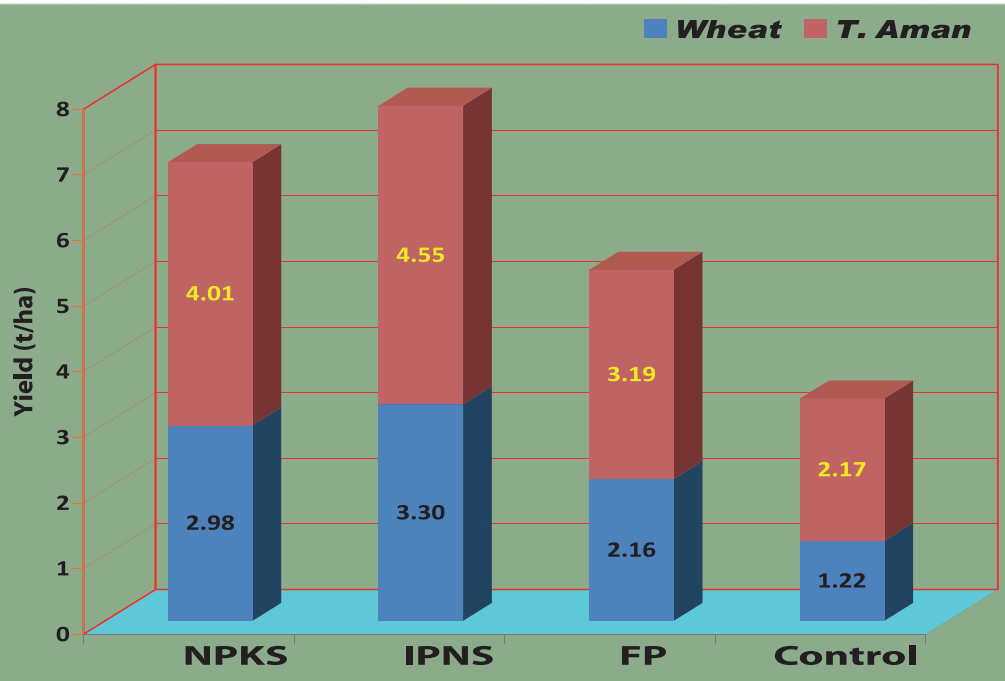
FERTILIZER RECOMMENDATION GUIDE - 2012



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FERTILIZER RECOMMENDATION GUIDE-2012

Editorial Board

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FOREWORD

During last couple of decades agricultural production system has been intensified through improved technological intervention. With the expansion of irrigation and fertilizer, cropping intensity has increased to about 190 percent. The soil has been over-exploited to produce more food for the growing population which resulted in soil health deterioration. This calls for sustainable management of natural resources for achieving food, nutritional, environmental and livelihood security.

Before 1980s N, P and K fertilizers were commonly used in the country. With the increase of cropping intensity, deficiency of other nutrients like S, Zn, B and Mg has appeared in the soil and this has become a common concern with different degrees throughout the country. Thus, location specific application of these nutrients has become essential for sustainable crop production, maintenance of soil health and also for reducing production cost.

In the above context and in lieu of the Government policy of achieving higher input efficiency in the production system, Bangladesh Agricultural Research Council (BARC) has been updating the Fertilizer Recommendation Guide (FRG) in every five years. In doing so, research is being conducted at the National Agriculture Research System (NARS) institutes to generate information on location specific fertilizer recommendation for crops and cropping patterns across the agro-ecological zones (AEZs) of the country. The BARC in cooperation with the contributions of NARS institutes, Department of Agriculture Extension (DAE) and Agricultural Universities updates and publishes the FRG guide. This guide would make the farmers to be aware of judicious use of fertilizers in crop production.

In the meantime, BARC has published five FRGs since 1979 and the current FRG-2012 is the sixth one. The FRG has already gained popularity among the users. The Guide is published mainly for the extension personnel; however it is useful to all concerned stakeholders engaged in crop production system. I firmly believe that the Guide will play a major role in sustainable crop production in the country and help attain self sufficiency in food.

I recognize the great contributions of the NARS scientists and extension personnel for their hard work in producing this useful guide. I also thank the scientists of the Natural Resources Management (NRM) Division of BARC for their untiring efforts to bring out this valuable document.

September 2012

Dr. Wais Kabir
Executive Chairman
BARC

PREFACE

Publication and periodic updating of Fertilizer Recommendation Guide (FRG) is a routine activity of the Natural Resources Management (NRM) Division of Bangladesh Agricultural Research Council (BARC). The first FRG 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 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 FRG-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 **Fertilizer Recommendation Guide-2012** is a revised and sixth version of FRG. The salient features of this guide are 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 present Guide includes information of more crops compared to the previous guides. Flowers and many traditional fruits and spices are new additions. Significant improvement has also been made with results to 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-2012 has been prepared targeting mainly for extension personnel. However, I strongly believe that the guide would 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, teachers of universities and officials of DAE is highly appreciated. Financial assistance of National Agricultural Technology Project (NATP), Phase-I for updating and printing the guide is thankfully acknowledged.

I wish to extend cordial thanks to Dr. Md. Abdus Satter, Prof. Dr M. Jahiruddin, Mrs. Sultana Razia, Dr. S. M. Bokhtiar and Dr. Md. Baktear Hossain in publishing this document.

Dr. A. A. Hassan
Member-Director (NRM)
BARC

September 2012

FERTILIZER RECOMMENDATION GUIDE-2012

Contents

EXECUTIVE SUMMARY

Bangladesh Agricultural Research Council (BARC) is mandated to publish and periodic updating of Fertilizer Recommendation Guide (FRG) at 5-year intervals. Meanwhile, five FRGs have been published in 1979, 1985, 1989, 1997 and 2005; and the FRG-2012 is the sixth one. The Guide has been prepared mainly for use by the extension personnel; nevertheless it would be useful to all levels of stakeholders involved in agricultural production system.

This Guide has been prepared with the relevant information generated by the National Agricultural Research System (NARS) institutes since publication of the last Guide (FRG-2005). Information of soil fertility status of different agro-ecological zones (AEZs) have been obtained from SRDI, that of fertilizer recommendation for crops from different NARS institutes & universities. The information of the existing cropping patterns at the farm level have been provided by the DAE, BARI and BRRI . All these information have been synthesized to produce the FRG-2012.

The present Guide (FRG-2012) has two parts, text part and fertilizer recommendation part. The text part covers theoretical aspects of plant nutrition, soil fertility and fertilizer management, soil organic matter management, land degradation, rationale of fertilizer use, quality control of fertilizers etc. In the "quality control of fertilizers" qualitative analysis of fertilizer samples practicable at the farm level using some locally available materials has been described. The fertilizer recommendation part comprises fertilizer recommendation for individual crops, cropping pattern based fertilizer recommendation for different AEZs and fertilizer recommendation for multiple cropping.

With a view to increasing crop production and in compliance with the Govt. policy to attain self sufficiency in food, fertilizer recommendation in this guide has been targeted to high yield goal (HYG). A total of 157 recommendations have been made for different cereal, fibre, pulse, oilseed, root, tuber vegetable, spice, fruit, plantation, flower and fodder crops. Flowers and fodder crops have been newly added to this Guide because of growing demand of flowers and expansion of commercial dairy farms in the country. Regarding cropping patterns, fertilizer recommendation has been made for a total of 294 cropping patterns. Efforts have been made to cover all the major cropping patterns existing at the farm level in different AEZs of the country. Besides, fertilizer recommendation has also been made for a total of 23 multiple croppings commonly practiced in the country.

FERTILIZER RECOMMENDATION GUIDE-2012

1. INTRODUCTION

1.1 Development of Fertilizer Recommendation Guide in Bangladesh

Fertilizer Recommendation Guide is an outcome of soil fertility research in Bangladesh. In 1957, a research scheme entitled, "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 in 1961 for the first time in the name of "Fertilizer Use in East Pakistan". During early 1960s, the soils of Bangladesh were broadly classified into seven tracts based on their origin and properties. The Then Department of Soil Survey (presently SRDI) 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 with local and locally improved varieties of crops. The Bangladesh Agricultural Research Council (BARC) had published the first Fertilizer Recommendation Guide (FRG) in 1979 entitled, "Fertilizer Guide for Major Crops of Bangladesh". Eventually with the progress of soil fertility research, the second Fertilizer Recommendation Guide was published in 1985, with 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 of soil fertility and land type-wise major cropping patterns along with crop management practices in different agro-ecological zones were compiled. The earlier Fertilizer Recommendation Guide was updated and published in the name of "Fertilizer Recommendation Guide-1989". Later, with the advancement of time and research progress, the former Fertilizer Recommendation Guide was updated and it appeared as "Fertilizer Recommendation Guide-1997".

Thereafter, the Fertilizer Recommendation Guide was further updated and published as "Fertilizer Recommendation Guide-2005". In that 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.

The **Fertilizer Recommendation Guide-2012** is a revised and updated version of the FRG-2005. This is the sixth Fertilizer Recommendation Guide published by the BARC. The salient features of this Guide are as follows:

- Fertilizer recommendation for different crops based on the soil test values, crop varieties and high yield goal (HYG)
- Fertilizer recommendation for major cropping patterns in different AEZs based on HYG
- Fertilizer recommendation for multiple cropping systems
- Clay minerals status of different AEZs
- Rationale of fertilizer use
- Soil fertility evaluation and assessment of nutrient need
- Soil organic matter management
- Carbon sequestration
- Deep placement of urea
- Land degradation (soil erosion, salinization, acidification, soil fertility depletion, water-logging and heavy metal contamination)
- Quality control of fertilizers

1.2 Steps in Using the Fertilizer Recommendation Guide-2012

The Fertilizer Recommendation Guide-2012 has been developed primarily for use by the extension personnel for advising the farmers to use recommended dose of fertilizers. The Fertilizer Recommendation Guide focuses on the rationale and principles of fertilizer application. It is not a blanket recommendation. Thus, the user should carefully read and follow the Guide. To consult this Guide, the following steps are important.

1. Read the Guide thoroughly to understand the rationale and principles of fertilizer application.
2. Use general fertilizer recommendations for cropping patterns (pages 195-239) for those areas where site specific soil test values and their interpretations are not available.
3. 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 9 and Fig. 7.
4. Prepare fertilizer recommendation for a target yield of a crop based on the tables given in pages 88-188 and Appendix-10. Develop fertilizer recommendations for the cropping patterns based on the rationales given in pages 53-54.

2. PLANT NUTRIENTS

2.1 Essential Nutrients

Plant nutrients are of completely inorganic in nature. Plants require certain elements for their growth and development. But man and animals also require organic foodstuffs (carbohydrates, proteins, fats and vitamins) in addition to inorganic 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 are: (i) a plant can not complete its life cycle in the absence of the element, (ii) the function of the element can not be carried out by another element, and (iii) the element is directly involved in plant metabolism. The essential nutrients are of two types: macronutrients and micronutrients. Macronutrients are required relatively in larger quantities and micronutrients are required relatively in smaller quantities. Macronutrient content of plants is usually above 0.1 % (dry weight basis) and micronutrient content is usually below 100 µg/g. Macronutrients are carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur. Micronutrients include iron, manganese, zinc, copper, boron, molybdenum and chlorine. In addition, several other elements are beneficial to some plants but are not considered essential for completion of life cycle of a plant. These beneficial elements are nickel, cobalt, sodium, silicon, selenium and vanadium. Except carbon, hydrogen and oxygen, all the 13 elements are taken up by plants from soils and they are called mineral nutrients. Plants usually obtain carbon, hydrogen and oxygen from air and water.

Sources of plant nutrients

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 in vigorous 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, N metabolism and respiration, translocation of sugars from leaves to other parts, regulation of stomatal openings, produces stiff straw in cereals, imparts disease resistance to plants
Calcium	Essential to cell wall membrane structure and permeability, role in cell elongation and division, helps in translocation of carbohydrates and nutrients
Magnesium	Constituent of chlorophyll, involved in phosphate transfer from ATP, structural component of ribosome, required for maximal activity of phosphorylatic enzyme in carbohydrate metabolism
Sulphur	Constituent of amino acids, biotin, Vit. B_1, and coenzyme A, helps in nodulation of legumes, aids in the fats and oils formation, involved in chlorophyll synthesis
Iron	Component of cytochromes, ferrodoxins and leghaemoglobin, involved in the nitrogenase and nitrate reductase enzymatic reactions
Manganese	Involved in oxidation-reduction, decarboxylation and hydrolysis reactions, synthesis of lignin, formation of O_2 in photosynthesis
Zinc	Synthesis of tryptophane needed for the production of auxins, activation of dehydrogenase enzymes, involved in chlorophyll synthesis and cell membrane integrity
Copper	Acts as an electron carrier in photosynthesis and respiration, constituent of cytochrome oxidase, synthesis of lignin that imparts strength to plants, helps in pollination and seed set
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; increases Ca solubility and mobility in plants.
Molybdenum	Constituent of nitrate reductase and nitrogenase enzymes, role in Fe absorption and translocation in plants
Chlorine	Involved in osmotic and cation neutralization; formation of O_2 in photosynthesis, essential for maintaining electrical balance in tonoplasts

2.3 Nutrient Availability in Soils

Plants build up their biomass using water from soils, CO_2 from air, energy from sunlight and nutrients from soil and water. For optimum plant growth, nutrients must be available as solutes in the soil water, in adequate and balanced amounts, and in a form which is accessible to the plant root system.

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 subsequent 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 conditions inducing nutrient deficiency in crops

Nutrient	Major conditions inducing nutrient deficiency
Nitrogen	Low organic matter content, wetland soils
Phosphorus	Acidic, leached and calcareous soils
Potassium	Sandy, leached and eroded soils
Calcium	Acidic, alkali and sodic soils
Magnesium	Acidic, alkali and sodic soils
Sulphur	Low organic matter content, submerged soils, burning of crop residues
Iron	Calcareous soils, high soil P, Mn, Cu, Zn and HCO_3^- contents
Manganese	Sandy soils, calcareous soils; high organic matter content, high soil Fe, Cu and Zn contents
Zinc	Calcareous soils, saline soils, submerged soils, low organic matter content, high soil P, Ca, Mg and Cu contents
Copper	High soil N, P and Zn contents
Boron	Sandy soils, high pH soils, dry soils
Molybdenum	Calcareous soils, acid soils with high free Fe content

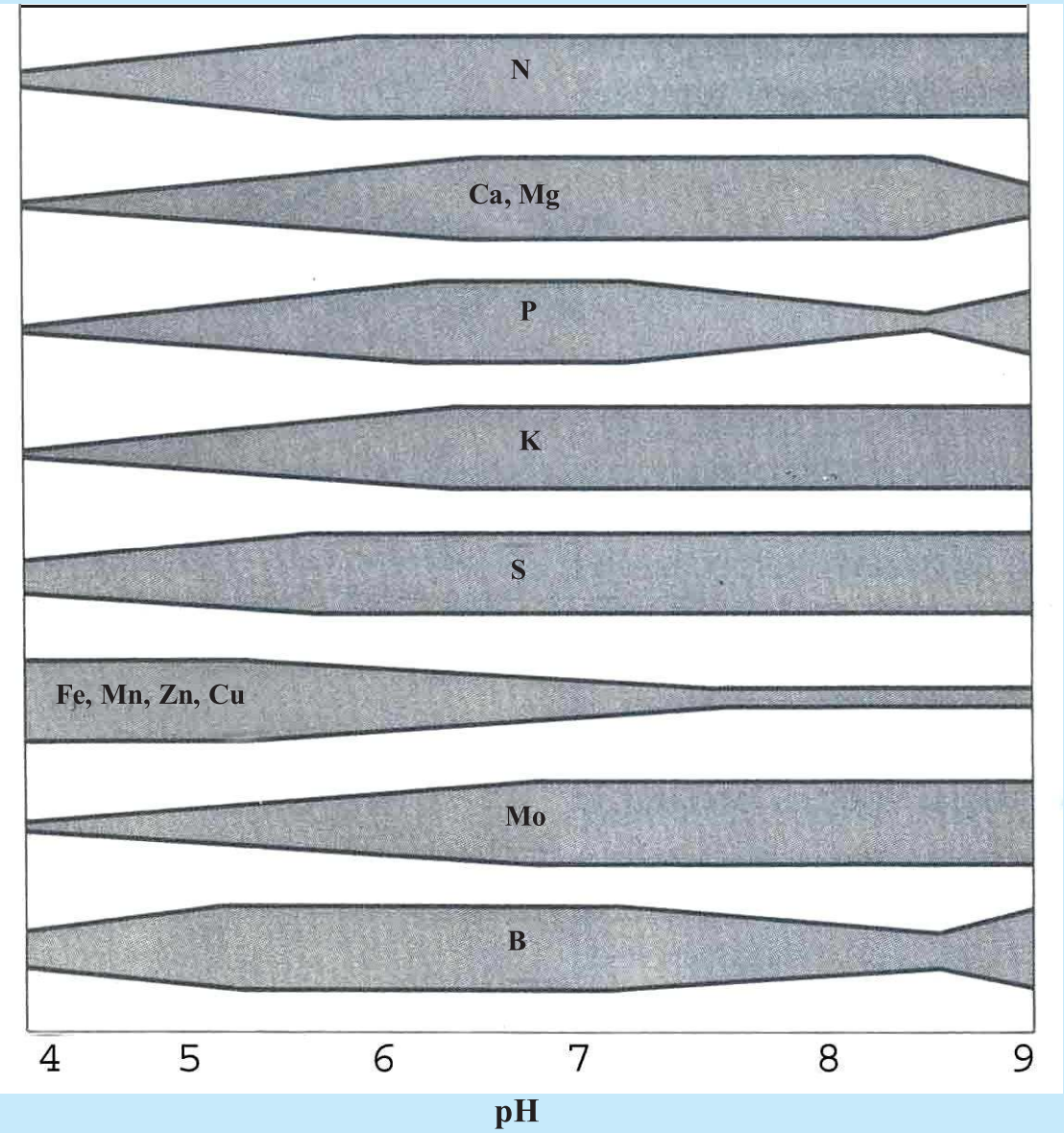

Fig. 1 Relationship between soil pH and nutrient availability

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

2.4 Nutrient Uptake by Crops

Nutrient uptake by a crop is the resultant product of crop nutrient concentration and crop yield including the crop residues. In general, higher the yield, higher is the removal of nutrients. Modern crop varieties 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 uptake (kg/ha)*			
		N	P	K	S
Rice (MV)	7.0	116	20	103	11
Wheat	4.5	123	23	99	12
Maize	9.0	169	31	133	32
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	NA
Tobacco	2.0	130	18	199	10
Sugarcane	100	140	25	325	51
Mustard	1.5	82	15	92	33
Groundnut	2.5	189	15	91	17
Soybean	3.5	237	19	140	22
Sesame	1.5	72	12	53	12
Sunflower	3.5	140	30	200	12
Chickpea	1.5	91	6	47	9
Lentil	1.0	57	7	18	NA
Blackgram	1.5	118	10	82	NA
Mungbean	1.0	106	21	59	NA
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	NA
Cucumber	40	70	22	100	NA
Brinjal	60	175	17	250	NA
Pumpkin	50	90	31	133	NA
Radish	20	120	26	100	NA
Sweetpotato	40	190	33	283	NA
Spinach	25	120	20	166	NA
Onion	35	120	22	133	26
Banana	40	250	26	350	15
Pineapple	50	185	24	290	2
Tea	2.0	128	17	60	NA

** Total uptake (kg/ha) includes nutrient uptake by main product and crop residues.*
NA: Not available

2.5 Nutrient Balance

Nutrient Balance is the sum of nutrient inputs minus the sum of nutrient outputs; the balance may be either 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.

