+, Cu^{2+}	Minerals, Fertilizers
Boron	H_3BO_3, $H_2BO_3^-$, HBO^{2-}	Minerals, Fertilizers
Molydenum	MoO_4^{2-}	Minerals, Fertilizers
Chlorine	Cl^-	Minerals, Fertilizers

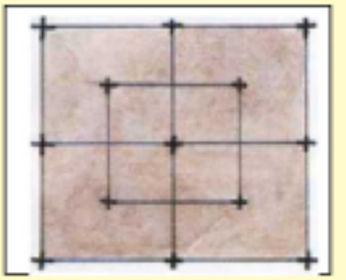
Appendix-19

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.

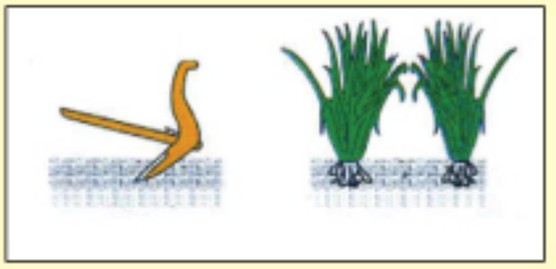
Step 1: Collection of equipment and stationeries for soil sampling: Considering the field condition and the availability the following equipments are needed for soil sampling.

a) Country spade, shovel, push anger, weeding tools, Dutch auger, etc (any one).
b) Plastic bucket or polyethylene sheet.
c) Thick poly bag and thread ball.
d) 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 thebottom. Put the soil slice in the bucket or on the plastic sheet. Collect sub-samples fromall 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.

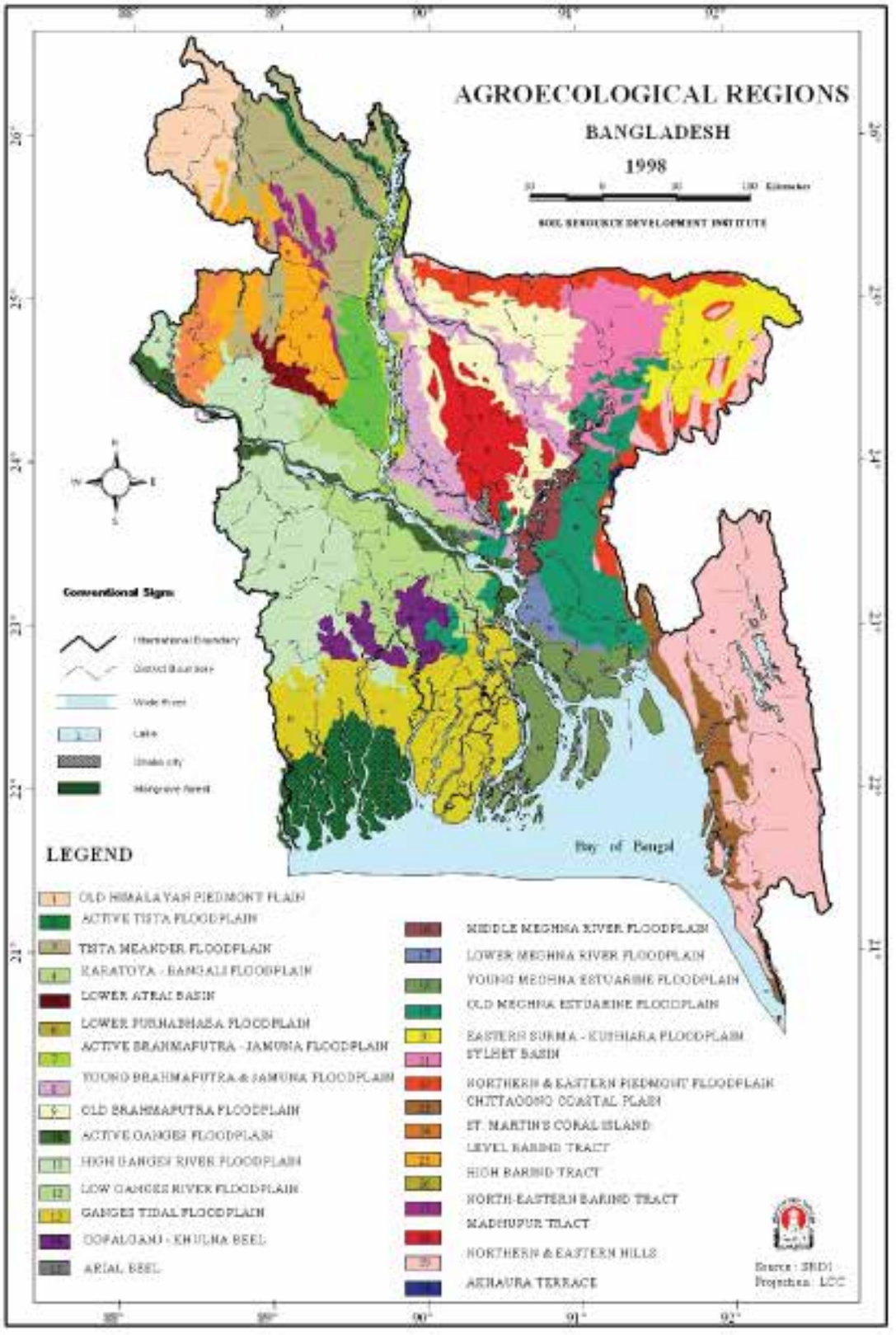
Step 7: From the composite sample take 400-500 grams into a plastic bag. The samples should be dried in shady place and pulverized with a wooden hammer.