In calculating nutrient balance, the fertilizer, manure, BNF, deposition (rain), sedimentation (flood) and irrigation water can be regarded as the nutrient inputs, and the crop produce, crop residues, leaching, gaseous loss (volatilization and denitrification) and soil erosion as the 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, the major inputs and outputs can be considered for calculating nutrient balance to understand partial or apparent nutrient balance. Nutrient balance values vary with locations, cropping systems and nutrient management practices.

With the advancement of time, nutrient balance is becoming more negative (Fig. 3). Again, land use with higher cropping intensity may show higher negative balances (Fig. 4). On the other hand, the addition of organic manure may help reduce negative balances; the magnitude depends on the types and amount of manure. Any reduction of 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 and Lentil-Mungbean-T. Aman rice) are suggested for cultivatation 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 a nutrient in soils. To minimize nutrient depletion, it is not justified to just increase the use of inorganic fertilizers, rather it is important to increase the use of organic sources of plant nutrients such as cowdung, poultry manure, compost etc.

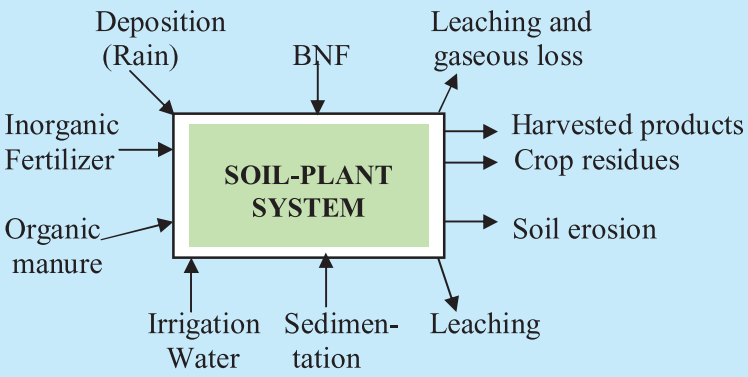

Fig. 2 Nutrient input-output system

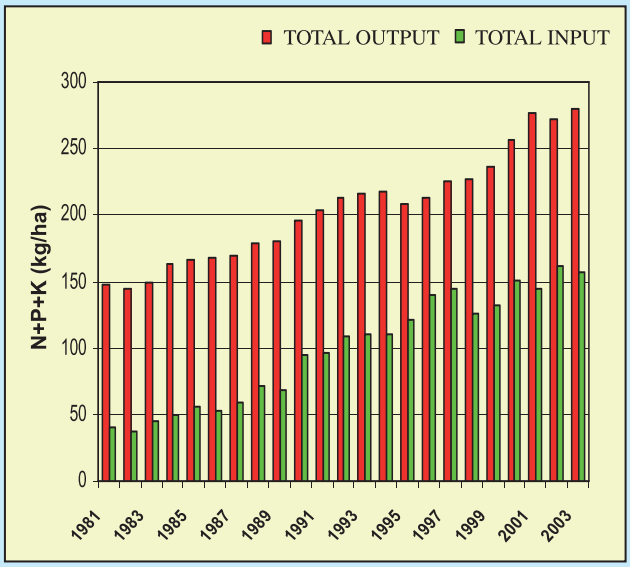

Fig. 3 Total N+P+K Input and Output in Bangladesh

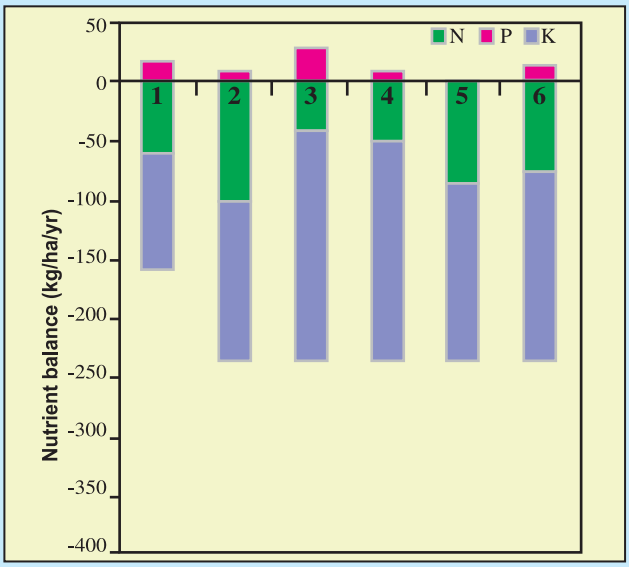

Fig. 4 Nutrient balance in different cropping patterns

1 = Boro - Fallow - T. Aman 2=Boro - T. Aus-T. Aman,
3= Boro- GM - T. Aman, 4= Mustard - Boro- T. Aman,
5= Wheat - T. Aus - T. Aman, 6= Wheat - Mungbean - T. Aman

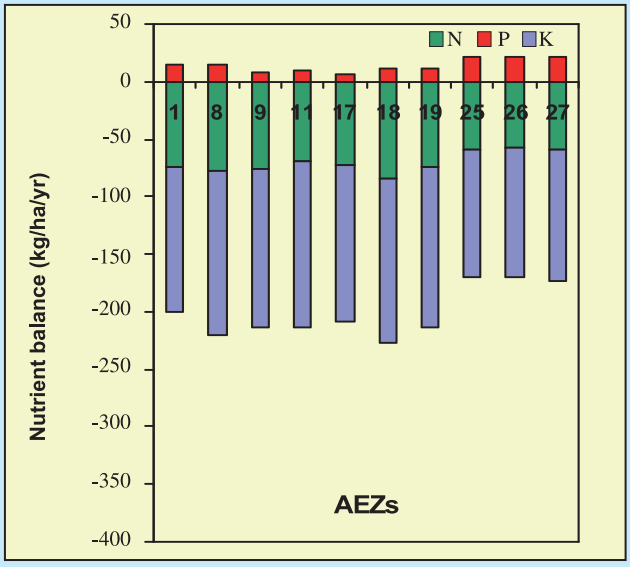

Fig. 5 Nutrient balance in Boro-Fallow-T. Aman rice cropping pattern of different AEZs

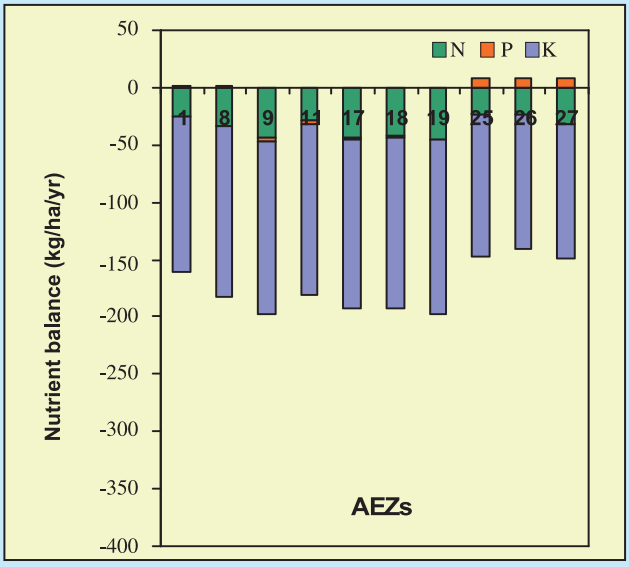

Fig. 6 Nutrient balance in Wheat-Fallow-T. Aman rice cropping pattern of different AEZs

3. SOIL FERTILITY AND CLAY MINERALS STATUS OF BANGLADESH

3.1 General Features

Thirty agro-ecological zones and 88 sub-zones have been identified by adding successive layers of information on the physical environment which are relevant for land use and assessing agricultural potential. These layers are:

- Physiography (land forms and parent materials)
- Soils
- Depth and duration of seasonal flooding and
- Agro-climatology [it comprises four elements: length of kharif and rabi growing seasons, length of the pre-kharif transition period, number of days below certain winter critical temperatures (<15 ^{o}C) and number of days with extremely high summer temperature (> 40 ^{o}C)]

Agro-ecological zones and sub-zones are very broad units. Fertility status of these zones varies greatly. Individual farmers have fragmented the land into small pieces causing wide variation in the management of each and every piece of land. This leads to the 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 30 agro-ecological zones is given here which serves as a ground for AEZ based fertilizer recommendations for cropping patterns. Area, locations 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 area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land* type	Extent (%)
1. Old Himalayan Piedmont Plain (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		
	Lalmonirhat	148	HL	2
	Nilphamari	142	MHL	72
	Rangpur	116	HS+WB	26
	Gaibandha	51		
3. Tista Meander Floodplain (946803 ha)	Rangpur	1719		
	Nilphamari	1489		
	Gaibandha	1439		
	Dinajpur	1127	HL	35
	Naogaon	957	MHL	51
	Kurigram	948	MLL	4
	Lalmonirhat	935	LL	1
	Panchagar	300	HS+WB	9
	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
			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 Nawabganj	57	LL	60
			HS+WB	30

* **HL:** Highland, **MHL:** Medium Highland, **MLL:** Medium Lowland, **LL:** Lowland, **VLL:** Very lowland, **HS:** Homestead, **WB:** Water body

(Table 2 contd.)

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land type	Extent (%)
7. Active Brahmaputra-Jamuna Floodplain (319001 ha)	Kurigram	843		
	Sirajganj	687		
	Gaibandha	499	HL	5
	Jamalpur	338	MHL	37
	Tangail	337	MLL	20
	Bogra	297	LL	8
	Manikganj	114	HS+WB	30
	Pabna	75		
8. Young Brahmaputra and Jamuna Floodplain (592394 ha)	Jamalpur	943		
	Mymensingh	861		
	Kishoreganj	776	HL	18
	Manikganj	710	MHL	42
	Sherpur	174	MLL	19
	Munshiganj	134	LL	9
	Narshingdi	93	HS+WB	12
	Narayanganj	56		
9. Old Brahmaputra Floodplain (723037 ha)	Mymensingh	2270		
	Netrokona	1568		
	Jamalpur	671	HL	28
	Sherpur	630	MHL	35
	Tangail	592	MLL	20
	Narsshingdi	590	LL	7
	Kishoreganj	439	HS+WB	10
	Narayanganj	286		
	Gazipur	170		
10. Active Ganges Floodplain (333447 ha)	Shariatpur	509		
	Pabna	476		
	Chapai Nawabganj	450		
	Faridpur	402		
	Rajshahi	274	HL	12
	Kushtia	247	MHL	33
	Munshiganj	206	MLL	18
	Manikganj	180	LL	4
	Rajbari	161	HS+WB	33
	Chandpur	159		
	Dhaka	134		
	Natore	82		
	Madaripur	52		

(Table 2 contd.)

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land type	Extent (%)
11. High Ganges River Floodplain (1320549 ha)	Jessore	2281		
	Jhenaidah	1970		
	Rajshahi	1472		
	Kushtia	1285		
	Natore	952	HL	43
	Magura	857	MHL	32
	Meherpur	705	MLL	12
	Chapai Nawabganj	669	LL	2
	Satkhira	638	HS+WB	11
	Chuadanga	551		
	Pabna	543		
	Khulna	232		
	Naogaon	117		
	Rajbari	54		
12. Low Ganges River Floodplain (796751 ha)	Faridpur	1534		
	Pabna	1219		
	Rajbari	975		
	Madariupur	818		
	Narail	714		
	Gopalganj	535	HL	13
	Manikganj	413	MHL	29
	Natore	381	MLL	31
	Shariatpur	370	LL	14
	Kushtia	176	VLL	2
	Bagerhat	146	HS+WB	11
	Dhaka	126		
	Munshiganj	97		
	Sirajganj	79		
	Khulna	68		
	Barisal	60		

(Table 2 contd.)

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land type	Extent (%)
13. Ganges Tidal Floodplain (1706573 ha)	Khulna Bagerhat Satkhira Barisal Patuakhali Borguna Pirojpur Jhalakati Sharitpur	3436 3131 3024 2022 1790 1496 1228 850 67	HL MHL MLL HS+WB	2 78 2 18
14. Gopalganj-Khulna Bils (224700)	Gopalganj Khulna Jessore Bagerhat Narail Madaripur Barisal Pirojpur	802 375 339 208 198 163 80 77	HL MHL MLL LL VLL HS+WB	3 13 41 28 11 4
15. Arial Bil (14436 ha)	Munshiganj Dhaka	103 41	MLL LL HS+WB	13 73 14
16. Middle Meghna River Floodplain (155464 ha)	Comilla Narshingdi B. Baria Chandpur Munshiganj Kishoreganj Narayanganj	331 293 278 233 152 141 128	MHL MLL LL VLL HS+WB	8 29 25 11 27
17. Lower Meghna River Floodplain (90934 ha)	Chandpur Laxmipur Noakhali	552 275 83	HL MHL MLL HS+WB	14 28 31 27
18. Young Meghna Estuarine Floodplain (926885 ha)	Bhola Noakhali Laxmipur Patuakhali Chittagong Barisal Feni Shariatpur	3309 2695 1376 855 393 376 175 50	HL MHL MLL HS+WB	1 45 7 47

(Table 2 contd.)

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land type	Extent (%)
19. Old Meghna Estuarine Floodplain (774026 ha)	Comilla	2251	HL	2
	B. Baria	1168	MHL	24
	Habiganj	817	MLL	33
	Chandpur	720	LL	21
	Noakhali	627	VLL	3
	Kishoreganj	434	HS+WB	17
	Feni	307		
	Barisal	288		
	Munshiganj	275		
	Shariatpur	221		
	Laxmipur	201		
	Narayanganj	170		
	Gopalganj	147		
	Madaripur	71		
20. Eastern Surma Kushiara Floodplain (462159 ha)	Sylhet	2748	HL	5
	Moulvibazar	1003	MHL	25
	Sunamganj	473	MLL	20
	Habiganj	398	LL	36
			HS+WB	14
21. Sylhet Basin (457345 ha)	Sunamganj	2445	MHL	4
	Kishoreganj	823	MLL	19
	Netrokona	792	LL	43
	Habiganj	367	VLL	23
	B. Baria	145	HS+WB	11
22. Northern and Eastern Piedmont Plains (403758 ha)	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's Bazar	658	MHL	43
	Feni	411	MLL	13
			HS+WB	27

(Table 2 continued)

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land type	Extent (%)
24. St. Martin's Coral Island (804 ha)	St. Martin's Coral Island	804	HL MHL MLL HS+WB	33 63 2 2
25. Level Barind Tract (504851 ha)	Naogaon Bogra Dinajpur Joypurhat Sirajganj Natore Rajshahi Gaibandha Chapai Nawabganj	1408 1182 1040 729 193 186 158 94 50	HL MHL MLL LL HS+WB	30 55 4 2 9
26. High Barind Tract (159964 ha)	Naogaon Chapai Nawabganj Rajshahi	623 502 475	HL MHL HS+WB	93 1 6
27. North Eastern Barind Tract (107926 ha)	Rangpur Dinajpur Bogra Gaibandha	466 374 161 72	HL MHL MLL HS+WB	36 56 1 7
28. Madhupur Tract (424359)	Gazipur Tangail Mymensingh Dhaka Narshingdi Narayanganj Jamalpur	1598 1033 795 462 155 133 65	HL MHL MLL LL HS+WB	56 18 7 9 10
29. Northern and Eastern Hills (1817172 ha)	Rangamati Bandarban Khagrachhari Chittagong Cox's Bazar Moulvibazar Habiganj Sylhet Comilla Sherpur Feni	4565 4423 3167 2328 1335 1292 495 270 108 82 60	HL MHL MLL HS+WB	92 2 1 5

(Table 2 continued)

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land type	Extent (%)
30. Akhaura Terrace (11324 ha)	B. Baria	113	HL MHL MLL LL VLL HS+WB	55 11 10 15 3 6

3.2 Soil Fertility Status

AEZ 1: Old Himalayan Piedmont Plain

This distinctive region is developed in Old Tista Alluvial fan extending out from the foot of the Himalayas. It has complex relief pattern comprising 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 soils 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	L-M	VL-L	VL-L	L-M	L-M	VL-L	L-M	L-M	VL-L	L-M
Medium Highland (34%)	3.9-6.4	L-M	VL-L	VL-L	L-M	VL-L	M	M	L-M	VL-L	L-M

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

The range of soil test values for each type of interpretation (e.g. VL) is given in Appendix-9

AEZ 2: Active Tista Floodplain

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 the rest of the whole profile and parent alluvium is rich in weatherable minerals. Four General Soil Types occur in the region of which, Non-calcareous Alluvium predominates. Organic matter content is low to medium and CEC is medium. Soil fertility level in general, including B status is very low to low. Ca 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%)	3.9-6.4	L-M	VL-L	VL-L	L-M	L-M	L-M	M-Opt	L-M	VL-L	L-M

AEZ 3: Tista Meander Floodplain

This 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 and parent materials 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%)	3.6-6.5	L-M	VL-L	VL-L	L-M	VL-L	VL-L	VL-L	L-M	VL-L	L-M
Medium Highland (51%)	3.5-6.5	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	VL-L	VL-L	L-M

AEZ 4: Karatoya-Bangali Floodplain

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	L-M	L-M	L-M	L-M	L-M	L-M	VL-L	Opt
Medium Highland (44%)	4.0-6.5	L-M	VL-L	VL-L	L-M	L-M	M-Opt	L-M	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

This region comprises 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 clays 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

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

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 the 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	M-Opt	M
Medium Lowland (20%)	4.5-8.0	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	L-M	M-Opt	M

AEZ 8: Young Brahmaputra and Jamuna Floodplain

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 content is 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	VL-L	L-M	VL-L	M	M	L-M	VL-L	M
Medium Highland (42%)	4.5-7.2	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	VL-L	M
Medium Lowland (19%)	4.5-7.2	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	VL-L	M

AEZ 9: Old Brahmaputra Floodplain

This 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 silty 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%)	3.8-6.5	L-M	VL-L	VL-L	L	VL-L	M-Opt	M-Opt	L-M	VL-L	Opt
Medium Highland (35%)	4.5-7.2	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	VL-L	VL-L	Opt
Medium Lowland (20%)	4.5-7.2	L-M	VL-L	VL-L	L	VL-L	M-Opt	M-Opt	L-M	VL-L	Opt

AEZ 10: Active Ganges Floodplain

This 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. The 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%)	6.7-8.4	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	L	VL-L	M
Medium Lowland (18%)	6.6-8.0	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

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 Calcareous 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 low to medium.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (43%)	4.5-7.9	L-M	VL-L	VL-L	L-M	VL-L	M-H	M-H	L-M	VL-L	M
Medium Highland (32%)	5.6-8.1	L-M	VL-L	VL-L	L-M	VL-L	M-H	M-H	L-M	VL-L	M
Medium Lowland (12%)	6.5-8.3	L-M	VL-L	VL-L	L-M	VL-L	M-H	M-H	L-M	VL-L	M

AEZ 12: Low Ganges River Floodplain

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 and K status is medium to optimum and the 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%)	6.6-8.2	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	L-M	VL-L	Opt
Medium Highland (29%)	6.1-8.2	L-M	VL-L	VL-L	M-Opt	VL-L	M-Opt	M-Opt	L-M	VL-L	Opt
Medium Lowland (31%)	5.8-8.1	L-M	VL-L	VL-L	M-Opt	L-M	M-Opt	M-Opt	L-M	VL-L	Opt
Lowland (14%)	5.9-7.6	M	VL-L	VL-L	M-Opt	L-M	M-Opt	M-Opt	L-M	L-M	Opt

AEZ 13: Ganges Tidal Floodplain

This region occupies an extensive area of tidal floodplain land in the south-west of the country. The grater 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, noncalcareous, heavy silty clays in the extensive basins. Non-calacreous 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 topsoils are acidic and subsoils are neutral to slightly alkaline. Soils of the Sundarban area are alkaline. General fertility level is high with low to medium organic matter content and very high CEC and K status. There are limitations of high exchangeable Na and low Ca/Mg ratio. The Zn status is low to medium and the B 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	L	VL-L	M-Opt	M-Opt	Opt-H	M-Opt	L-M	M-Opt	Opt

AEZ 14: Gopalganj-Khulna Bils

The 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 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 Noncalcareous Dark Grey Floodplain soils. Organic matter content is high. They have low bearing capacity when wet, very strongly acidic to neutral in top soil reaction and low in K, 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	L-M	L	VL-L	Opt	Opt	VL-L	VL	Opt
Medium Lowland (41%)	4.7-7.3	H	VL-L	L-M	L	L-M	Opt	Opt	VL-L	VL-L	Opt
Lowland (28%)	4.3-6.7	H	VL-L	L-M	L	L-M	Opt	Opt	VL-L	VL-L	Opt
Very Lowland (11%)	4.0-6.4	H	VL-L	L-M	L-M	VL-L	Opt	Opt	VL-L	VL-L	Opt

AEZ 15: Arial Bil

This region occupies a low lying basin 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% in the top and subsoils. 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 very low. 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%)	5.3-6.8	M	VL-L	L-M	VL-L	M-Opt	Opt	Opt	M	VL	Opt
Lowland (73%)	4.7-5.4	M	VL-L	M-Opt	L-M	M-Opt	Opt	L-M	M	VL	Opt

AEZ 16: Middle Meghna River Floodplain

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 lvel is very low to low.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Medium Lowland (29%)	4.8-6.9	L-M	VL-L	L-M	L-M	L-M	M-Opt	M-Opt	L-M	VL-L	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	VL	L-M	L-M	M-Opt	M-Opt	Opt	VL	Opt

AEZ 17: Lower Meghna River Floodplain

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 clay loams 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	VL-M	M-Opt	M-Opt	M-Opt	L	M
Medium Highland (28%)	4.7-7.6	L-M	VL-L	VL-L	L-M	VL-M	M-Opt	M-Opt	L-Opt	L-M	M
Medium Lowland (31%)	5.1-7.8	L-M	VL-L	VL-L	L-M	VL-M	M-Opt	M-Opt	L-Opt	L-M	M

AEZ 18: Young Meghna Estuarine Floodplain

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. Top soils are slightly acidic to slightly alkaline and sub-soils of the area are slightly alkaline. General fertility is medium but the N status is very low and organic matter is medium to optimum.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Medium Highland (45%)	4.5-8.4	M-Opt	VL-L	L-M	L-M	L-Opt	M-H	M-H	L-M	L-M	Opt

AEZ 19: Old Meghna Estuarine Floodplain

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 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 optimum. The level of P is very low to low, S is low to medium and B status ranges from low to optimum.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Medium Highland (24%)	4.5-7.8	L-M	VL-L	VL-L	L-Opt	L-M	Opt	Opt	L-M	L-Opt	Opt
Medium Lowland (33%)	5.4-7.6	L-M	VL-L	VL-L	L-Opt	L-M	Opt	Opt	L-M	L-Opt	Opt
Lowland (21%)	5.6-6.7	L-M	VL-L	VL-L	L-Opt	L-M	Opt	Opt	L-M	L-Opt	Opt

AEZ 20: Eastern Surma-Kushiyara Floodplain

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.

This area is occupied by 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 and 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 Highland (25%)	4.4-7.1	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	M	L-M	M
Medium Lowland (20%)	4.7-6.1	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	M	L-M	M
Lowland (36%)	4.2-7.7	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	M	L-M	M

AEZ 21: Sylhet Basin

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 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 P contents.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Medium Lowland (19%)	4.7-5.9	L-M	VL-L	VL-L	L-M	M-Opt	M-Opt	M-Opt	M-Opt	M-Opt	Opt
Lowland (43%)	4.8-6.1	M	VL-L	VL-L	M-Opt	M-Opt	M-Opt	M-Opt	M-Opt	M-Opt	Opt
Very Lowland (32%)	4.9-6.2	M	VL-L	VL-L	M-Opt	M-Opt	M-Opt	M-Opt	M-Opt	M-Opt	Opt

AEZ 22: Northern and Eastern Piedmont Plains

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 of the area. 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, P, S and B status.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (33%)	4.1-6.0	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	L-M	VL-L	L
Medium Highland (31%)	4.1-6.0	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	L-M	VL-L	L
Medium Lowland (16%)	4.1-6.0	L-M	VL-L	VL-L	L-M	L	M-Opt	M-Opt	L-M	L-M	L

AEZ 23: Chittagong Coastal Plain

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 Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (17%)	4.3-6.0	L-M	L	VL-L	L-Opt	L-Opt	M-Opt	M-Opt	L-M	L-M	M
Medium Highland (43%)	4.4-6.2	L-M	VL-L	VL-L	L-Opt	L-Opt	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-Opt	L-M	L-M	L-M	L-M	M

AEZ 24: St. Martin's Coral Island

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 S, Ca, Mg and B contents.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (33%)	4.6-7.8	VL-L	VL-L	VL-L	L-M	Opt-H	Opt-H	Opt-H	L	H	M
Medium Highland (63%)	4.6-7.8	VL-L	VL-L	VL-L	L-M	Opt-H	Opt-H	Opt-H	L	H	M

AEZ 25: Level Barind Tract

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 topsoil 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 limiting.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (30%)	4.3-6.1	L-M	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	VL-L	L-M
Medium Highland (55%)	4.7-7.2	L	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	VL-L	L-M

AEZ 26: High Barind Tract

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 topsoil is grey silt loam to silty clay loam, is strongly puddled and has a compact ploughpan at the base. The subsoil 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 & 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

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 topsoil 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 poor 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	VL-L	L-M	VL-L	L-M	L-M	L-M	L-M	L-M
Medium Highland (56%)	4.4-6.4	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	L-M	L-M

AEZ 28: Madhupur Tract

This is a region of complex relief and soils are developed over the Madhupur Clay. The landscape comprises 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, very low to low in P and B, and low to medium in K and S contents.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (56%)	4.0-6.1	L-M	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	VL-L	L-M
Medium Highland (18%)	4.3-6.4	L-M	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	VL-L	L-M

AEZ 29: Northern and Eastern Hills

This region includes the country's hill areas. Relief is complex. Hills have been dissected to different degrees over different rocks. In general, slopes are very steep and few low hills have flat summits.

The major hill soils are yellow-brown to strong brown, permeable, friable, loamy; mainly very strongly acidic and low in moisture holding capacity. However, soil patterns are generally complex due to local difference in sand silt and clay contents of the underlying sedimentary rocks and in the amount of erosion that has occurred. Brown Hill soils are the predominant General Soil Types of the area. Organic matter content and general fertility level are low to medium with very low to low status of N and P.

Major Land Type	Soil pH	Soil OM	Nutrient status								
			N	P	K	S	Ca	Mg	Zn	B	Mo
Highland (92%)	4.0-7.0	L-M	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	L-M	L-M

AEZ 30: Akhaura Terrace

This small region occupies the eastern border of Brahmanbaria and southwest corner of Habiganj district. In appearance, the region 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
Highland (55%)	5.4-6.5	L-M	VL-L	VL	L	L	L	L	L-M	L-M	L-M
Medium Highland (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

3.3 Clay Minerals Status

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 soils over the country. 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 zones	Major minerals
1. Old Himalayan Piedmont Plain	Mica and Chlorite*
2. Active Tista Floodplain	Mica and Chlorite*
3. Tista Meander Floodplain	Mica and Chlorite*
4. Karatoya-Bangali Floodplain	Mica and Chlorite*
5. Lower Atrai Basin	Mica and Chlorite*
6. Lower Purnabhaba Floodplain	Mica, Kaolinite, interstratified Mica-Vermiculite-Smectite and Kaolinite-Smectite
7. Active Brahmaputra-Jamuna Floodplain	Mica, Vermiculite* and Kaolinite
8. Young Brahmaputra and Jamuna Floodplain	Mica, Vermiculite* and Kaolinite
9. Old Brahmaputra Floodplain	Mica, Chlorite and 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. Gopalgonj-Khulna Bils	Mica and Smectite
15. Arial Bil	Mica and Smectite
16. Middle Meghna River Floodplain	Mica, Chlorite and Vermiculite*
17. Lower Meghna River Floodplain	Mica and Smectite

Agroecological zones	Major minerals
18. Young Meghna Estuarine Floodplain	Mica and Smectite
19. Old Meghna Estuarine Floodplain	Mica, Chlorite and Vermiculite*
20. Eastern Surma-Kushiyara Floodplain	Mica, Kaolinite and Vermiculite*
21. Sylhet Basin	Mica, Kaolinite and Vermiculite*
22. Northern and Eastern Piedmont Plains	Eastern part: Mica, Kaolinite & Vermiculite* Northern part: Kaolinite and Mica
23. Chittagong Coastal Plain	Mica, Kaolinite and Vermiculite*
24. St. Martin's Coral Island	Mica and 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	Eastern part: Mica, Kaolinite & Vermiculite* Northern part: Kaolinite and Mica
30. Akhaura Terrace	Mica, Kaolinite, interstratified Mica-Vermiculite-Smectite and Kaolinite-Smectite

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4. SOIL FERTILITY EVALUATION

When soil does not supply sufficient nutrients for optimum crop productivity, nutrients must be applied as fertilizer or manure. The proper nutrient rate is determined by knowing nutrient requirement of the crop and potential nutrient supply of soil. The quantity of nutrients required by plants depends on many factors like (i) Crops and crop varieties, (ii) Yield level, (iii) Soil properties, (iv) Environment, and (v) Management. The following three techniques are commonly used to assess nutrient status of a soil.

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

4.1 Soil Analysis

Soil analysis is done to determine the status of total and available forms of a nutrient. For fertilizer recommendation, soil test is usually carried out to know the status of available forms for all nutrients, except nitrogen. For nitrogen, total status is important for fertilizer scheduling. Compared with plant analysis, soil tests determine relative nutrient status before planting of a crop.

Objectives of soil analysis

- 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 analysis

- 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. If nutrient deficiency appears in plant, sometimes it becomes difficult to correct this deficiency through fertilizer application.

Steps in soil analysis

- Collection of soil samples
- Preparation of soil samples
- Analysis of soil samples
- Interpretation of soil test results
- Recommendation of nutrient rate based on soil test and crop response correlation.

The value of soil analysis in quantifying nutrient requirements depends on careful sampling and analysis, and using tests that are calibrated or correlated well with plant response.

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, stubbles, plant roots 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 be analyzed also for total soluble salts (i.e. electrical conductivity). All nutrients except nitrogen are evaluated for their available status and for nitrogen total N content is evaluated.

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 sites 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	Very definite
Low	75.1-150	Definite
Medium	150.1-225	Likely/Probable
Optimum	225.1-300	Less likely
High	300.1-375	Unlikely
Very high	> 375	Very unlikely

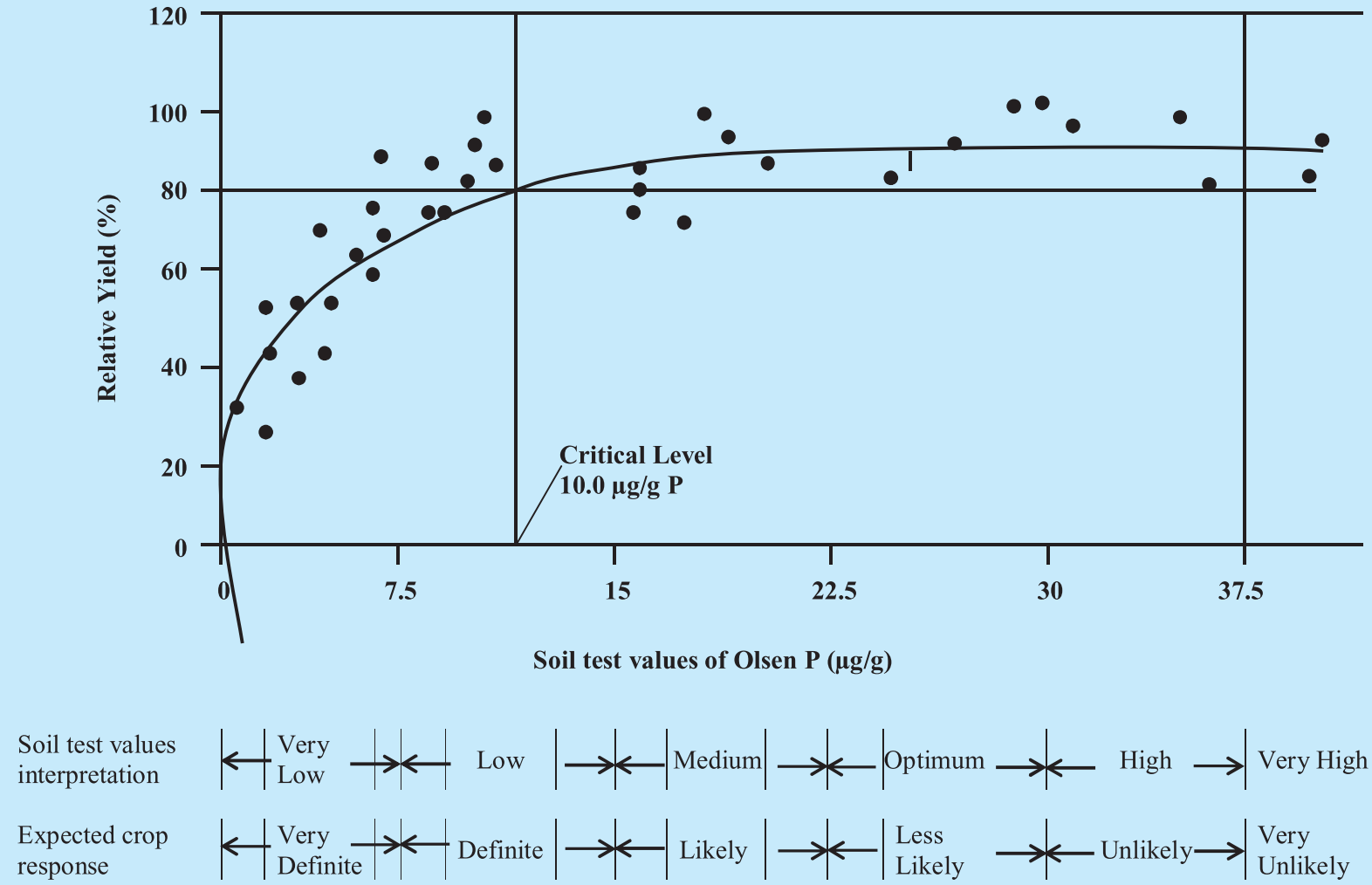


Fig. 7 Soil test interpretation and expected crop response based on critical limit (example for Phosphorus).

4.3 Crop Response to Added Fertilizers

Based on soil test result, nutrient contents 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 curve is known as growth response curve. From the response function equation the value of an added nutrient that maximizes yield is estimated as follows:

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

Where,

Y is the maximum crop growth or yield
a, b and c are coefficients
x is the 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
Py = price of crop product

Response of a crop to added nutrients depends on soil-crop-climatic variables and production practices. In general, most of the soils and 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 conditions. Crops and crop varieties 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 fertilizer application.