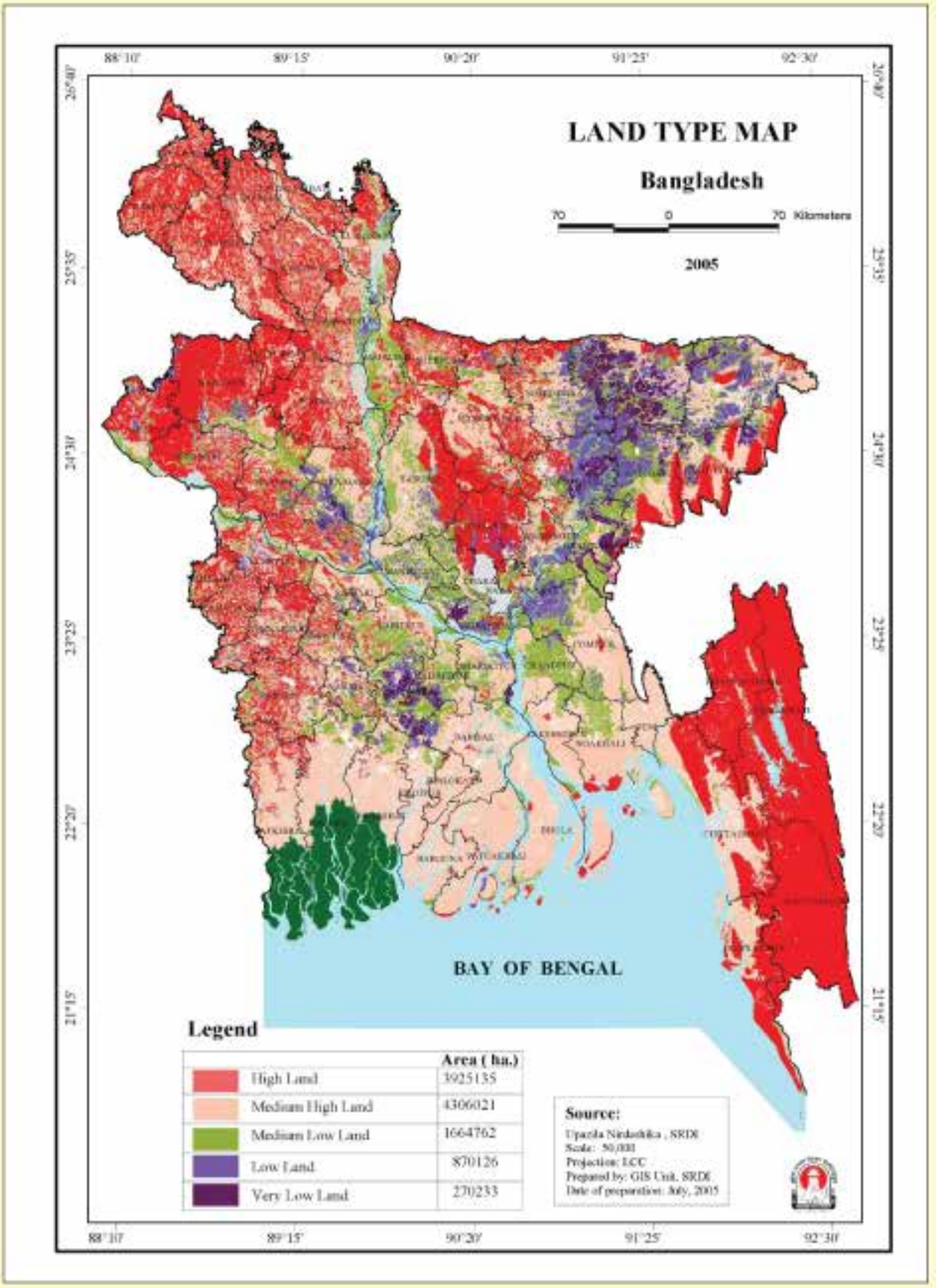
Step 8: The plastic bag with soil sample should be tightly closed with thread and placed inside another plastic bag. An information sheet (Tag) should be placed between two plastic bags and again the bag should be tightly closed with thread. An additional information sheet (Tag) should be tied at the neck of the bag. The sample should be sent immediately to the laboratory for analysis.

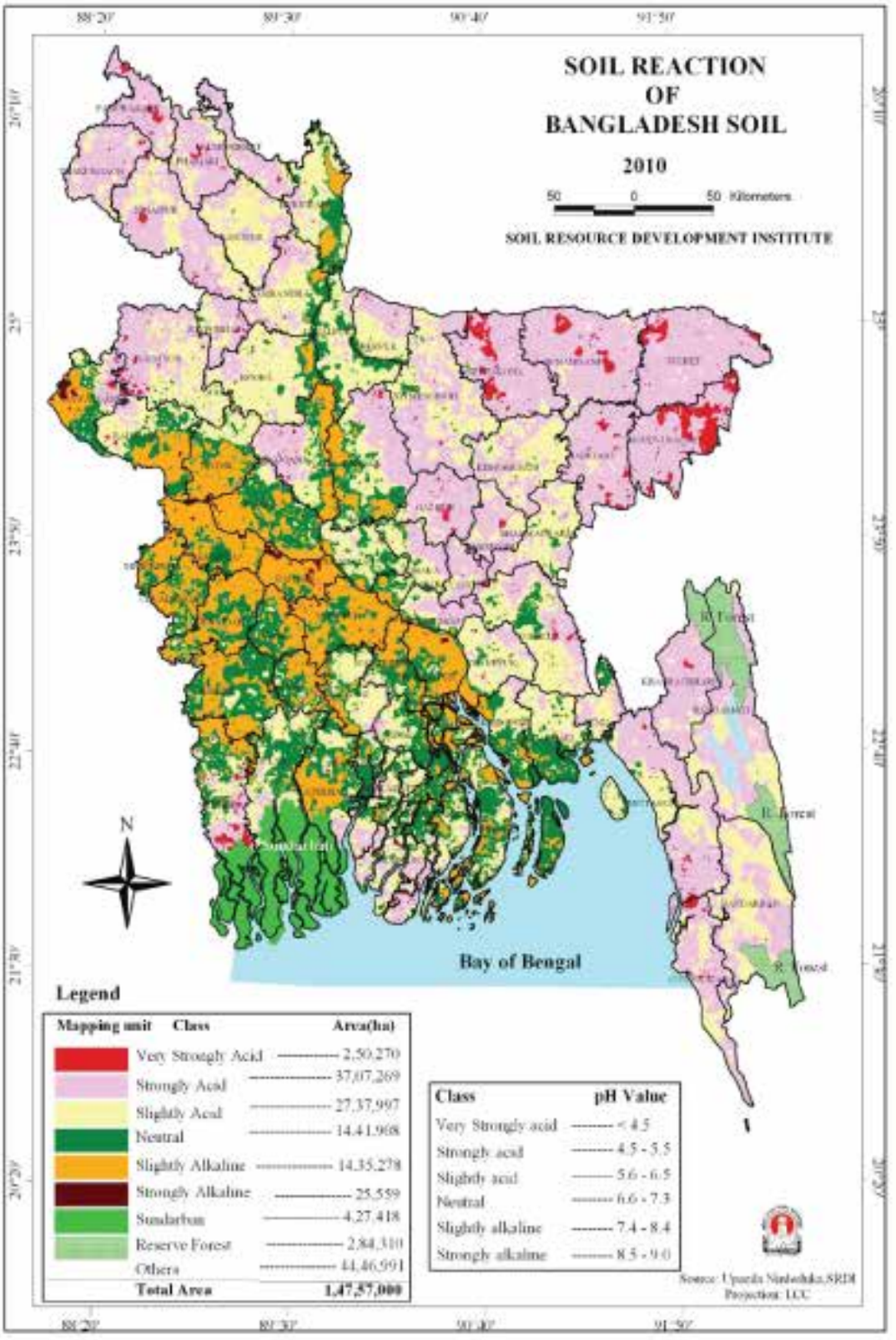
Note: Samples should not be collected from the nearby places to the road/embankment, brick filed, compost/cowdung heap, straw burned area etc. and from very recently fertilized land. Do not wipe out the grasses or other plants from the surface of the sampling spots before collecting soil samples. This 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.