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 status. 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 unfavourable 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 concentrated acid or dry ashing in a high- temperature oven.

Growth stage is important in plant analysis because nutrient status as well as demand vary with the stage of crop growth. 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 stage 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.

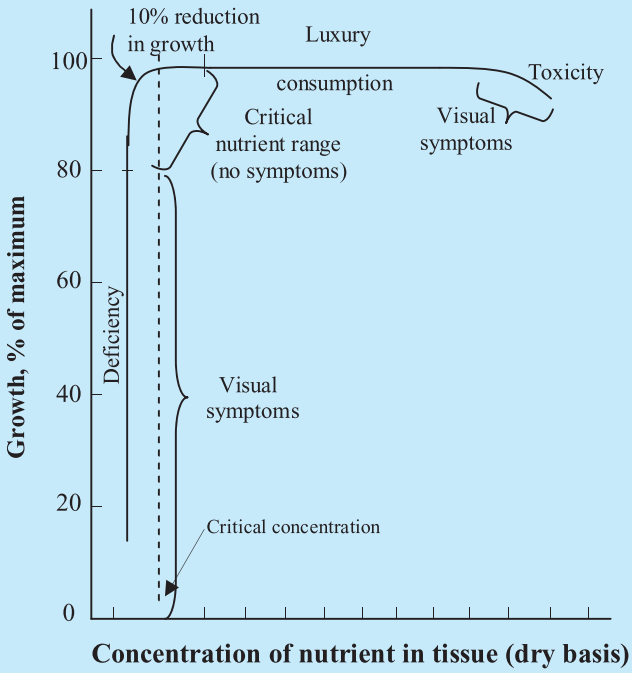


Fig. 8 Relationship between plant nutrient concentration and crop yield. Critical nutrient range (CNR) represents an economic yield loss without visual deficiency symptoms.

Plants that are severely deficient in an essential nutrient exhibit a visual deficiency symptom 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 concentrations. The critical nutrient concentration (CNC) is the nutrient level below which crop yield or quality is unsatisfactory.

Table 4. Nutrient concentration in plants

Macronutrient		Micronutrient	
Element	**Concentration (%)**	**Element**	**Concentration (ppm)**
Nitrogen	1.0-5.0	Iron	50-250
Phosphorus	0.1-0.4	Manganese	20-500
Potassium	1.0-4.0	Copper	5-20
Calcium	0.2-1.0	Zinc	25-150
Magnesium	0.1-0.4	Molybdenum	0.1-1.0
Sulphur	0.1-0.5	Boron	6-60
		Chlorine	0.2-2.0%

4.5 Diagnosis of Nutrient Deficiency Symptoms

When a plant is deficient of a particular element, some characteristic symptoms appear. 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 are 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.

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 top dressing/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 topdressing/sidedressing by using the leaf color chart.

Deficiency symptoms of different nutrients in plants

Nutrient	Deficiency symptoms
Nitrogen	Yellowing of older leaves; yellowing of younger leaves in case of severe deficiency.
Phosphorus	Purple coloration of older leaves, reduced tillering in cereals.
Potassium	Chlorosis and necrosis of the leaf edges; weakening of straw; susceptibility to diseases.
Sulphur	Yellowing of younger leaves; reddish color on the lower surfaces of leaves in cruciferous crops (e.g. cabbage).
Calcium	Burning of leaf tips and margins (called die back or tip burn); white or greyish green nodules in legumes; discolored and softer fruits.
Magnesium	Interveinal chlorosis of older leaves; reddish-purple cast of lower leaves in cotton.
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 color
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)
Boron	Grain set failure; reduced seedling vigor in pulses; hollow-heart in cauliflower; deformed shape of papaya
Molybdenum	Interveinal chlorosis of younger leaves; poor nodulation in legumes
Chlorine	Wilting of plants; chlorosis of younger leaves

Symptoms of Nutrient Deficiencies in Crop Plants

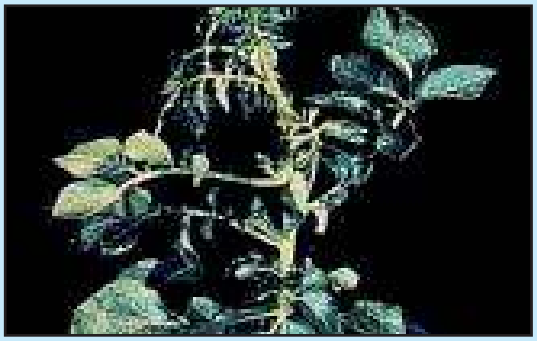
N deficient potato plant showing yellowing of leaves (left) and normal plant (right)

N deficient maize leaves showing yellowing of older leaves proceeding down the midrib

N deficient soybean; lower leaves turn uniformly pale green, then yellow

N deficient cucumber fruit is misshapen and chlorotic

P deficient maize plant with reddish purple leaf margins



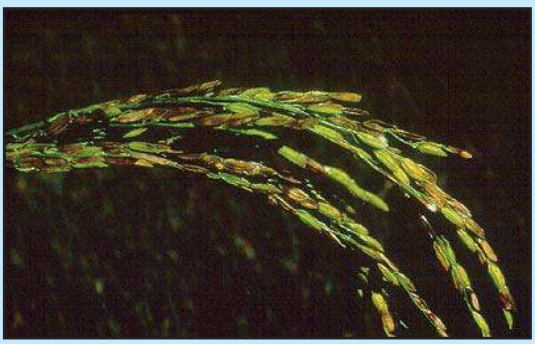
P deficient potato plants are stunted, with dark green leaves

P deficient guava shoots with purple orange color (left two) and normal guava shoot (right)

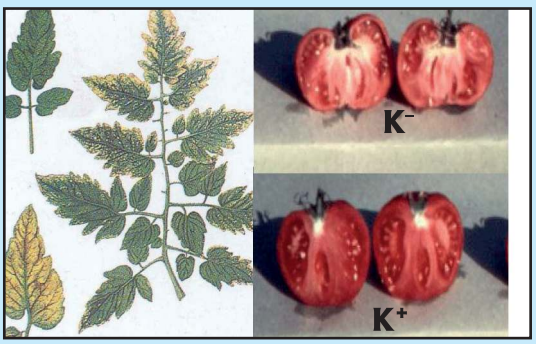
P deficient cabbage plant showing purple color of leaves

K deficiency symptom in older rice leaves

K deficiency symptom in young rice leaf



K deficient rice panicle



K deficiency symptoms of tomato: Yellowing in margins and tips of lower leaves. Upper fruits are deformed and lower fruits are normal

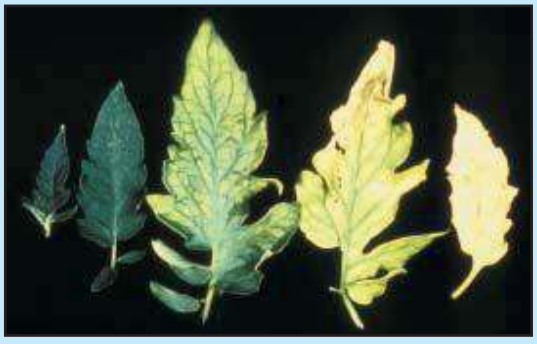
S deficient maize plant; younger leaves become yellow but lower leaves remain green

S deficient banana plant; younger leaves become yellow but lower leaves remain green

Normal tomato leaves (left two) and S deficient tomato leaves (right two)

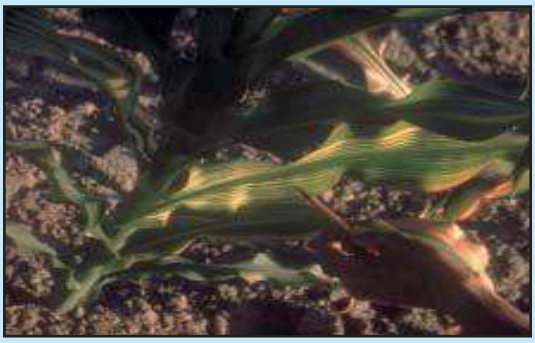
S deficient rice plant (left) and Sulphur deficient rice field (right)

Mg deficient maize plant



Normal tomato leaves (left two) and Mg deficient tomato leaves (right three)

Mg deficient cucumber ; interveinal chlorosis of older leaves



Mg deficient corn; interveinal chlorosis of older leaves

Zn deficient rice plant

Zn deficient maize plant

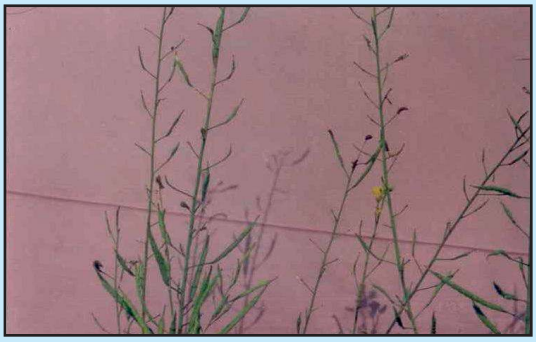
.

Zn deficient onion leaves are twisted

Zn deficient tomato leaf showing interveinal necrosis

De-formed shape of papaya due to B deficiency

Hollow and cracking of head in cauliflower due to B deficiency



Pod set in mustard affectet due to B deficiency

B deficient wheat spike (left) & normal wheat spike (right)

Mo causes mottling along with interveinal necrosis in tomato

Mo causes pale appearance of leaves in cabbage

5. FERTILIZER MANAGEMENT

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 chemicals 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 plants, e.g. cowdung, poultry manure, compost etc. It is known as manure.

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 or Cl), which is required by plants relatively to smaller amount but essential for plant growth, e.g. Zinc sulphate, Boric acid, Copper sulphate etc.

Complete fertilizer: Fertilizer which contains all three primary nutrients (N, P and K).

Compound fertilizer: Fertilizer which contains at least two of the plant nutrients (N, P and K) obtained chemically or by blending or both, 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. Both granular and coated fertilizers are know as slow release fertilizers.

Biofertilizer: Fertilizer that contains an active culture of beneficial microorganism which benefit the plants by providing nitrogen or phsophorus 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.

Filler material: A substance added to fertilizer materials to provide bulk, prevent caking or serve some purpose other than providing essential plant nutrients.

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

Soil conditioner: Material added to soils, the main function of which is to improve their physical properties and/or chemical properties and/or their biological activity.

Liming material: An inorganic soil conditioner containing one or both of the elements calcium and magnesium, generally in the form of an oxide, hydroxide, or carbonate, principally intended to raise the soil pH. Dololime [$CaMg(CO_3)_2$] is now commonly used in Bangladesh.

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 started increasing steadily only 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 fertilizers 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.

During the past few years, total fertilizer nutrient use in Bangladesh has increased significantly. Of the total nutrients used in the country, nitrogen alone constitutes about 75 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. 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 programs. 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 has been made available in the market as another source of P. It is to be noted that DAP contains N in addition to P. Therefore, there is a need to adjust for N fertilizer application if DAP is used as a source of P instead of TSP. A list of commonly used fertilizers in this country with their nutrient contents is given in Appendix 3.

Fertilizer Use in other Countries

The use of fertilizer nutrients in the Asian region has increased considerably in the recent years (Appendix-2). Application of fertilizers per unit area is the highest in Korea followed by China and the lowest in Myanmar. 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, 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 (regardless of fertilizer sources) 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.

Unbalanced 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 (NUE)

Farmers are concerned with the gross margin and benefit-cost ratio for their crop production using fertilizer and other inputs. A small part of the applied nutrient is taken up by plants. For example, crops uptake 15-25% of the applied phosphate fertilizer depending on the conditions. This can be explained as nutrient use efficiency. Crop and nutrient management practices have good influences on nutrient use efficiency (NUE).

The NUE can be expressed as agronomic efficiency (AE), recovery efficiency (RE) and physiological efficiency (PE).

Agronomic Efficiency (AE)

Agronomic efficiency refers to the increase in crop yield per unit of an applied nutrient. It can be calculated as follows:

$$AE = \frac{Y_{NA} - Y_{NO}}{N_{RN}}$$

Where,

AE : Agronomic efficiency
Y_{NA} : Yield (kg/ha) due to nutrient addition
Y_{NO} : Yield (kg/ha) due to nutrient omission
N_{RN} : Rate of nutrient addition (kg/ha)

Recovery Efficiency (RE)

Recovery efficiency (RE) refers to the increase in nutrient uptake by plants per unit of an applied nutrient. It can be calculated as follows:

$$RE = \frac{NU_{NA} - NU_{NO}}{N_{RN}}$$

Where,

RE : Recovery efficiency
NU_{NA} : Nutrient uptake (kg/ha) due to nutrient addition
NU_{NO} : Nutrient uptake (kg/ha) due to nutrient omission
N_{RN} : Rate of nutrient addition (kg/ha)

Physiological Efficiency (PE)

Physiological efficiency (PE) refers to the ability of a plant to transform a given amount of an acquired nutrient into grain yield. It refers to the grain yield per unit nutrient uptake. It can be calculated as follows:

$$PE = \frac{Y_{NA} - Y_{NO}}{NU_{NA} - NU_{NO}}$$

Where,

PE : Physiological efficiency
Y_{NA} : Yield (kg/ha) due to nutrient addition
Y_{NO} : Yield (kg/ha) due to nutrient omission
NU_{NA} : Nutrient uptake (kg/ha) due to nutrient addition
NU_{NO} : Nutrient uptake (kg/ha) due to nutrient omission

5.5 Deep Placement of Urea

Urea Super Granules (USG) and Urea Mega Granules (UMG) can be used to increase nitrogen use efficiency (NUE). 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 7-10 days of transplanting of rice at 7-10 cm soil depth at the centre of every four hills between rows 1 and 2, between rows 3 and 4, and so on.

Recovery of N can be increased by placing the USG at lower depths and away from the plant. Nitrogen recovery from USG in wetland rice is greater than the N recovery from

surface applied and/or incorporated prilled urea. Saving of 30% N is possible in wetland rice cultivation by using USG or UMG.

The main benefit of deep placement of N as USG/UMG is that the N loss through NH_3 volatilization, denitrification, leaching and surface runoff is significantly minimized. It is less subjected 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. It helps in the biological nitrogen fixation (BNF), solubilization of insoluble phosphate, stimulating plant growth or decomposition of organic matter.

Rhizobial biofertilizer

Rhizobial biofertilizer/inoculants are made with bacterial strains, reported to 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, fieldpea, groundnut and soybean) results from the activity of root nodules which fix atmospheric nitrogen making available for the plants.

Method of application of rhizobial biofertilizers

i) Take some amount of seed in a container/bowl.
ii) Add sugarcane molasses (2-3% for large seeds viz. groundnut, soybean and 3-5% for small seeds *viz*. lentil, mungbean) 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 the coated 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 seed coating with biofertilizer.
vii) Use double amount 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 Boro rice, the average N contribution by Azolla is equivalent to 25-40 kg N/ha. Azolla should be applied to standing water at the rate of 3-4 t/ha 1-2 weeks after transplanting of rice. After 2-3 weeks of its application, water needs to be drained out and Azolla should be buried in the soil. Azolla can be grown and incorporated to the rice field more than once.

5.7 Rationale of Fertilizer Use

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

i) More than 60% of added nitrogen is lost from the soil through different ways (denitrification, volatilization and leaching) and the applied nitrogen (*e.g.* prilled urea) leaves no residue in soil for use by the next crops. So 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 if 12-15 tons green biomass of dhaincha (*Sesbania*) is incorporated. This reduction could be 8-10 kg/ha when stover of grain legumes (*e.g.* mungbean) is incorporated to soil.

ii) Phosphorus availability is low in acid and calcareous soils. The plant uptake of this element is usually 15-25% of the added amount, thus it produces residual effect on the following 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 maize, vegetables, spices and pulses under moderately acid to slightly alkaline soil conditions. Such reduction would be 30-40% for rice and jute, and no reduction for maize, vegetables, spices and pulses in strongly acid and calcareous soils.

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. Response of crops to added K is not clear in many cases. 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, vegetables and spices when recommended dose of K fertilizer is used. The K dose could be reduced by 20-40% in subsequent crops if 2-4 tons of crop residues per hectare are incorporated to soils. Since release of K is high in kharif season due to high temperature, potassium application may be reduced by 10-15% of the recommended dose.

iv) Sulphur availability is low under wetland condition. 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 and vegetable crops, which should receive full dose of S.

v) Magnesium availability is generally low in Piedmont and Tista floodplain soils. Magnesium fertilizer should be applied to rabi crops and to kharif crops like jute. For wetland rice cultivation, magnesium application is not needed. If soil is amended with dolomite to raise pH, further application of Mg is not needed within at least 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. In non rice-rice cropping pattern (except maize, potato, vegetable and spice crops) Zn should be applied to the rice crop only. For growing maize, potato and vegetables Zn needs to be applied to a full dose.

vii) Boron availability is low under dry land condition. Rabi crops should receive boron at a recommended rate and the subsequent crops in a cycle dose not need further boron supplement. In the cropping pattern where rabi season is the fallow period then full recommended dose of boron should be applied to the kharif 1 crop.

viii) If organic manures such as cowdung, poultry manure, bio-slurry and compost are used, the rates of chemical fertilizers should be adjusted with the amount of nutrients from manures..

ix) Liming is recommended for soils having pH below 5.5 at the rate of 1.0 t/ha in the form of dolomite lime at an interval of 3 years. Soil pH should be checked before every application.

x) Under rainfed condition, the yield reduction would be 15% for rice and jute, 20% for potato and sugarcane, and 35% reduction for wheat, oilseed, vegetable and spice crops, for which all the recommended fertilizer nutrients (N, P, K, S, Mg, Zn and B) should be reduced by 25% compared to that under 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 the 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 its 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 in wetland rice culture.

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

- Fertilizers should not be applied too close to seeds and 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 of a crop.
- T. Aman rice seedlings should be planted immediately after incorporation of green manure

For efficient use of fertilizers, an appropriate method of fertilizer application is 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.