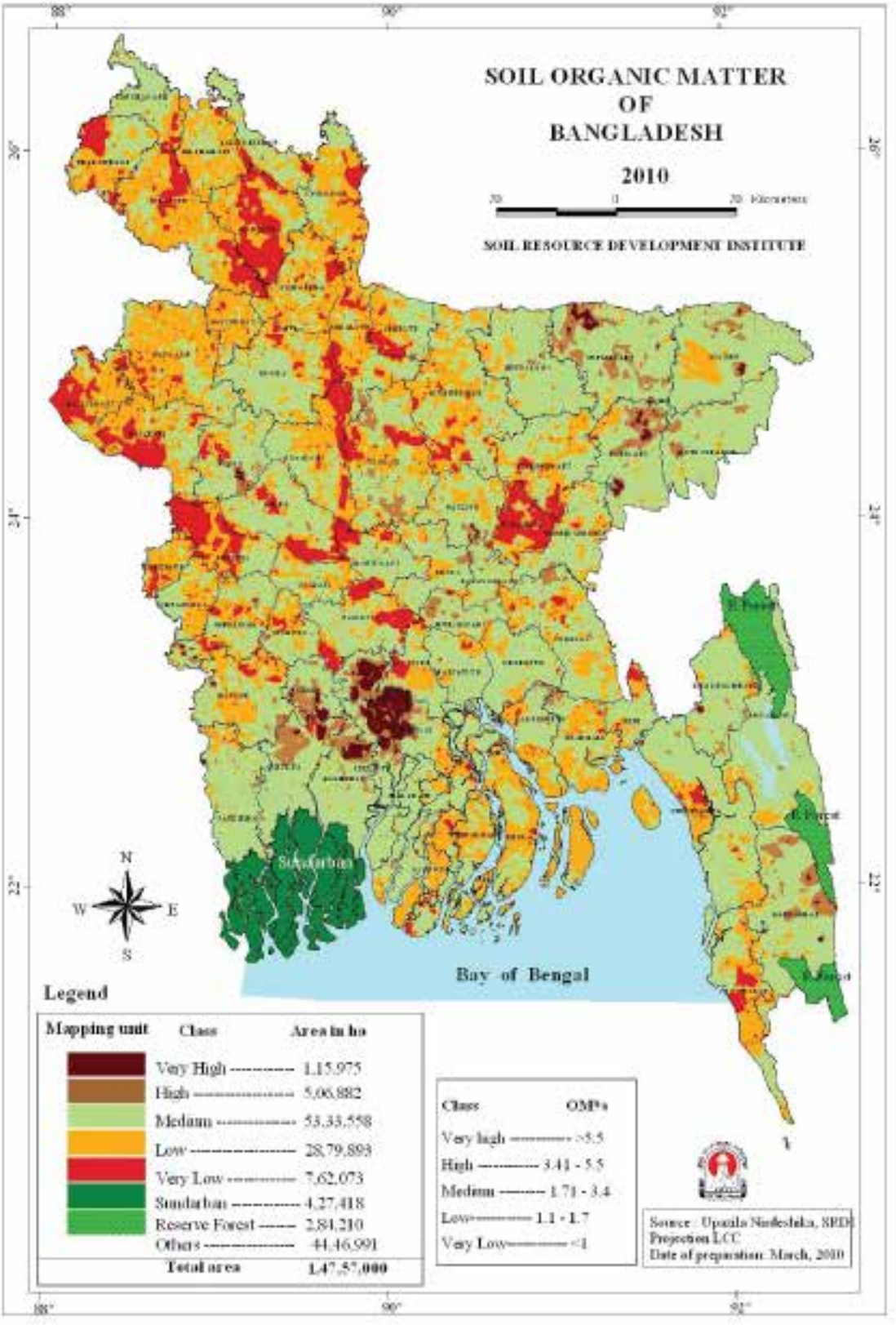
Information Sheet

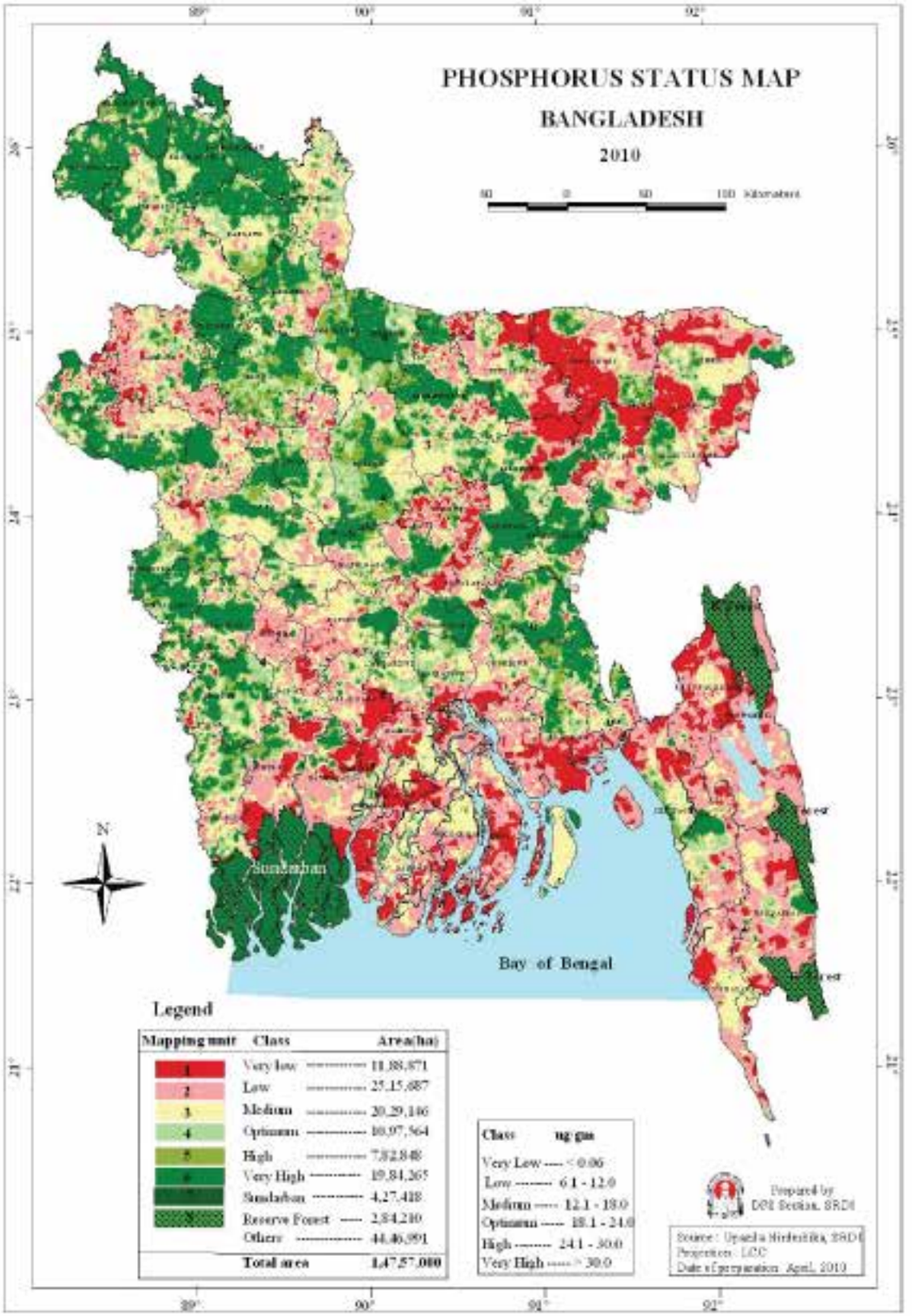
Name of the farmer	:	Soil sample No.	:
Father's Name	:	Land type	:
Mother's Name	:	Flooding Depth(cm)	:
Vill/Mouza	:	Soil series/Dal	:
Union/Block	:	Existing cropping pattern	:
Upazila & District	:	Crops to be cultivated	:
Date of Collection	:	Lab. Code No.	:

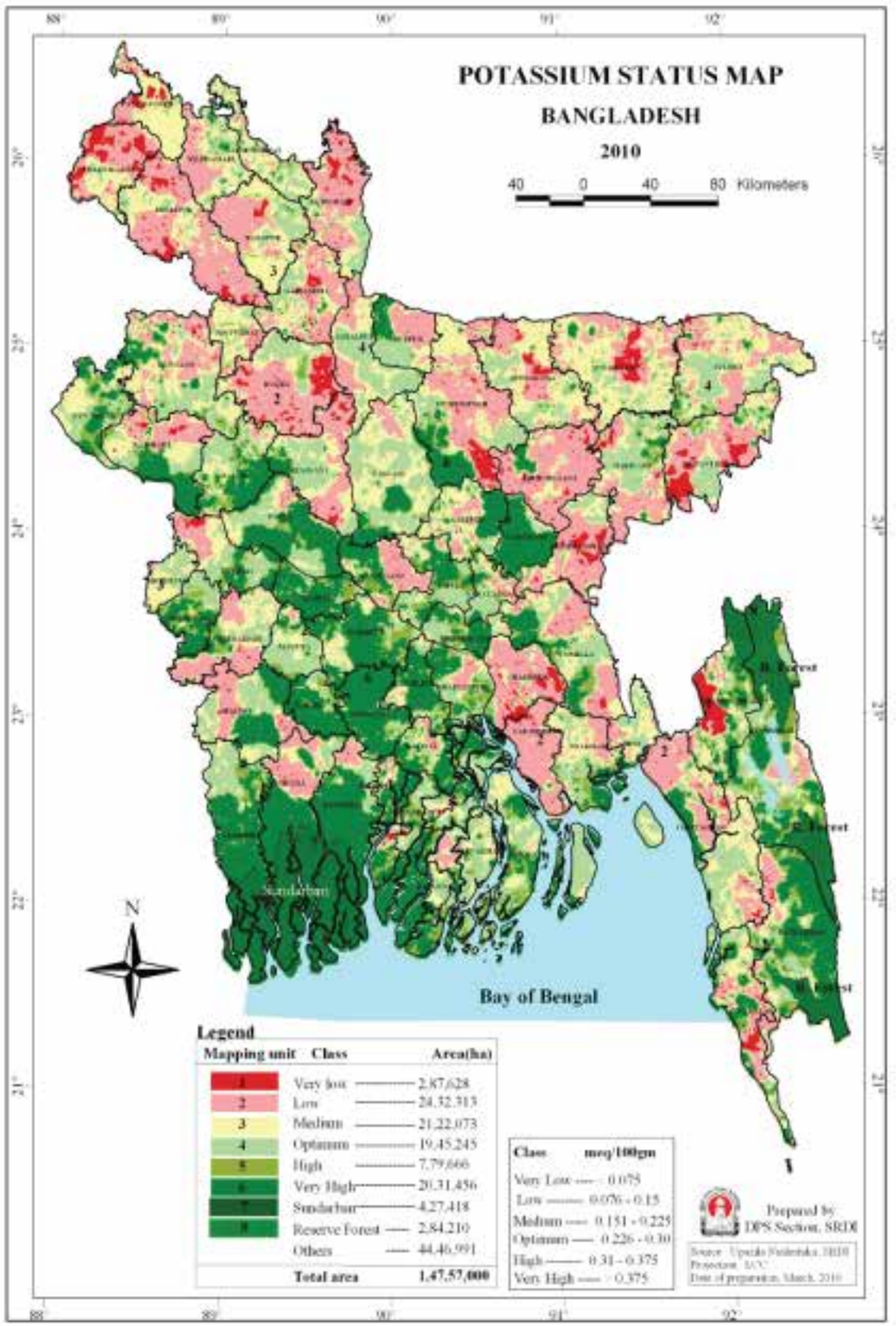

AGROECOLOGICAL REGIONS
BANGLADESH
1998
SOIL RESOURCE DEVELOPMENT INSTITUTE
Conventional Signs
LEGEND
Bay of Bengal
OLD HIMALAYAN PIEDMONT PLAIN
ACTIVE TISTA FLOODPLAIN
TISTA MEANDER FLOODPLAIN
KARATOYA - BANGALI FLOODPLAIN
LOWER ATRAI BASIN
LOWER PUNARBHABA FLOODPLAIN
ACTIVE BRAHMAPUTRA - JAMUNA FLOODPLAIN
YOUNG BRAHMAPUTRA & JAMUNA FLOODPLAIN
OLD BRAHMAPUTRA FLOODPLAIN
ACTIVE GANGES FLOODPLAIN
HIGH GANGES RIVER FLOODPLAIN
LOW GANGES RIVER FLOODPLAIN
GANGES TIDAL FLOODPLAIN
GOPALGANJ - KHULNA BEEL
ARIAL BEEL
MIDDLE MEGHNA RIVER FLOODPLAIN
LOWER MEGHNA RIVER FLOODPLAIN
YOUNG MEGHNA ESTUARINE FLOODPLAIN
OLD MEGHNA ESTUARINE FLOODPLAIN
EASTERN SURMA - KUSHIARA FLOODPLAIN
SYLHET BASIN
NORTHERN & EASTERN PIEDMONT FLOODPLAIN
CHITTAGONG COASTAL PLAIN
ST. MARTIN'S CORAL ISLAND
LEVEL BARIND TRACT
HIGH BARIND TRACT
NORTH-EASTERN BARIND TRACT
MADHUPUR TRACT
NORTHERN & EASTERN HILLS
AKHAURA TERRACE
Source : SRDI
Projection : LCC

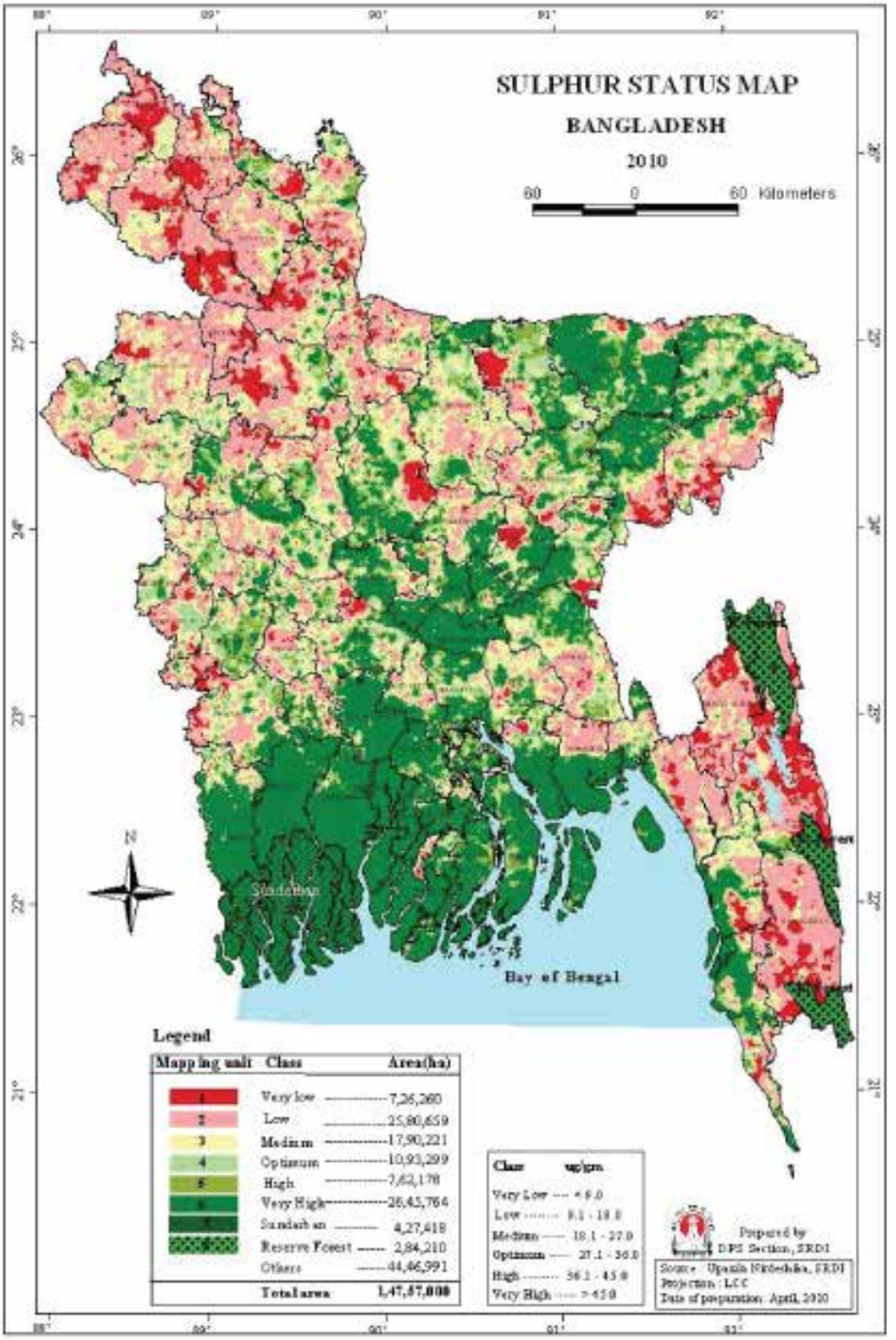

LAND TYPE MAP
Bangladesh
70 0 70 Kilometers
2005
BAY OF BENGAL
Legend
Area (ha.)
High Land 3925135
Medium High Land 4306021
Medium Low Land 1664762
Low Land 870126
Very Low Land 270233
Source:
Upazila Nirdeshika , SRDI
Scale: 50,000
Projection: LCC
Prepared by: GIS Unit, SRDI
Date of preparation: July, 2005
88°10'
89°15'
90°20'
91°25'
92°30'
26°40'
25°35'
24°30'
23°25'
22°20'
21°15'