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 split as basal and the second split at maximum tillering stage.

iii) For vegetable crops, urea should be applied in 2-3 splits over the growth period of the crop. For short duration crops, the full dose of urea may be applied during final land preparation.

iv) For spice crops, urea application may be made in 2-3 splits.

v) The full dose of phosphorus, potassium, sulphur, magnesium, zinc and boron fertilizers should be applied as basal during final land preparation. Zinc and phosphorus fertilizers should not be mixed together. 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 topdressed if necessary, especially if the recommended dose of these fertilizers has not been applied during land preparation.

vi) Topdressing should be done under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

vii) For tobacco, potassium should be applied as K_2SO_4 instead of KCl (MoP).

viii) Micronutrient fertilizers can also be applied as foliar spray since these nutrients are required by crops relatively in smaller amounts. The sources and solution concentration of different micronutrients could be as follows:

Micronutrient	Source	Concentration (g/100 litre)
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

ix) For application of Rhizobial fertilizers, procedure described in Chapter 5.6 should be followed.

5.9 Fertilizer Management in Multiple Cropping

Multiple cropping is an important practice to minimize risks and to 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 is a labor 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 labor resources can be benefited from multiple cropping.

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. Examples of fertilizer recommendations for different mixed and intercropping systems are given in the chapter 9.4 of this Guide.

5.10 Fertilizer Management in Conservation Agriculture

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

- There would be a stratification of nutrients in soils
- Soil organic matter increases due to less decomposition and this would help carbon sequestration
- Soil moisture retention increases due to residue cover

- Requirement of fertilizer N addition may be increased initially
- Requirement of other nutrients addition may be decreased

Decline in soil disturbance and increase in crop residue retention favour the accumulation of soil organic matter. The rate of such changes depends on the amount of organic matter addition from crop residues.

Nutrient requirement of crops with conservation agriculture would vary from that with conventional agriculture. 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 nitrogen addition would be higher for the first few crops since nitrogen 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. Conservation agriculture helps maintain soil temperature and conserve soil moisture. The amount of P uptake depends mainly on the diffusion of this element. Diffusion of P increases with the soil water content. Therefore, it is expected that under no-tillage condition, phosphorus diffusion rate would be higher compared to that under conventional tillage.

Potassium requirement of crops under crop residue retention would be lower compared to no residue retention. For example, rice straw contains much more potassium than rice grain. However, the potassium benefit would depend on the amount of residue returned to soil and the rate of residue decomposition.

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 is a storehouse of plant nutrients, chiefly N, P and S. It serves as a food and energy for beneficial organisms viz. N_2 fixing bacteria (e.g *Rhizobium, Azobtobacter*), earthworms.

6.1 Status of Soil Organic Matter in Bangladesh

Soil organic matter is a key factor in maintaining long-term soil fertility since it is the reservoir of metabolic energy, which drives soil biological processes involved in nutrient availability. A good agricultural soil should have around 2.0% organic matter, but in Bangladesh most of the soils have less than 1.5% organic matter, and some soils have even less than 1% organic matter. Organic matter is known as 'storehouse of plant nutrients' and ‘life force of a soil'.

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 those factors affecting microbial activity (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 constantly undergoing changes and needs to be replenished continuously to maintain soil productivity. The major sources of soil organic matter include animal manure, farmyard wastes, domestic wastes, industrial wastes, city wastes, green manure etc.

A large variety of organic wastes are available in the country that can be used as potential manure to improve our soils. 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 litter etc.), agro-industrial wastes (sugarcane trash, oil cakes, bagasse, pressmud, 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 the valuable sources of organic matter and plant nutrients. Crop residues can be recycled either by composting or by way of mulch or by direct incorporation to 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 shade. The cattle urine is rich in nitrogen and should be preserved with the dung. The manure in the pit should be kept moist in order to reduce the volatilization of nitrogen. 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. Materials 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, pressmud, 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 less 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 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 3 – 6 months time. 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.

Trichocompost

Trichoderma can be used for the purpose of rapid composting. Compost materials such as cowdung, poultry refuge, water hyacinth (chopped), sawdust, household wastes etc. should be mixed together in a definite proportion and the spore suspension of *Trichoderma* (e.g. *T. harzianum*, count 3 $\times 10^7$/ml) should be drenched onto the compost materials, and loaded them in layers in the house, which could be measuring 10 ft. in length, 5 ft. in width and 4.5 ft. in height. Apart from fertilizer value, Trichocompost can significantly reduce the incidence of soil-borne diseases and thus helps produce healthy seedlings as well as healthy crops.

Vermicompost

In composting, earthworms can play a good role. Earthworms can 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 litters. It has also been found to be especially efficient in breaking down the toughest organic wastes like sugarcane trash. There are four methods of vermicomposting-dip pot method, raised pit method, pucca pit method and wooden box method. An ideal vermicompost contains 1% N, 1% P, 1% K, 18% carbon and 15-25% moisture.

Bio-slurry

Bio-slurry is an anaerobically decomposition product of animal manure. Cowdung and poultry manure are commercially used in biogas plants. After extraction of biogas (mainly 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 bio-slurry utilization is to carry bio-slurry from the pit to the distant crop field. However, bio-slurry can be air-dried before use.

Green manure (GM)

Green manure 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 nitrogen to soils.

Any herbaceous plant may be used for green manuring, but plants of the leguminosae family are preferred because of the added advantage of getting fixed nitrogen. The common GM plants include dhaincha *(Sesbania aculeata),* African dhaincha *(S. rostrata),* sunhemp (*Crotalaria juncea*), cowpea, 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 of time 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 N/ha to the soil. *Azolla* (water fern) can also be used as a green manure in Boro rice field.

6.3 Integrated Plant Nutrition System

The basic concept of Integrated Plant Nutrition System (IPNS) 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 IPNS approach refers to an appropriate combination of mineral fertilizers, organic manures, crop residues, composts, N-fixing crops and bio-fertilizers taking into account of the local ecological conditions, land use systems and the individual farmer's social and economic conditions. In the IPNS 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. IPNS) is essential for sustenance.

The IPNS based fertilizer requirement can be calculated as follows:

$$A = B - C$$

Where,

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	Zn	B
Rabi	Potato	30	135	30	90	10	2.0	1.5
Kharif-1	T. Aus rice	4	75	10	20	6	0.6	-
Kharif-2	T. Aman rice	5	90	10	30	8	1.0	-

b) Nutrient addition from manure and fertilizers for potato

Nutrient	N	P	K	S	Zn	B
Recommended dose (kg/ha)	135	30	90	10	2.0	1.0
Supply from manure (Cowdung @ 5 t/ha)	25	7.5	11.5	-	-	
Supply from fertilizer	110	22.5	78.5	10	2.0	1.0

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

Nutrient	N	P	K	S	Zn	B
Recommended dose (kg/ha)	75	10	20	6	1.0	-
Supply from manure (None)	-	-	-	-	-	-
Supply from fertilizer	75	10	20	6	1.0	-

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

Nutrient	N	P	K	S	Zn	B
Recommended dose (kg/ha)	90	10	30	8	1.0	-
Supply from manure (None)	-	-	-	-	-	-
Supply from fertilizer	90	10	30	8	1.0	-

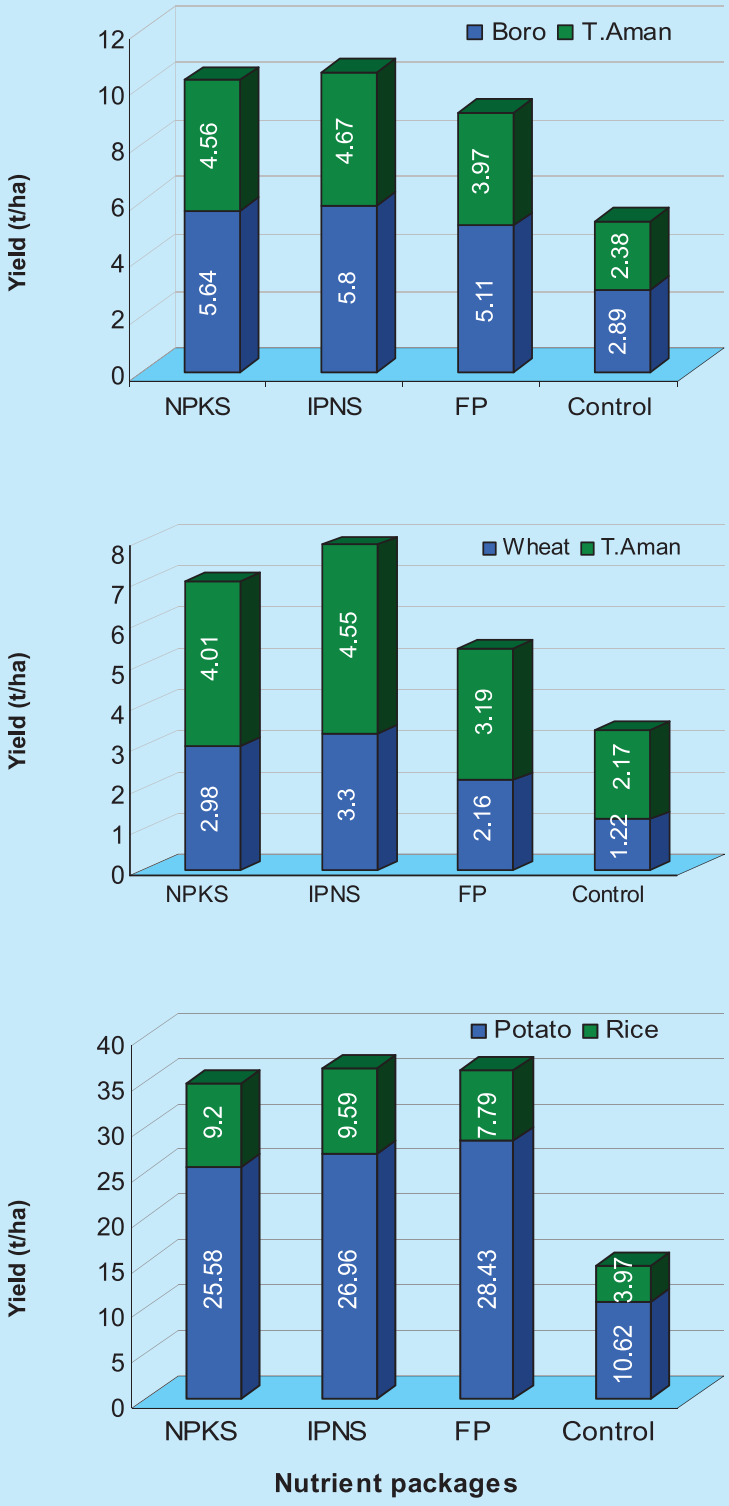


Fig. 9 Effects of different nutrient management packages on the yield of crops grown in sequence

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 CO_2 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 manure. The highest depletion of soil carbon has been reported in soils of Meghna river floodplain (35%), followed by Madhupur Tract (29%), Brahmaputra floodplain (21%), Old Himalayan Piedmont Plain (18%) and Ganges Floodplain (15%). The sequestration of atmospheric C in the soil and biomass reduce greenhouse effects. 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 build up or depletion of soil carbon stock.

7. LAND DEGRADATION

Land degradation processes are either natural or human induced. Human induced land degradation arises due to inappropriate land management practices e.g. deforestation, cultivation on steep slopes, shifting cultivation, over-exploitation of ground water, unbalanced use of fertilizers and improper crop rotations. There are a number of land degradation processes which include soil erosion, salinization, acidification, fertility depletion, water-logging and heavy metal pollution.

7.1 Soil Erosion

Light textured soils and soils of sloppy lands are vulnerable to erosion by water and wind. The storms in the summer and heavy rainfall in the rainy season cause massive soil erosion in Bangladesh. However, water erosion especially sheet erosion is dominant in this country. Obviously soil erosion is remarkable in the hilly areas which occupy about 1.7 mha land. Next to hilly areas, terrace areas (Madhupur, Barind and Akhaura terrace) are susceptible to soil erosion. Wind erosion occurs in the dry months and it is prominent in drought prone areas like Rajshahi and Dinajpur districts, and also in the charlands and seashore sandy beaches. Since top soil is relatively rich in organic matter and nutrient contents, the eroded soil left behind becomes poor in fertility status.

Table 5. Land susceptible to different degrees of soil erosion in the hilly areas

Hilly areas	Area (km^2)			
	Moderately susceptible	Highly susceptible	Very highly susceptible	Total
Chittagong Hill Tracts	350	1814	10765	12929
Chittagong & Cox's Bazar	414	949	954	2317
Greater Sylhet district	161	462	964	1587
Others (Comilla, Brahmanbaria, Netrokona, Jamalpur)	-	35	102	137
Total	**925 (5%)**	**3260 (20%)**	**12785 (75%)**	**16970 (100%)**

Source: SRDI

Hills are concentrated in the Chittagong Hill Tracts, Chittagong, Cox's Bazar, Habiganj and Moulavibazar, and it also occurs in Sherpur, Mymensingh, Sunamganj, Sylhet, Brahmanbaria, Comilla and Feni districts. Chittagonj Hill Tracts (CHT) cover about 76%

of the total hilly areas of the country over 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, nutrient leaching and low soil organic matter content. Soil erosion causes due to sloppy land and jhum cultivation. Jhum cultivation (shifting cultivation) and deforestation are the predominant forms of land degradation. Soil erosion can be reduced by some practices like terracing, contour planting and stubble mulching. Steep slopes should better be left under perennial plants and permanent cover.

7.2 Soil Salinization

Salinization is the most important 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 inundation by saline water to different degrees. Other environmental challenges include tidal surge, cyclone, acid sulphate soils (located at Sundarbans and Chakaria), water-logging in polder areas, river erosion and unstable atolls.

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

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

Saline soils have a high content of soluble salts. In this soil, EC value of saturated extract is more than 4 dS/m at 25^0C, 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.

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

Climatologically, the coastal belt is most vulnerable and mangrove forests in Bagerhat are most vulnerable. The critical challenge is to manage coastal resources and to adapt the production system with the climate change scenario. The major effects due to climate change are the increased soil and water salinity, inland salinity intrusion, water-logging, loss of crops, loss of mangrove and fisheries diversity, and disease in crops, fishes and animals.

7.3 Soil Acidification

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 slightly to strongly acidic in reaction. It is estimated that soils of 0.25 mha lands across the country are very strongly acidic (pH <4.5), 3.70 mha lands are strongly acidic (pH 4.5-5.5), and 2.74 mha lands are slightly acidic (pH 5.6-6.5). Acid soils may constraint crop production in more than 30% of lands in this country.

Acid soils possess toxic concentrations of Al^{3+}, Fe^{3+} and Mn^{2+}, lower concentrations of P and low availability of bases which together cause reduction in crop yield. Legumes are highly affected due to soil acidity. Acidity limits both survival and persistence of nodule 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.

Liming is done to raise soil pH and 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. Lime addition would have residual effect on the next crops for more than 3 years. Liming materials are calcium carbonate ($CaCO_3$), calcium oxide (CaO), calcium hydroxide [$Ca(OH)_2$], magnesium carbonate ($MgCO_3$) and dolomite lime [$CaMg(CO_3)_2$]. Dolomite lime is now commonly used in this country. Dolomite lime is also called dololime.

Liming should be practiced in sols having pH below 5.5. The amount of liming necessary to neutralize soil acidity depends on the soil pH, organic matter and clay contents. The rate of dolomite lime application would be 1.0 t/ha.

Acid sulphate soils

The potential of the acid sulphate soils for crop production is severely limited by some environmental factors like saline tidal flooding, tidal bores and probability of cyclonic storms. The soil pH is generally below 3.5. Its extent is about 0.23 mha, occurring in Chittagong, Cox's Bazar, Khulna and Satkhira. In Chittagong, this soil is known as "Kosh" Soils. These soils can be utilized for mangrove forest, salt production and shrimp culture. If protection from tidal flooding through embankment is possible, T. Aman rice can be cultivated. Deficiency of P and toxicity of Fe and Al are a major constraint for crop cultivation.

Peat soils

Peat soils occupy about 0.13 mha land. It occurs in the Gopalganj-Khulna Bils (AEZ 14). Organic materials occupy more than half of the upper 80 cm of the profile. Soft peat and muck occupy permanently wet basin centers. The area remains wet throughout the year.

The soils have low bearing capacity. The soil contains higher amount of organic matter. The soils are deeply flooded during rainy season, strongly acidic and have low P, Zn and Cu availability. Peat soil when dries, it shrinks and cracks making the soils very hard. When there is mineral top soil above the peat, rice cultivation is practiced.

7.4 Water-Logging of Soils

In Bangladesh, soils are mostly floodplains (80%). Floodplain soils are formed due to action of four major rivers– the Padma (Ganges), Meghna, Brahmaputra and Jamuna, and their tributaries & distributions. Flood and inundation are regular seasonal phenomena.

About 2.6 mha area is affected by waterlogging, of which 6.32% covers haor area. It includes bils, jhils, haors and baors. Some examples of bils are Chalan bil, Gopalganj-Khulna bil, Arial bil and Bil Dakatia (located in Khulna-Jessore). Jhils are seen in the southwestern Ganges deltaic parts, for example Bhabadah (touching Avaynagar, Monirampur and Keshabpur upazilas under Jessore district).

Haors occupy Surma-Kushiyara floodplain and Sylhet basin areas. It extends in Sylhet, Moulavibazar, Sunamganj, Habiganj, Netrakona, Kishoreganj and Bhahmanbaria districts (AEZ 21). Some examples of haors are Hakaluki haor, Tangua haor, Kawadighi haor, Hail Haor and Balai haor.

The major problems related to crop production are strong soil acidity (upon drying), heavy soil texture, nutrient deficiency and difficult communication. It's predominantly a single cropped (Boro rice) area. It suffers from wave erosion and eutrophication. Waterlogging 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.

Char lands

This area occurs 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 yield.

It is estimated that about 0.72 mha is char lands, however, it may vary depending on the situation (erosion and accretion).

7.5 Soil Fertility Depletion

Depletion of soil fertility has arisen due to intensive land use without appropriate soil management. The situation has become worse in areas where HYV crops are being grown using low to unbalanced doses of mineral fertilizers, with little or no organic recycling. Because of increasing cropping intensity and cultivation of modern varieties of crops, the net removal of plant nutrients is far from the nutrient supply through fertilizers and manures. It is reported that the overall N balances of Bangladesh soils are negative depending on the nutrient management and cropping systems, the P balances are near zero and the K balances are highly negative. High nutrient depletion occurs in soils under maize cropping.