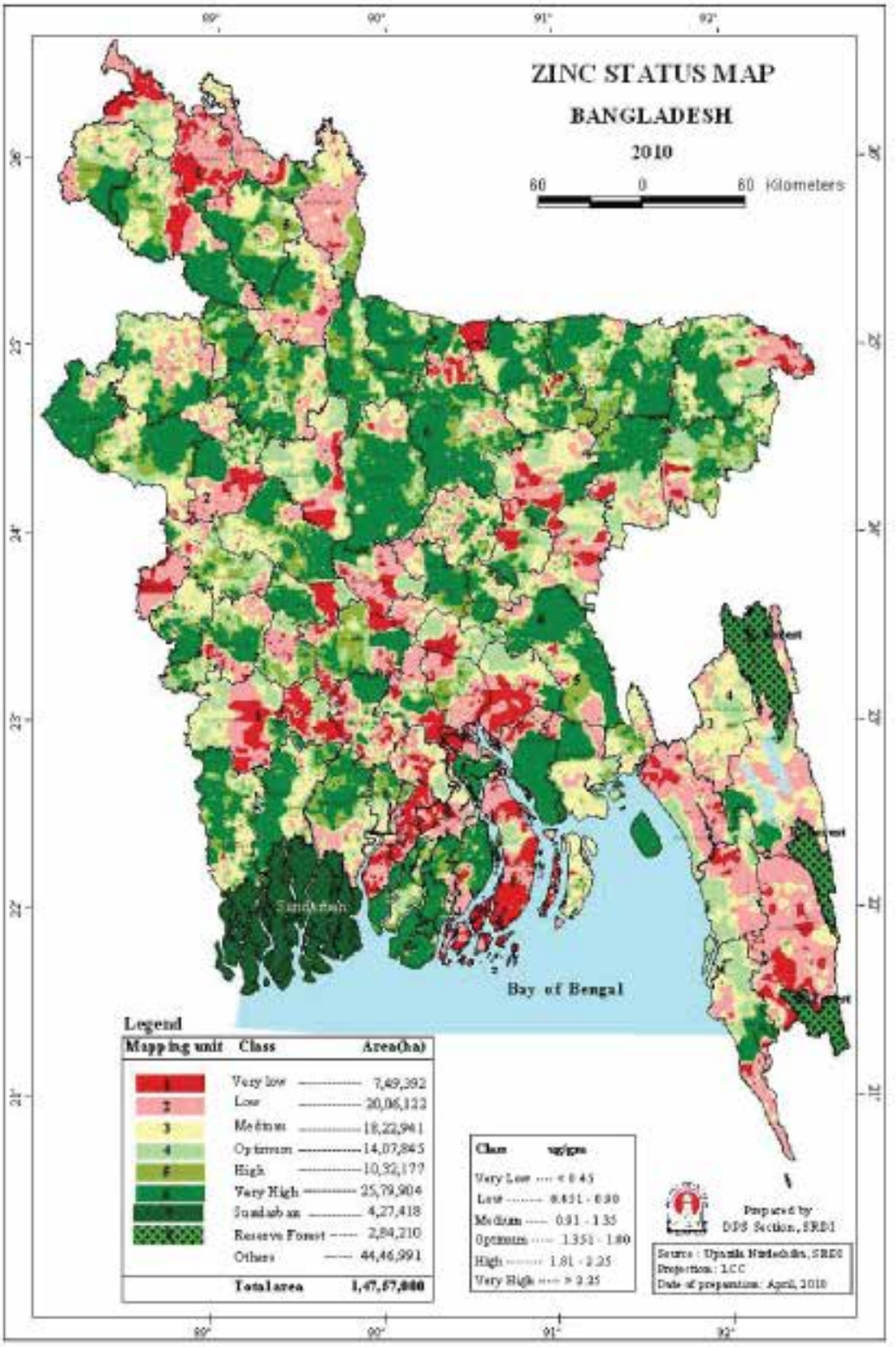

SOIL REACTION
OF
BANGLADESH SOIL
2010
50 0 50 Kilometers
SOIL RESOURCE DEVELOPMENT INSTITUTE
N
Bay of Bengal
Legend
Mapping unit Class Area(ha)
Very Strongly Acid 2,50,270
Strongly Acid 37,07,269
Slightly Acid 27,37,997
Neutral 14,41,968
Slightly Alkaline 14,35,278
Strongly Alkaline 25,559
Sundarban 4,27,418
Reserve Forest 2,84,310
Others 44,46,991
Total Area 1,47,57,000
Class pH Value
Very Strongly acid < 4.5
Strongly acid 4.5 - 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
Source: Upazila Nirbahika,SRDI
Projection: LCC

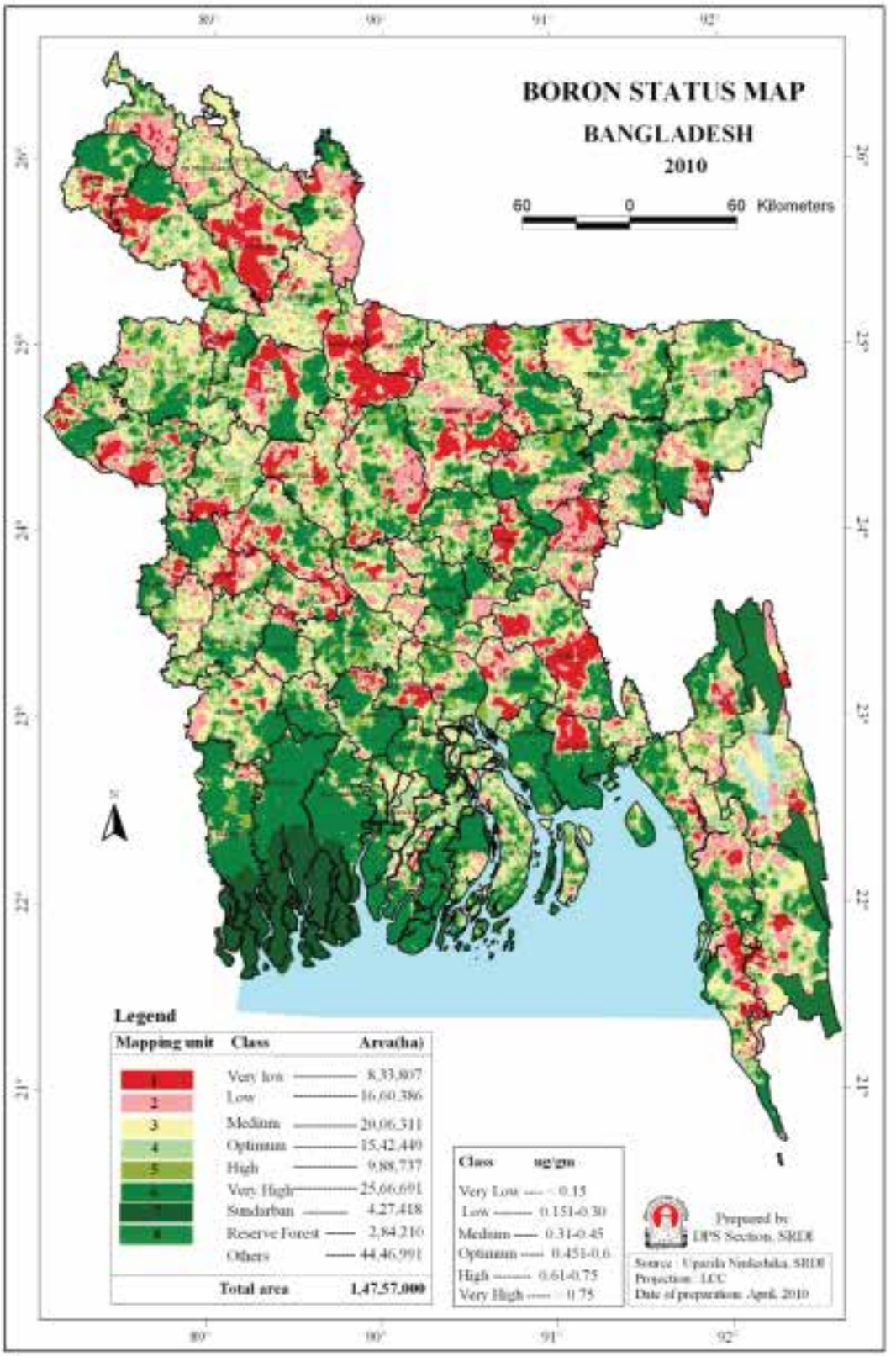

SOIL ORGANIC MATTER
OF
BANGLADESH
2010
SOIL RESOURCE DEVELOPMENT INSTITUTE
Sundarbans
Bay of Bengal
N
S
W
E
Legend
Mapping unit
Class
Area in ha
Very High ---------- 1,15,975
High ---------- 5,06,882
Medium ---------- 53,35,558
Low ---------- 28,79,893
Very Low ---------- 7,62,073
Sundarban ---------- 4,27,418
Reserve Forest ------ 2,84,210
Others ---------- 44,46,991
Total area 147,57,000
Class OMPs
Very high ---------- >5.5
High ---------- 3.41 - 5.5
Medium ---------- 1.71 - 3.4
Low ---------- 1.1 - 1.7
Very Low ---------- <1
Source : Upazila Nirdeshika, SRDI
Projection LCC
Date of preparation: March, 2010