As the time advances, new nutrient deficiency arises. Six nutrients such as N, P, K, S, Zn and B are commonly deficient in Bangladesh soils. Zinc deficiency is particularly evident in calcareous and wetland rice soils. Boron deficiency is common in rabi crops such as mustard, wheat and chickpea. Magnesium deficiency is reported in Old Himalayan Piedmont Plain and Tista Floodplain soils. There is sporadic information of Cu, Mo and Mn deficiencies in crops. Deficiencies of Fe and Cl are not yet found.

Crop production can not be sustained if the nutrients removed during the cropping phase are not replenished. Fertilizer recommendations should consider short-term as well as long-term crop response to applied fertilizers. Changes in soil nutrient pools need to be accounted for evaluating nutrient management strategies by estimating the system level nutrient use efficiency.

7.6 Heavy Metal Contamination of Soils

Industrial discharge, fertilizers, fossil fuels, sewage sludge and municipal wastes are the major sources of heavy metal contamination in soils and subsequent uptake by crops. Industrials wastes and effluents are being discharged randomly on soils, into canals, rivers, along the road sides or in the vicinity of the industrial areas without any treatment. Lead, cadmium, arsenic, mercury, chromium and nickel are the significant contaminants. Hazaribag, Tongi and Konabari are important industrial areas near to Dhaka city. The rivers around Greater Dhaka City (Buriganga, Lakhya, Balu, Turag) are highly polluted with heavy metals and organic pollutants. There are huge agricultural lands adjacent to these industrial areas where polluted river water is being used for irrigation purpose in rice and vegetable cultivation. Reports are available that significant amounts of cadmium, lead and nickel are being transferred from soils to vegetable crops (spinach, tomato and cauliflower) grown in industrially polluted soils of Konabari and Keraniganj. High concentrations of heavy metals in the water have been reported to reduce fish growth with elevated levels of heavy metals in the flesh. Phosphate fertilizers might be a good source of cadmium contamination of soils. Uptake of heavy metals by crops may ultimately enter into the food chain and may lead to long term health hazards.

8. QUALITY CONTROL OF FERTILIZERS

8.1 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) in 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 (MAL) of different heavy/toxic metals for both organic and inorganic fertilizers have been fixed in the country. Maximum allowable limits (MAL) 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 4). To ensure the quality of organic fertilizers, standard for physical and chemical properties have been fixed along with the maximum allowable limits (MAL) of different heavy/toxic metals, which have been published as Gazette Notification by MoA during April 2008.

8.2 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 Extension (DAE) through certain procedures as stated in the Fertilizer (Management) Regulation, 2007.

8.3 Monitoring of Fertilizers

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 Committees' 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 into 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 a significant role in the quality control of fertilizers and fertilizer materials in the country. There are seven Government notified laboratories for fertilizer analysis. The laboratories are Soil Science laboratories of BARI, BRRI, BINA, Department of Soil, Water and Environment, Dhaka University, Department of Biochemistry and Molecular Biology, 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 laboratories are Biochemistry and Molecular Biology 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 reports annually to the Ministry of Agriculture (MoA) regarding quality status of fertilizers used in the country.

8.4 Identification of Adulterated Fertilizers

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 Soil Resource Development Institute (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.

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.

Identification of adulterated Triple Super Phosphate (TSP)

- Triple Super Phosphate is a widely used phosphatic fertilizer in Bangladesh. It is granular, grey to dark grey in color and contains 20% total P and 17.4% water soluble P with acidic taste. A good quality TSP is strong by acidic in taste with pungent smell but adulterated TSP has no acidic taste and pungent smell.
- Good quality TSP is little bit hard and can not 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.

Identification of adulterated Diammonium Phosphate (DAP)

- Diammonium phosphate is a widely used chemical fertilizer in the country, which contains 18% N and 20% total P and 17.8% water soluble P. Diammonium phosphate is highly soluble in water, having pungent smell and acidic in taste. It is granular and dark grey to white in color.
- A good quality DAP contains 18% N, which absorbs moisture from the atmosphere. For that reason DAP becomes wet when exposed to air.
- Place 1 to 2 teaspoonful of DAP fertilizer on a dry paper and keep it open for 1 to 2 hours. If it becomes wet, the fertilizer is of good quality, and if it does not become wet the DAP is adulterated.
- For quality testing, pour one teaspoonful of DAP fertilizer into 100 ml of water in a beaker or glass. The good quality DAP will be dissolved shortly. After dissolution, add half teaspoonful of barium chloride ($BaCl_2$) into the solution. In case of good quality DAP, $BaCl_2$ will be settled down at the bottom of the beaker or glass. On the other hand, adulterated DAP will produce turbid/muddy/hazy precipitate in the solution due to presence of sulphur.

DAP fertilizer

Identification of adulterated Potassium Chloride (Muriate of Potash)

- Muriate of Potash (MoP) is one of the most widely used potash fertilizers in Bangladesh. MoP is light to deep red in colour, crystalline in nature and contains 50% K. Muriate of Potash 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 MoP fertilizer

Solution of good quality and adulterated MoP

- 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 color will stick on to the finger when dipped into the solution. The good quality MoP will produce light homogenous red colour solution. The color will not stick on to the finger if deep into the solution.

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 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

Identification of adulterated NPKS (Mixed fertilizer)

- NPKS is a mixed fertilizer containing nitrogen, phosphorus, potassium and sulphur. 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.

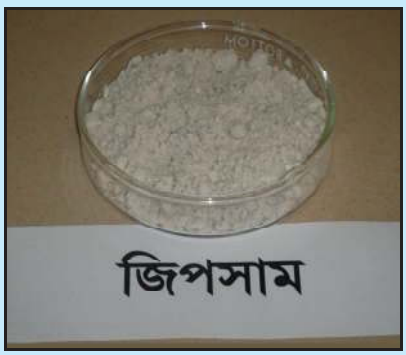
- There are wide variations in the nature and degree of adulteration of NPKS mixed fertilizers. So it is difficult to identity adulterated NPKS fertilizer at the field level.
- Good quality NPKS fertilizers are heavier than the adulterated NPKS fertilizers.

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.

Identification of adulterated Gypsum

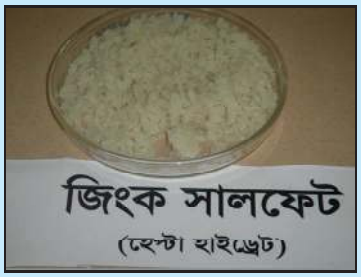
- Gypsum is used as a source of sulphur in Bangladesh. It comes out as by-product during production of TSP. Gypsum is amorphous/powder, grey to white in color, contains 16% S and 20% Ca. Gypsum contains comparatively high moisture and for that reason it cannot be preserved for a long time in open place. 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

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

- Zinc sulphate, heptahydrate is crystalline like sugar. It contains 23% Zn and 11% 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 totally dissolved and no sediment will be found at the bottom



Zinc sulphate, heptahydrate

Good quality Zinc sulphate, heptahydrate solution

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.

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

- Zinc Sulphate, monohydrate must be granular and contains 36% Zn and 18% 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 1 to 2 teaspoonful of the fertilizer into 100 ml cold water in a glass container or beaker and stir. The fertilizer will not be dissolved fully and will produce turbidity.
- 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.

Good quality Zinc sulphate mono hydrate and adulterated Zinc sulphate, mono hydrate solution

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.

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 cold water in a beaker or glass container 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.

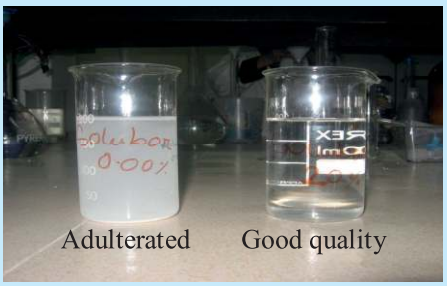
Chelated Zinc solution

- In case of adulterated chelated zinc, when it is poured into cold water, it will not be dissolved quickly. Upon addition of barium chloride white precipitate or sediment will be produced.

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 container containing 100 ml clear cold water and stirred. 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

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
- be dark grey to black in color
- be odourless
- have no bad smell

A good quality organic fertilizer does not form clod when pressed 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.

9. FERTILIZER RECOMMENDATION FOR CROPS AND CROPPING PATTERNS

9.1 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 Appendices 10 and 11, respectively.

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 10.

9.1.1 CEREAL CROPS

RICE (*Oryza sativa*)

(Boro rice)

(Var. BRRI dhan29, Binadhan-6, BRRI hybrid dhan1, BRRI hybrid dhan2 and BRRI hybrid dhan3)

Yield Goal: 7.5 ± 0.75 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–50	0–8	0–33	0–6	–
Medium	51–100	9–16	34–66	7–12	0.0–1.3
Low	101–150	17–24	67–99	13–18	1.4–2.6
Very low	151–200	25–32	100–132	19–24	2.7–3.9

Method of application:

a) All of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.

c) 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.

RICE (*Oryza sativa*)

(Boro rice)

(Var. BR3, BR8, BR9, BR14, BR16, BR17, BR18, BR19, BRRI dhan28, BRRI dhan45, BRRI dhan47, BRRI dhan 50, Binadhan-5 and Binadhan-8)

Yield Goal: 6.0 ± 0.6 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–45	0–7	0–30	0–5	–
Medium	46–90	8–14	31–60	6–10	0.0–1.0
Low	91–135	15–21	61–90	11–15	1.1–2.0
Very low	136–180	22–28	91–120	16–20	2.1–3.0

Method of application:

a) All of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.

c) 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.

RICE (*Oryza sativa*)

(Boro rice)

(Var. BR 1, BR2, BR7, BR15, BRRI dhan35 and BRRI dhan36)

Yield Goal: 5.0 ± 0.50 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–40	0–7	0–30	0–5	–
Medium	41–80	8–14	31–60	6–10	0.0–0.7
Low	81–120	15–21	61–90	11–15	0.8–1.4
Very low	121–160	22–28	91–120	16–20	1.5–2.1

Method of application: Same as above

RICE (*Oryza sativa*)

(Boro rice)

(Var. LIV under transplanted culture)

Yield Goal: 3.5 ± 0.35 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–23	0–4	0–14	0–3	–
Medium	24–46	5–8	15–28	4–6	0.0-0.6
Low	47–69	9–12	29–42	7–9	0.7–1.2
Very low	70–92	13–16	43–56	10–12	1.3–1.8

Method of application:

a) All of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.

c) 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.

RICE (*Oryza sativa*)

(T. Aus rice)

(Var. BR 1, BR2, BR3, BR7, BR8, BR9, BR14, BR16, BR26, BRRI dhan27, BRRI dhan48 and Iratom 24)

Yield Goal: 4.0 ± 0.4 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–25	0–5	0–15	0–3	–
Medium	26–50	6–10	16–30	4–6	0.0-0.6
Low	51–75	11–15	31–45	7–9	0.7–1.2
Very low	76–100	16–20	46–60	10–12	1.3–1.8

Method of application: Same as above

RICE (*Oryza sativa*)

(T. Aus rice & B. Aus rice)

(Transplanted Culture: Var. BR6, BR20, BR21 and BR24)
(Direct Seeded Culture: 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	0–17	0–4	0–11	0–3	–
Medium	18–34	5–8	12–22	4–6	0.0-0.6
Low	35–51	9–12	23–33	7-9	0.7–1.2
Very low	52–68	13–16	34–44	10–12	1.3–1.8

Method of application:

a) All of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation for both of transplanted and direct seeded culture.

b) Under transplanted culture nitrogen should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.

c) Under direct seeded culture nitrogen 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.

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

RICE (*Oryza sativa*)

(B. Aus rice)

(Var. LIV under Direct Seeded Culture)

Yield Goal: 2.5 ± 0.25 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–10	0–3	0–8	0–2	–
Medium	11–20	4–6	9–16	3–4	0.0–0.5
Low	21–30	7–9	17–24	5–6	0.6–1.0
Very low	31–40	10–12	25–32	7–8	1.1–1.5

Method of application: Same as above

RICE (*Oryza sativa*)

(T. Aman rice)

(Var. BR4, BR10, BR11, BR22, BR23, BRRI dhan30, BRRI dhan31, BRRI dhan32, BRRI dhan40, BRRI dhan41, BRRI dhan44, BRRI dhan46, BRRI dhan49, BRRI dhan51, BRRI dhan52, BRRI dhan53, BRRI dhan54 and BRRI hybrid dhan4, Binadhan-4, Binadhan-7 and Binadhan-8)

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	0–20	0–4	–
Medium	31–60	6–10	21–40	5–8	0.0–0.7
Low	61–90	11–15	41–60	9–12	0.8–1.4
Very low	91–120	16–20	61–80	13–16	1.5–2.1

Method of application:

a) All of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.

c) 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.

RICE (*Oryza sativa*)

(T. Aman rice)

(Var. BR25, BRRI dhan33, BRRI dhan39, BRRI dhan56, BRRI dhan57 and Binashail)

Yield Goal: 4.0± 0.4 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–20	0–4	0–20	0–3	–
Medium	21–40	5–8	21–40	4–6	0.0-0.6
Low	41–60	9–12	41–60	7–9	0.7–1.2
Very low	61–80	13–16	61–80	10–12	1.3–1.8

Method of application: Same as above.

RICE (*Oryza sativa*)

(T. Aman rice)

(Var. BR5, BRRI dhan34, BRRI dhan37 and BRRI dhan38)

Yield Goal: 3.0 ± 0.3 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–13	0–3	0–15	0–3	–
Medium	14–26	4–6	16–30	4–6	0.0–0.5
Low	27–39	7–9	31–45	7–9	0.6–1.0
Very low	40–52	10–12	46–60	10–12	1.1–1.5

Method of application:

a) All of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.

c) 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.

RICE (*Oryza sativa*)

(T. Aman rice)

(Var. Binadhan-9)

Aromatic rice

Yield Goal: 3.0 ± 0.3 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–13	0–3	0–12	0–3	–
Medium	14–26	4–6	13–24	4–6	0.0–0.5
Low	27–39	7–9	25–36	7–9	0.6–1.0
Very low	40–52	10–12	37–48	10–12	1.1–1.5

Method of application: Same as above

RICE (*Oryza sativa*)

(T. Aman rice)

(Var. LIV under Transplant Culture)

Yield Goal: 3.0 ± 0.3 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–15	0–3	0–11	0–3	–
Medium	16–30	4–6	12–22	4–6	0.0–0.5
Low	31–45	7–9	23–33	7–9	0.6–1.0
Very low	46–60	10–12	34–44	10–12	1.1–1.5

Method of application:

a) All of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits, the first one as basal/immediately after seedling establishment, the second one at early tillering stage and the third one at 5–7 days before panicle initiation (PI) stage. It should be applied as broadcast and mixed thoroughly with the soil as soon as possible for better utilization.

c) 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.

RICE (*Oryza sativa*)

(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	0–10	0–3	0–8	0–2	–
Medium	11–20	4–6	9–16	3–4	0.0–0.5
Low	21–30	7–9	17–24	5–6	0.6–1.0
Very low	31–40	10–12	25–32	7–8	1.1–1.5

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur and zinc fertilizers should be applied as basal during final land preparation.

b) Remaining half nitrogen should be topdressed at the maximum tillering stage and should be mixed thoroughly with the soil as soon as possible for better utilization.

Fertilizer Recommendation for Seedbed

Usually, fertilizer is not required for seedbed if it is prepared in optimum or sub-optimum fertile soils. For less fertile soils, cowdung or farmyard manure at the rate of 2 kg/m^2 can be applied. If seedlings become yellow, urea should be top dressed at the rate of 7 g/m^2 after 2 weeks of germination. If seedlings still remain yellowish after urea application then there might have sulphur deficiency. In that case gypsum should be applied at the rate of 10 g/m^2 as top dress. In the winter season, seedlings of boro rice may become yellowish due to cold injury which may be confused as tungro disease.

WHEAT (*Triticum aestivum*)

(Irrigated)

[Var. Sourav (BARI Gom-19), Gourab (BARI Gom-20), Shatabdi (BARI Gom-21), Bijoy (BARI Gom-23), Prodip (BARI Gom-24), BARI Gom-25 and BARI Gom-26]

Yield Goal: 4.5 ± 0.45 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Mg	Zn	B
Optimum	0–40	0–10	0–30	0–5	–	–	–
Medium	41–80	11–20	31–60	6–10	0–3	0.0–1.3	0.0–0.5
Low	81–120	21–30	61–90	11–15	4–6	1.4–2.6	0.6–1.0
Very low	121–160	31–40	91–120	16–20	7–9	2.7–3.9	1.1–1.5

Method of application:

a) Two-third of the nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc, boron and organic manure (if used) should be applied as basal during final land preparation.

b) Remaining one-third of nitrogen should be applied at 17–21 days after sowing (DAS) after first irrigation.

c) Application of organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

WHEAT (*Triticum aestivum*)

(Rainfed)

[(Var. Kanchan, Akbar, Protiva, Sourav (BARI Gom-19), Gourab (BARI Gom-20), Shatabdi (BARI Gom-21)]

Yield Goal: 2.5± 0.25 t/ha

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	–	–	0.0–0.4
Low	31–45	11–15	25–36	5.1–7.5	0–3	0.0–1.0	0.5–0.8
Very low	46–60	16–20	37–48	7.6–10.0	4–6	1.1–2.0	0.9–1.2

Method of application:

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

b) One-third nitrogen (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 organic manure at the rate of 4 ton cowdung or 2.5 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

MAIZE (*Zea mays*)

(Hybrid maize)

(Var. 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 Maize 10 and BARI Hybrid Maize 11)

Yield Goal: 10.0 ± 1.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Mg	Zn	B
Optimum	0–85	0–25	0–40	0–18	0–5	–	–
Medium	86–170	26–50	41–80	19–36	6–10	0.0–2.0	0.0–0.7
Low	171–255	51–75	81–120	37–52	11–15	2.1–4.0	0.8–1.4
Very low	256–340	76–100	121–160	53–72	16–20	4.1–6.0	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 nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc and boron 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 nitrogen 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 kharif season, nitrogen 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 organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

MAIZE (*Zea mays*)

(Var. BARI Bhutta-5, BARI Bhutta-6 and BARI Bhutta-7)

Yield Goal: 6.0 ± 0.6 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Mg	Zn	B
Optimum	0–50	0–16	0–32	0–10	–	–	–
Medium	51–100	17–32	33–64	11–20	0–4	0.0–1.4	0.0-0.7
Low	101–150	33–48	65–96	21–30	5–8	1.5–2.8	0.8–1.4
Very low	151–200	49–64	97–128	31–40	9–12	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 nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc and boron 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 nitrogen 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 kharif season, nitrogen 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 organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

MAIZE (*Zea mays*)

(Var. Khaibhutta)

Yield Goal: 5.5 ± 0.55 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Mg	Zn	B
Optimum	0–40	0–12	0–25	0–10	–	–	–
Medium	41–80	13–24	26–50	11–20	0–3	0.0–1.4	0.0-0.7
Low	81–120	25–36	51–75	21–30	4–6	1.5–2.8	0.8–1.4
Very low	121–160	37–48	76–100	31–40	7–9	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 nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc and boron 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 nitrogen 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 kharif season, nitrogen 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 organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare 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.

BARLEY (*Hordeum vulgare*)

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

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	0–17	0–3	–
Medium	21–40	8–14	18–34	4–6	0.0–1.0
Low	41–60	15–21	35–51	7–9	1.1–2.0
Very low	61–80	22–28	52–68	10–12	2.1–3.0

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur and zinc should be applied as basal during final land preparation.

b) Remaining half nitrogen should be applied as topdress in two equal splits at 30–35 days after sowing (DAS) and 55–60 DAS after irrigation.

c) Under rainfed culture all fertilizers should be applied as broadcast during final land preparation.

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	0.0–0.7
Low	41–60	15–21	31–45	7–9	0.8–1.4
Very low	61–80	22–28	46–60	10–12	1.5–2.1

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur and zinc should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied as topdress at 30–35 DAS after irrigation.

c) Under rainfed culture all fertilizers should be applied as broadcast during final land preparation.

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	0.0–0.7
Low	41–60	17–24	29–42	7–9	0.8–1.4
Very low	61–80	25–32	43–56	10–12	1.5–2.1

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur and zinc should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied as topdress in two equal splits at 30-35 DAS and 55-60 DAS after irrigation.

c) Under rainfed culture all fertilizers should be applied as broadcast during final land preparation.

9.1.2 FIBRE CROPS

JUTE (*Corchorus capsularis*)

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

Yield Goal : 3.5 ± 0.35 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–25	0–4	0–13	0–5	–
Medium	26–50	5–8	14–26	6–10	0.0–1.5
Low	51–75	9–12	27–39	11–15	1.6–3.0
Very low	76–100	13–16	40–52	16–20	3.1–4.5

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur, zinc and organic manure (if used) should be applied as basal during final land preparation.

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

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 rate of application of organic manure as per Appendix-7.

JUTE (*Corchorus olitorius*)

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

Yield Goal: 4.5 ± 0.45 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–37	0–5	0–25	0–9	–
Medium	38–74	6–10	26–50	10–18	0.0–2.0
Low	75–111	11–15	51–75	19–27	2.1–4.0
Very low	112–148	16–20	76–100	28–36	4.1–6.0

Method of application: Same as above

KENAF (*Hibiscus cannabinus*)

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

Yield Goal: 5.0 ± 0.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)		
	N	P	K
Optimum	0–30	0–6	0–17
Medium	31–60	7–12	18–34
Low	61–90	13–18	35–51
Very low	91–120	19–24	52–68

Method of application:

a) Half of nitrogen and all of phosphorus, potassium and organic manure (if used) should be applied as basal during final land preparation.

b) Remaining half nitrogen should be top dressed 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 rate of application of organic manure as per Appendix-7.

MESTA (*Hibiscus sabdariffa*)

(Var. HS-24)

Yield Goal: 4.5 ± 0.45 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)		
	N	P	K
Optimum	0–25	0–5	0–11
Medium	26–50	6–10	12–22
Low	51–75	11–15	23–33
Very low	76–100	16–20	34–44

Method of application: Same as above

LATE JUTE SEED PRODUCTION

JUTE (*Corchorus capsularis*)

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

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					
	N	P	K	S	Zn	B
Optimum	0–35	0–5.5	0–12	0–5	–	–
Medium	36–70	5.6–11.0	13–24	6–10	0.0–2.0	0.0–0.7
Low	71–110	11.1–16.5	25–36	11–15	2.1–4.0	0.8–1.4
Very low	111–140	16.6–22.0	37–48	16–20	4.1–6.0	1.5–2.1

Method of application:

a) All of phosphorus, potassium, sulphur, zinc, boron and organic manure (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-third during final land preparation, the second one-third at 20–25 DAS and the 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 rate of application of organic manure as per Appendix-7.

JUTE (*Corchorus olitorius*)

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

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					
	N	P	K	S	Zn	B
Optimum	0–42	0–10	0–13	0–6	–	–
Medium	43–84	11–20	14–28	7–12	0.0–2.0	0.0–1.0
Low	85–126	21–30	29–42	13–18	2.1–4.0	1.1–2.0
Very low	127–168	31–40	43–52	19–24	4.1–6.0	2.1–3.0

Method of application: Same as above

KENAF (*Hibiscus cannabinus*)

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

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			
	N	P	K	S
Optimum	0–31	0–6	0–10	0.0–3.5
Medium	32–62	7–12	11–20	3.6–7.0
Low	63–93	13–18	21–30	7.1–10.5
Very low	94–124	19–24	31–40	10.6–14.0

Method of application:

a) All of phosphorus, potassium, sulphur and organic manure (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-third during final land preparation, the second one-third at 20–25 DAS and the third 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 rate of application of organic manure (as per Appendix-7).

MESTA (*Hibiscus sabdariffa*)

(Var. HS-24)

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			
	N	P	K	S
Optimum	0–27	0–6	0–15	0–3.5
Medium	28–54	7–12	16–30	3.6–7.0
Low	55–81	13–18	31–45	7.1–10.5
Very low	82–108	19–24	46–60	10.6–14.0

Method of application: Same as above

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)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–30	0–12	0–25	0–6	-	-	5	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		

*** CD:** Cowdung; **PM:** Poultry manure

Method of application:

a) **As basal:** All of organic manure 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% 0f 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 -

   i) 20% of N, 15% of K and 30% of Zn should be applied as side dressing during 20-25 days after sowing (DAS).

   ii) 25% of N, 25% of P, 30% of K, 40% of S, 40% of Zn and 50% of B should be applied as side dressing during 40-45 DAS.

   iii) 30% of N, 30% of K, 30% of S, 30% of Zn and 40% of B should be applied as side dressing during 60-65 DAS.

   iv) 15% of N and 10% of K should be applied as side dressing during 75-80 DAS.

   After application the fertilizers should be mixed thoroughly with the soil as soon as possible for better utilization.

COTTON (*Gossypium harbaceum*)

(Var. CB-12)

Yield goal: 2.7 ± 0.27 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–38	0–17	0–40	0–7	-	-		
Medium	39–76	14–34	41–80	8–14	0–2	0.0–0.7	5	3
Low	77–114	35–51	81–120	15–21	3–4	0.8–1.4		
Very low	115–152	52–68	121–160	22–28	5–6	1.5–2.1		

*** CD:** Cowdung; **PM:** Poultry manure

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

COTTON (*Gossypium harbaceum*)

(Var. Rupali-1 and DM-2)

Yield goal: 3.6 ± 0.36 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–50	0–21	0–52	0–10	-	-		
Medium	51–100	22–42	53–104	11–20	0–3	0.0–1.2	5	3
Low	101–150	43–63	105–156	21–30	4–6	1.3–2.4		
Very low	151–200	64–84	157–208	31–40	7–9	2.5–3.6		

*** CD:** Cowdung; **PM:** Poultry manure

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

9.1.3 PULSE CROPS

LENTIL (*Lens culinaris*)

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

Yield Goal: 1.8± 0.18 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–6	0–8	0–10	0–6	–	–	–
Medium	7–12	9–16	11–20	7–12	0.0–1.0	0.0–0.5	0–0.2
Low	13–18	17–24	21–30	13–18	1.1–2.0	0.6–1.0	0.3–0.4
Very low	19–24	25–32	31–40	19–24	2.1–3.0	1.1–1.5	0.5–0.6

Method of application:

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

b) 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.

CHICKPEA (*Cicer arietinum*)

(Var. BARI Chhola-2, BARI Chola-3, BARI Chola-4, BARI Chola-5, BARI Chola-6 and BARI Chola-7)

Yield Goal: 2.5 ± 0.25 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–11	0–8	0–15	0–7	–	–	–
Medium	12–22	9–16	16–30	8–14	0.0–1.0	0.0–0.5	0–0.2
Low	23–33	17–24	31–45	15–21	1.1–2.0	0.6–1.0	0.3–0.4
Very low	34–44	25–32	46–60	22–28	2.1–3.0	1.1–1.5	0.5–0.6

Method of application:

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

b) 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.

CHICKPEA (*Cicer arietinum*)

(Var. Hyposola, Binasola-2, Binasola-3, Binasola-4, Binasola-5 and Binasola-6)

Yield Goal: 2.0 ± 0.20 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–8	0–7	0–12	0–6	–	–	–
Medium	9–16	8–14	13–24	7–12	0.0–1.0	0.0–0.5	0–0.2
Low	17–24	15–21	25–36	13–18	1.1–2.0	0.6–1.0	0.3–0.4
Very low	25–32	22–28	37–48	19–24	2.1–3.0	1.1–1.5	0.5–0.6

Method of application:

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

b) 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.

MUNGBEAN (*Vigna radiata*)

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

Yield Goal: 1.5 ± 0.15 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–6	0–9	0–12	0–6	–	–	–
Medium	7–12	10–18	13–24	7–12	0.0–1.0	0.0–0.5	0–0.2
Low	13–18	19–27	25–36	13–18	1.1–2.0	0.6–1.0	0.3–0.4
Very low	19–24	28–32	37–48	19–24	2.1–3.0	1.1–1.5	0.5–0.6

Method of application:

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

b) 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.

BLACKGRAM (*Vigna mungo*)

(Var. BARI mash-1, BARI mash-2, BARI mash-3 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 basal during 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 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 basal during 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 grasspea seed. Nitrogen should be topdressed at the evening after harvest of aman rice 10-15 days after sowing of the grasspea seed.

COWPEA (*Vigna unguiculata*)

(Var. BARI felon-2)

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	0.0–2.5
Medium	6–10	6–10	7–12	2.6–5.0
Low	11–15	11–15	13–18	5.1–7.5
Very low	16–20	16–20	19–24	7.6–10.0

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.

9.1.4 OIL SEED CROPS

MUSTARD (*Brassica juncia* and *Brassica napus*)

(Var. BARI sarisha-11, BARI sarisha-13, BARI sarisha-16, Binasharisa-3, Binasharisa-4 and Binasharisa-5)

Yield Goal: 2.0 ± 0.2 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Mg	Zn	B
Optimum	0–40	0–12	0–30	0–9	–	–	–
Medium	41–80	13–24	31–60	10–18	0–3	0.0–1.5	0.0–0.5
Low	81–120	25–36	61–90	19–27	4–6	1.6–3.0	0.6–1.0
Very low	121–160	37–48	91–120	28–36	7–9	3.1–4.5	1.1–1.5

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc, boron and organic manure (if used) should be applied as basal during final land preparation. Remaining half nitrogen should be applied as top dress at the time of flower initiation stage (25 days after sowing).

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

c) Application of organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

MUSTARD (*Brassica campestris*)

(Var. Tori-7, BARI sarisha-9, BARI sarisha-14 and BARI sharisha-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)						
	N	P	K	S	Mg	Zn	B
Optimum	0–30	0–9	0–20	0–5	–	–	–
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) Half of nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc, boron and organic manure (if used) should be applied as basal during final land preparation. Remaining half nitrogen should be applied as top dress at the time of flower initiation stage (25 DAS).

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

c) Application of organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

SESAME (*Sesamum indicum*)

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

Yield Goal: 1.3 ± 0.13 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					
	N	P	K	S	Zn	B
Optimum	0–26	0–9	0–16	0–7	–	–
Medium	27–52	10–18	17–32	8–14	0.0–1.3	0.0–0.5
Low	53–78	19–27	33–48	15–21	1.4–2.6	0.6–1.0
Very low	79–104	28–36	49–64	22–28	2.7–3.9	1.0–1.5

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc, boron and organic manure (if used) should be applied as basal during final land preparation. Remaining half nitrogen 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.

c) Application of organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

GROUNDNUT (*Arachis hypogaea*)

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

Yield Goal: 2.6 ± 0.26 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–15	0–12	0–20	0–12	–	–	–
Medium	16–30	13–24	21–40	13–24	0–1.0	0–0.7	0–0.2
Low	31–45	25–36	41–60	25–36	1.1–2.0	0.8–1.4	0.3–0.4
Very low	46–60	37–48	61–80	37–48	2.1–3.0	1.4–2.1	0.5–0.6

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc, boron and molybdenum should be applied as basal during final land preparation. Remaining nitrogen 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, BARI Soyabean-5, BARI Soyabean-6, Binasoybean-1 and Binasoybean-2)

Yield Goal: 2.0 ± 0.2 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–8	0–10	0–20	0–5	–	–	–
Medium	9–16	11–20	21–40	6–10	0–1.0	0.0–0.5	0–0.2
Low	17–24	21–30	41–60	11–15	1.0–2.0	0.6–1.0	0.3–0.4
Very low	25–32	31–40	61–80	16–20	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.

SUNFLOWER (*Helianthus annus*)

(Var. Kironi and BARI surjomukhi-2)

Yield Goal: 2.0 ± 0.20 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Mg	Zn	B
Optimum	0–43	0–12	0–20	0–7	–	–	–
Medium	44–86	13–24	21–40	8–14	0.0–3.0	0.0–1.0	0.0–0.8
Low	87–129	25–32	41–60	15–21	4.0–6.0	1.1–2.0	0.9–1.6
Very low	130–172	33–48	61–80	22–28	7.0–9.0	2.1–3.0	1.7–2.4

Method of application:

a) Half of nitrogen and all of phosphorus, potassium, sulphur, magnesium, zinc, boron and organic manure (if used) should be applied as basal during final land preparation. Remaining half nitrogen 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 organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure as per Appendix-7.

SAFFLOWER (*Carthamus tintorious*)

(Var. BARI Saf–1)

Yield Goal: 1.5 ± 0.15 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			
	N	P	K	S
Optimum	0–16	0–6	0–8	0–3
Medium	17–32	7–12	9–16	4–6
Low	33–48	13–18	17–24	7–9
Very low	49–64	19–24	25–32	10–12

Method of application:

a. Half of nitrogen and all of phosphorus, potassium, sulphur and organic manure (if used) should be applied as basal during final land preparation. Remaining half nitrogen 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.

c. Application of organic manure at the rate of 5 ton cowdung or 3 ton poultry manure per hectare is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-7).

LINSEED (*Linum usitatissimum*)

[Var. BARI Tishi-1 (Nila)]

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

Method of application:

a) Half of nitrogen and all of phosphorus, potassium and sulphur should be applied as basal during final land preparation. Remaining nitrogen should be applied at the time of flower initiation (at 20 DAS) as top dress.

b) Under rainfed condition all fertilizers should be applied as basal during final land preparation.

NIGER (*Guizotia abyssinica*)

[Var.BARI Guji-1 (Shova)]

Yield Goal: 1.5 ± 0.15 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

Method of application:

a) Half of nitrogen and all of phosphorus, potassium and sulphur should be applied as basal during final land preparation. Remaining half nitrogen should be applied at 3–4 weeks of sowing as top dress.

b) Under rainfed condition all fertilizers should be applied as basal during final land preparation.

9.1.5 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 (Asterix), BARI Alu-28(Lady Rosetta), BARI Alu-29 (Courage), BARI Alu-30 (Meridian), BARI Alu-31(Sagitta) and others)]

Yield Goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							Manure (t/ha)	
	N	P	K	S	Mg	Zn	B	CD or PM*	
Optimum	0–45	0–10	0–45	0–5	–	–	–		
Medium	46–90	11–20	46–90	6–10	0–5	0–2.0	0.0–0.5	5	3
Low	91–135	21–30	91–135	11–15	6–10	3.0–4.0	0.6–1.0		
Very low	136–180	31–40	136–180	16–20	11–15	5.0–6.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, sulphur, magnesium, zinc and boron and half of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining half nitrogen and potassium should be applied as side dressing at 30–35 days after planting during earthing up operation.

SWEET POTATO (*Ipomoea batatas*)

[Var. Bari Misti Alu-1(Tripti), Bari Misti Alu-2 (Kamalashundhuri), BARI Misti Alu-3 (Daulatpuri), BARI Misti Alu-4 and BARI Misti Alu-5]

Yield Goal: 40.0 ± 4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							Manure (t/ha)	
	N	P	K	S	Mg	Zn	B	CD or PM*	
Optimum	0–35	0–15	0–35	0–5	–	–	–	5	3
Medium	36–70	16–30	36–70	6–10	0–4	0.0–1.0	0.0–0.5		
Low	71–105	31–45	71–105	11–15	5–8	1.1–2.0	0.6–1.0		
Very low	106–140	46–60	106–140	16–20	9–12	2.1–3.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, sulphur, magnesium, zinc and boron; and half of nitrogen and potassium should be applied as basal during final land preparation. Remaining half nitrogen and potassium should be applied as side dressing at 30–35 days after planting during earthing up operation.

b) Under rainfed condition all fertilizers should be applied during final land preparation.

AROIDS

MUKHIKACHU (*Colocasia esculenta*)

(Var. Bilashi and others)

Yield Goal: 30.0 ±3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–32	0–9	0–27	0–6	5	3
Medium	33–64	10–18	28–54	7–12		
Low	65–96	19–27	55–81	13–18		
Very low	97–128	28–36	82–108	19–24		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium and sulphur should be applied as basal during final land preparation.

b) Nitrogen should be applied as side dressing in two equal splits at 15–20 and 40–45 days after emergence during earthing up operation.