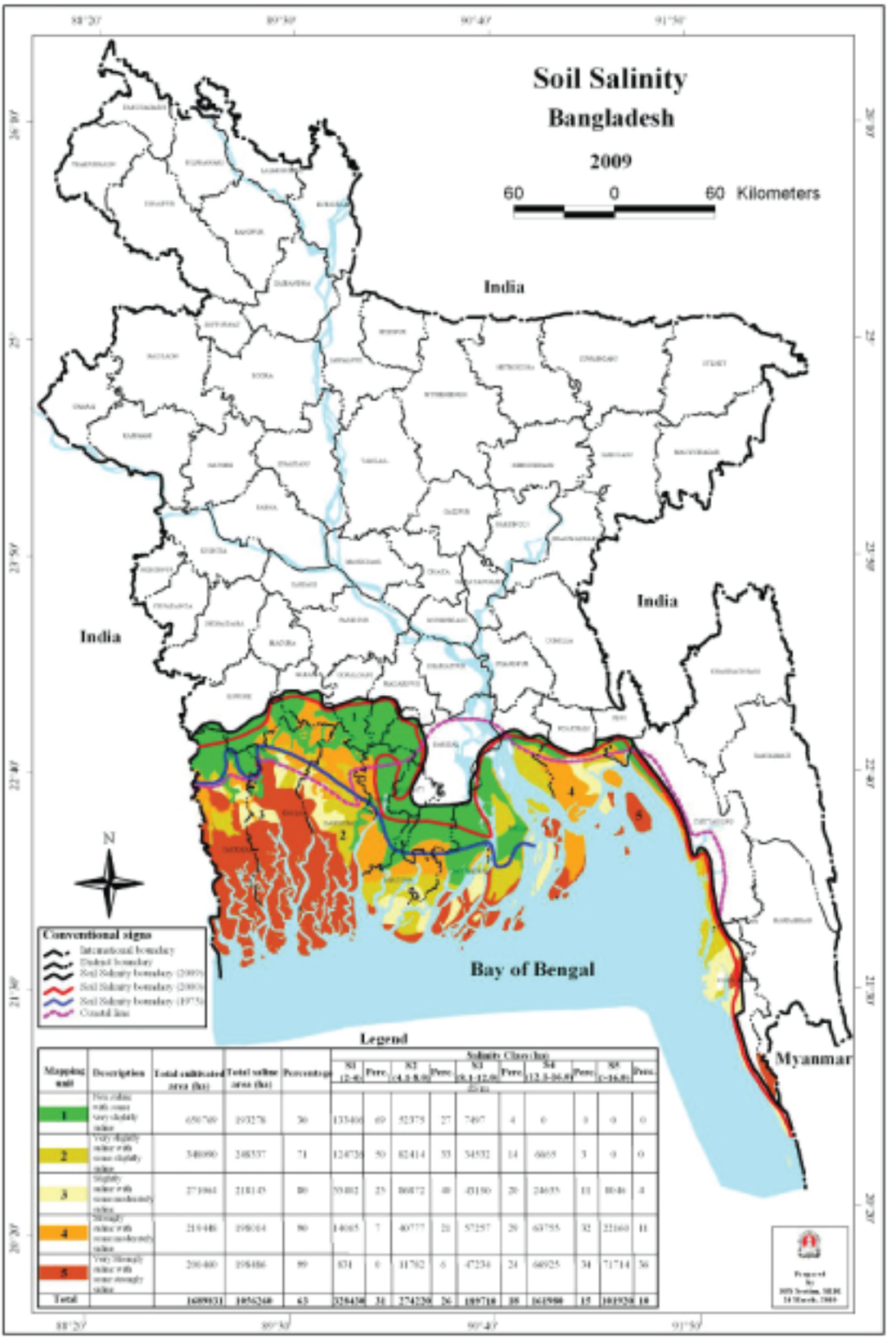

PHOSPHORUS STATUS MAP
BANGLADESH
2010
N
Sundarban
Bay of Bengal
Legend
Mapping unit Class Area(ha)
1 Very low ---------- 11,88,871
2 Low ---------- 25,15,687
3 Medium ---------- 20,29,146
4 Optimum ---------- 10,97,564
5 High ---------- 7,02,848
6 Very High ---------- 19,84,365
7 Sundarban ---------- 4,27,418
8 Reserve Forest ---- 2,84,210
Others ---------- 44,46,991
Total area 1,47,57,000
Class ug/gm
Very Low ---- < 0.06
Low ------- 6.1 - 12.0
Medium ----- 12.1 - 18.0
Optimum ---- 18.1 - 24.0
High ------- 24.1 - 30.0
Very High ----- > 30.0
Prepared by
Source : Upazila Hirdesthka, SRDI
Projection : LCC
Date of Preparation: April, 2010


POTASSIUM STATUS MAP
BANGLADESH
2010
40 0 40 80 Kilometers
Sundarban
Bay of Bengal
N
Legend
Mapping unit Class Area(ha)
1 Very low 2,87,628
2 Low 24,32,313
3 Medium 21,22,073
4 Optimum 19,45,245
5 High 7,79,666
6 Very High 20,31,456
7 Sundarbar 4,27,418
8 Reserve Forest 2,84,210
Others 44,46,991
Total area 1,47,57,000
Class meq/100gm
Very Low 0.075
Low 0.076 - 0.15
Medium 0.151 - 0.225
Optimum 0.226 - 0.30
High 0.31 - 0.375
Very High > 0.375
Prepared by
IDPS Section, SRDI


SULPHUR STATUS MAP
BANGLADESH
2010
60 0 60 Kilometers
N
Sundarban
Bay of Bengal
Legend
Mapping unit Class Area(ha)
1 Very low 7,26,260
2 Low 25,80,659
3 Medium 17,90,221
4 Optimum 10,93,299
5 High 7,62,178
6 Very High 26,45,764
7 Sundarban 4,27,418
8 Reserve Forest 2,84,210
Others 44,46,991
Total area 1,47,57,000
Class up/gm
Very Low 4.5.0
Low 5.1 - 18.0
Medium 18.1 - 27.0
Optimum 27.1 - 36.0
High 36.1 - 45.0
Very High 45.0
Prepared by
DPI Section, SRDI
Source : Upazila Fildebaka, SRDI
Projection : LCC
Date of preparation: April, 2010


ZINC STATUS MAP
BANGLADESH
2010
60 0 60 Kilometers
Sundarban
Bay of Bengal
Legend
Mapping unit Class Area(ha)
1 Very low 7,49,392
2 Low 20,06,122
3 Medium 18,22,941
4 Optimum 14,07,845
5 High 10,52,177
6 Very High 25,79,904
7 Sundarban 4,27,418
8 Reserve Forest 2,84,210
Others 44,46,991
Total area 1,47,57,000
Class ug/gm
Very Low .... < 0.45
Low ..... 0.451 - 0.90
Medium .... 0.91 - 1.35
Optimum .... 1.351 - 1.80
High ..... 1.81 - 2.25
Very High .... > 2.25
Prepared by
SRDI Section, SRDI
Source : Upazila Nirdeshika, SRDI
Projection: LCC
Date of preparation: April, 2010


BORON STATUS MAP
BANGLADESH
2010
60 0 60 KIlometers
Legend
Mapping unit Class Area(ha)
1 Very low 8,33,807
2 Low 16,60,386
3 Medium 20,06,511
4 Optimum 15,42,440
5 High 9,88,737
6 Very High 25,66,691
7 Sundarban 4,27,418
8 Reserve Forest 2,84,210
Others 44,46,991
Total area 1,47,57,000
Class ug/gm
Very Low 0.15
Low 0.151-0.30
Medium 0.31-0.45
Optimum 0.451-0.6
High 0.61-0.75
Very High 0.75
Prepared by
LRPS Section, SRDI
Source : Upazila Nirkshika, SRDI
Projection : LCC
Date of preparation: April, 2010



Mapping unit	Description	Total cultivated area (ha)	Total saline area (ha)	Percentage	Salinity Class (ha)									
					S1 (2-4)	Perc.	S2 (4.1-8.0)	Perc.	S3 (8.1-12.0)	Perc.	S4 (12.1-16.0)	Perc.	S5 (>16.0)	Perc.
1	Very saline with some very slightly saline	650760	103278	16	133466	69	52375	27	7497	4	0	1	0	0
2	Very slightly saline with some slightly saline	540090	248537	71	124726	50	82414	33	34532	14	6605	3	0	0
3	Slightly saline with some moderately saline	271061	218145	80	59402	25	86872	40	45150	20	24635	11	8046	4
4	Strongly saline with some moderately saline	215486	195104	90	14065	7	40777	21	57257	29	63755	32	22160	11
5	Very Strongly saline with some strongly saline	200460	195486	99	831	0	11702	6	47234	24	66925	34	71714	36
Total		1689831	1056260	63	332490	31	274220	26	189710	18	161950	15	101920	10

ACRONYNS

AAO : Additional Agriculture Officer
ADP : Adenosine Diphosphate
AEO : Agriculture Extension Officer
AEZ : Agro-ecological zone
ATDP : Agricultural Technology Development project
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
BRRI : 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