PANIKACHU (*Colocasia esculenta*)

(Var. Latiraj, BARI Panikachu-2, BARI Panikachu-3 & others)

Yield Goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–30	0–12	0–32	0–5	5	3
Medium	31–60	13–24	33–64	6–10		
Low	61–90	25–36	65–96	11–15		
Very low	91–120	37–46	97–128	16–20		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium and sulphur should be applied as basal during final land preparation.

b) Nitrogen 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.

9.1.6 VEGETABLE CROPS

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)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–60	0–22	0–25	0–8	–	–	5	3
Medium	61–120	23–44	26–50	19–16	0–1.5	0–0.5		
Low	121–180	45–66	51–75	17–24	1.6–3.0	0.6–1.0		
Very low	181–240	67–88	76–100	25–32	3.1–4.5	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, sulphur, zinc and boron should be applied as basal during final land preparation.

b) Nitrogen and potassium should be applied in two equal splits at 15 and 35 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.

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)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–40	0–15	0–20	0–6	–	–	5	3
Medium	41–80	16–30	21–40	7–12	0.0–1.2	0.0–0.4		
Low	81–120	31–45	41–60	13–18	1.3–2.4	0.5–0.8		
Very low	121–160	46–60	61–80	18–24	2.5–3.6	0.9–1.2		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application: Same as above.

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)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–45	0–20	0–45	0–7	–	–	5	3
Medium	46–90	21–40	46–90	8–14	0.0–1.5	0.0–0.7		
Low	91–135	41–60	91–135	15–21	1.6–3.0	0.8–1.4		
Very low	136–180	61–80	136–180	22–28	3.1–4.5	1.5–2.1		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) Half of organic manure and all of phosphorus, sulphur, zinc and boron should be applied as basal during final land preparation. Remaining half organic manure should be applied in pit before planting of seedlings.

b) Nitrogen and potassium 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.

CAULIFLOWER (*Brassica oleracea*)

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

Yield Goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–40	0–20	0–38	0–7	–	–	5	3
Medium	41–80	21–40	39–76	8–14	0.0–1.5	0.0–0.3		
Low	81–120	41–60	77-104	15–21	1.6–3.0	0.4–0.6		
Very low	121–160	61–80	105–152	22–28	3.1–4.5	0.7–0.9		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application: Same as above

CHINESE CABBAGE (*Brassica chinensis*)

(Var. BARI China Copi-1)

Yield Goal: 40.0 ± 4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–53	0–17	0–20	0–8	5	3
Medium	54–106	18–34	21–40	9–16		
Low	107–159	35–51	41–60	17–24		
Very low	160–212	52–68	61–80	25–32		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus and sulphur; and half of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining half nitrogen and potassium should be applied at 20 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

BROCCOLI (*Brassica oleracea*)

(All varieties)

Yield Goal: 25.0 ± 2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–35	0–12	0–20	0–6	–	–	5	3
Medium	36–70	13–24	21–40	7–12	0–1.0	0.0–0.6		
Low	71–105	25–36	41–60	13–18	1.1–2.0	0.7–1.2		
Very low	106–140	37–48	61–80	19–24	2.1–3.0	1.3–1.8		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) Half of organic manure and all of phosphorus, sulphur, zinc and boron should be applied as basal during final land preparation. Remaining manure should be applied in pits before planting of seedlings.

b) Nitrogen and potassium should be applied in three equal splits at 15, 30 and 45 days after transplanting as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

CHINASAK (*Brassica chinensis*)
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)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–50	0–10	0–20	0–8		
Medium	51–100	11–20	21–40	9–16	5	3
Low	101–150	21–30	41–60	17–24		
Very low	151–200	31–40	61–80	25–32		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus and sulphur; and half of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining half nitrogen and potassium should be applied at 20–25 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

TOMATO (*Solanum lycopersicum*)
(Winter)

[Var. BARI Tomato-2 (Ratan), BARI Tomato-3, BARI Tomato-14, BARI Tomato-15, BARI Hybrid Tomato-5, BARI Hybrid Tomato-6, BARI Hybrid Tomato-7, Roma VF, Binatomato-4, Binatomato-5, Binatomato-6, Binatomato-7 and others]

Yield Goal: 80.0 ± 8.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–45	0–15	0–25	0–5	–	–	10	6
Medium	46–90	16–30	26–50	6–10	0.0–1.0	0.0–0.5		
Low	91–135	31–45	51–75	11–15	1.1–2.0	0.6–1.0		
Very low	136–180	46–60	76–100	16–20	2.1–3.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) Half of organic manure and all of phosphorus, sulphur, zinc and boron should be applied as basal during final land preparation. Remaining organic manure should be applied in pits before planting of seedlings.

b) Nitrogen and potassium should be applied in two equal splits at 15 and 35 days after transplanting 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 Hybrid Tomato-3, BARI Hybrid Tomato-4, BARI Hybrid Tomato-8, Binatomato-2 and Binatomato-3)

Yield Goal: 45.0 ± 4.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–40	0–12	0–25	0–5	–	–	5	3
Medium	41–80	13–24	26–50	6–10	0.0–1.0	0.0–0.5		
Low	81–120	25–36	51–75	11–15	1.1–2.0	0.6–1.0		
Very low	121–160	37–48	76–100	16–20	2.1–3.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) Half of organic manure and all of phosphorus, sulphur, zinc and boron should be applied as basal during final land preparation. Remaining organic manure should be applied in pits before planting of seedlings.

b) Nitrogen and potassium should be applied in three equal splits at 20, 40 and 60 days after transplanting 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-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)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–40	0–12	0–30	0–5	–	–	5	3
Medium	41–80	13–24	31–60	6–10	0.0–1.0	0.0–0.5		
Low	81–120	25–36	61–90	11–15	1.1–2.0	0.6–1.0		
Very low	121–160	37–48	91–120	16–20	2.1–3.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) Half of organic manure should be applied at the time of final land preparation. Remaining organic manure and all of phosphorus, sulphur, zinc and boron should be applied in pit before one week of transplanting seedlings.

b) Nitrogen and potassium should be applied in three equal splits at 20, 40 and 60 DAT as ring method around the plants 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 & others)

Yield Goal: 16.0 ± 1.6 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–30	0–10	0–20	0–5	–	–	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		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron; and one-fourth of nitrogen should be applied as basal during final land preparation.

b) Remaining three-fourth nitrogen should be applied at 20, 40 and 60 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

RADISH (*Raphnus sativus*)

[Var. BARI Mula-1 (Tasaki Mula), 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)					Manure (t/ha)	
	N	P	K	S	Zn	CD or PM*	
Optimum	0–50	0–15	0–40	0–8	–	5	3
Medium	51–100	16–30	41–80	9–16	0–1.5		
Low	101–150	31–45	81–120	17–24	1.6–3.0		
Very low	151–200	46–60	121–160	25–32	3.1–4.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, sulphur and zinc; and one third of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen and potassium should be side dressed in two equal splits at 21 and 35 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

CARROT (*Daucus carota*)

(All cultivars)

Yield Goal: 20.0 ± 2.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–40	0–13	0–30	0–8	5	3
Medium	41–80	14–26	31–60	9–16		
Low	81–120	27–39	61–90	17–24		
Very low	121–160	40–52	91–120	25–32		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium and sulphur; and one-third of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen 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-4, BARI Sheem-6, IPSA Shim-2 & others)

Yield Goal: 20.0 ± 2.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					Manure (t/ha)	
	N	P	K	S	Zn	CD or PM*	
Optimum	0–15	0–10	0–15	0–3	–	5	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		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur and zinc; and half of nitrogen should be applied as basal during final land preparation.

b) Remaining half nitrogen should be applied during 25–30 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

YARDLONG BEAN (*Vigna unguiculata*)

(Var. BARI Borbati-1, Kagor Natoki and others)

Yield Goal: 10.0 ±1.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					
	N	P	K	S	Zn	B
Optimum	0–6	0–9	0–11	0–3	–	–
Medium	7–12	10–18	12–22	4–6	0.0–0.6	0.0–0.6
Low	13–18	19–27	23–33	7–9	0.7–1.2	0.7–1.2
Very low	19–24	28–26	34–44	10–12	1.3–2.0	1.3–2.0

Method of application:

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

b) Nitrogen should be applied in two equal splits during the 2nd and 4th weeks of germination.

c) *Rhizobium* inoculum (at the rate of 50 g/kg seed) must 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)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–30	0–10	0–15	0–3	–	–	5	3
Medium	31–60	11–20	16–30	4–6	0.0–1.0	0.0–0.7		
Low	61–90	21–30	31–45	7–9	1.1–2.0	0.8–1.4		
Very low	91–120	31–40	46–60	10–12	2.1–3.0	1.5–2.1		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron; and one-third of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be side dressed at 20 and 35 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

GARDEN PEA (*Pisum sativum*)

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

Yield Goal: 15.0 ± 1.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					Manure (t/ha)	
	N	P	K	S	Zn	CD or PM*	
Optimum	0–16	0–8	0–10	0–4	–	5	3
Medium	17–32	9–16	11–20	5–8	0.0–0.7		
Low	33–48	17–24	21–30	9–12	0.8–1.4		
Very low	49–64	25–32	31–40	13–16	1.5–2.1		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur and zinc; and one-third of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be side dressed at 20 and 35 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

SWEET GOURD (*Cucurbita moschata*)

(Var. BARI Misti Kumra-1, BARI Misti Kumra-2 and others)

Yield Goal: 40.0 ± 4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–25	0–12	0–20	0–7	–	–	5	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		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron 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 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

BOTTLE GOURD (*Lagenaria siceraria*)
ASH GOURD (*Benincasa hispida*)

(Bottle gourd: Var. BARI Lau-1, BARI Lau-2, BARI Lau-3, BARI Lau-4 and others)
(Ash gourd: Var. BARI Chal Kumra-1 and IPSA Ash gourd-1)

Yield Goal: 40.0 ± 4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–25	0–12	0–20	0–7	–	–	5	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		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron 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 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

TEASLE GOURD (*Momordica cochinchinensis*)

(All cultivars)

Yield Goal: 18.0 ± 1.8 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–20	0–8	0–14	0–6	–	–	5	3
Medium	21–40	9–16	15–28	7–12	0.0–1.0	0.0–0.7		
Low	41–60	17–24	29–42	13–18	1.1–2.0	0.8–1.4		
Very low	61–80	25–32	43–56	19–24	2.1–3.0	1.5–2.1		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron 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 20, 40 and 60 days after planting and mixed thoroughly with the soil as soon as possible for better utilization.

BITTER GOURD (*Momordica charantia*)

(Var. BARI Karola-1 and others)

Yield Goal: 25.0 ± 2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					Manure (t/ha)	
	N	P	K	S	B	CD or PM*	
Optimum	0–25	0–10	0–15	0–5	–	5	3
Medium	26–50	11–20	16–30	6–10	0.0–0.5		
Low	51–75	21–30	31–45	11–15	0.6–1.0		
Very low	76–100	31–40	46–60	16–20	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron 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 20, 40 and 60 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

POINTED GOURD (*Trichosanthes dioica*)

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

Yield Goal: 20.0 ±2.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–30	0–6	0–12	0–5	–	–	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		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron should be applied in pit 5–7 days before planting and mixed thoroughly with the soil.

b) Nitrogen should be applied in four equal splits at the 3rd, 6th, 9th and 12th weeks of planting around the plant as side dressing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

SNAKE GOURD (*Trichosanthes anguina*)
RIDGE GOURD (*Luffa acutangula*)
SPONGE GOURD (*Luffa cylindrica*)

(Snake gourd: Var. BARI Chichinga-1 and others
Ridge gourd : Var. BARI Jhinga-1 and others
Sponge gourd: All cultivars)

Yield Goal: 27.0 ± 2.7 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)
	N	P	K	S	Zn	B	CD or PM*
Optimum	0–25	0–12	0–20	0–7	–	–	5 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	

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron 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 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

CUCUMBER (*Cucumis sativus*)

(All varieties)

Yield Goal: 16.0 ± 1.6 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–20	0–8	0–16	0–6	–	–		
Medium	21–40	9–16	17–32	7–12	0.0–1.0	0.0–0.5	5	3
Low	41–60	17–24	33–48	13–18	1.1–2.0	0.6–1.0		
Very low	61–80	25–32	49–64	19–24	2.1–3.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur Zn and boron; and one-third of nitrogen and potassium should be applied in pit 5–7 days before planting and mixed thoroughly with the soil.

b) Remaining nitrogen and potassium should be applied during 20, 35 and 50 days after planting around the plant as side dressing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

KANGKONG (*Ipomoea aquatica*)

(Var. BARI Gimakalmi-1)

Yield Goal: 40.0 ± 4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–40	0–11	0–17	0–3		
Medium	41–80	12–22	18–34	4–6	5	3
Low	81–120	23–33	35–51	7–9		
Very low	121–160	34–44	52–68	10–12		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium and sulphur; and one third of nitrogen should be applied as basal during final land preparation.

b) The remaining nitrogen should applied as top dress after each harvest under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

INDIAN SPINACH (*Basella alba*)

[Var. BARI Puishak-1 (Chitra), BARI Puishak-2 and others)]

Yield Goal: 40.0 ± 4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–30	0–6	0–20	0–5		
Medium	31–60	7–12	21–40	6–10	5	3
Low	61–90	13–18	41–60	11–15		
Very low	91–120	19–24	61–80	16–20		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus and sulphur; and one-third of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining nitrogen and potassium should be applied in two equal splits at 14 and 28 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

SPINACH (*Spinacea oleracea*)

(Var. Kupipalong and others)

Yield Goal: 40.0±4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)	
	N	P	K	S	CD or PM*	
Optimum	0–17	0–5	0–5	0–2		
Medium	18–34	6–10	6–10	3–4	5	3
Low	35–51	11–15	11–15	5–6		
Very low	52–68	16–20	16–20	7–8		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium and sulphur should be applied as basal during final land preparation.

b) Nitrogen should be applied in two installments at 21 and 42 days after sowing.

AMARANTHUS (*Amaranthus lividus*)

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

Yield Goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)
	N	P	K	S	CD or PM*
Optimum	0–39	0–9	0–20	0–2	5 3
Medium	40–78	10–18	21–40	3–4	
Low	79–117	19–27	41–60	5–6	
Very low	118–156	28–36	61–80	7–8	

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium and sulphur; and one-third of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied in two equal splits at 15 and 35 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

RED AMARANTHUS (*Amaranthus gangeticus*)

(Var. BARI Lalshak-1 and others)

Yield Goal: 14 ± 1.4 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure (t/ha)
	N	P	K	S	CD or PM*
Optimum	0–27	0–6	0–10	0–1.5	5 3
Medium	28–54	7–12	11–20	1.6–3.0	
Low	55–81	13–18	21–30	3.1–4.5	
Very low	82–108	19–24	31–40	4.6–6.0	

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium and sulphur; and half of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied as topdress at 10–15 days after sowing under moist soil condition.

9.1.7 SPICE CROPS

ONION (*Allium cepa*)

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

Yield Goal: 16.0 ± 1.6 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–30	0–15	0–40	0–10	–	–	5	3
Medium	31–60	16–30	41–80	11–20	0–1.5	0–0.7		
Low	61–90	31–45	81–120	21–30	1.6–3.0	0.71–1.4		
Very low	91–120	46–60	121–160	31–40	3.1–4.5	1.41–2.1		

Method of application:

a) All of organic manure, phosphorus, sulphur, zinc and boron, and half of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining nitrogen and potassium should be applied in two equal splits at 25 and 50 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

SUMMER ONION (*Allium cepa*)

(Var. BARI Piaz-2, BARI Piaz-3 and BARI P Piaz-5)

Yield Goal: 12.0 ± 1.2 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–21	0–10	0–20	0–10	–	–	5	3
Medium	22–42	11–20	21–40	11–20	0–1.0	0.0–0.5		
Low	43–63	21–30	41–60	21–30	1.1–2.0	0.6–1.0		
Very low	64–84	31–40	61–80	31–40	2.1–3.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, sulphur, zinc and boron; and half of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining nitrogen and potassium should be applied in two equal splits at 25 and 50 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

ONION SEED (*Allium cepa*)

(Var. BARI Piaz-1 and others)

Yield Goal (Seed): 800 ± 80 kg/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–30	0–17	0–41	0–9	–	–	5	3
Medium	31–60	18–34	42–82	10–18	0–1.5	0–0.7		
Low	61–90	35–51	83–123	19–27	1.6–3.0	0.71–1.4		
Very low	91–120	52–68	124–164	28–36	3.1–4.5	1.41–2.1		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, sulphur, zinc and boron; and half of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining nitrogen and potassium should be applied in three equal splits at 25, 50 and 75 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

GARLIC (*Allium sativum*)

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

Yield Goal: 15.0 ± 1.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–38	0–16	0–30	0–15	0.0–1.0	0.0–1.0	5	3
Medium	39–76	17–32	31–60	16–30	1.1–2.0	1.1–2.0		
Low	77–114	33–48	61–90	31–45	2.1–3.0	2.1–3.0		
Very low	115–152	49–64	91–120	46–60	3.1–4.0	3.1–4.0		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, sulphur, zinc and boron; and half of nitrogen and potassium should be applied as basal during final land preparation.

b) Remaining nitrogen and potassium should be applied at the time of first mulching under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

GARLIC (*Allium sativum*)

(Var. BARI Rashun-1, BAU Rashun-1 and other suitable cultivars)

(Under Zero tillage)

Yield Goal: 13.0 ±1.3 t/ha

Nutrient Recommendation (kg/ha)					Manure (t/ha)
N	P	K	S	Zn	CD or PM*
160	50	125	25	3	5 3

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) Under zero tillage, garlic is cultivated widely in "Chalan Bil" 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 organic manure, phosphorus, potassium, sulphur and zinc; and one-third of nitrogen should be applied as broadcast on muddy soils. After application of fertilizers garlic should be planted by dibbling shallowly ($1/3^{rd}$ of the clove into the soil) and the land should be covered again with the rice straw.

b) Remaining nitrogen should be applied in two equal splits; the first split during 25-30 days after planting (DAP) and the second split during 55-60 DAP. The nitrogen should be applied by topdressing on the straw mulch followed by gentle shaking of the straw for allowing the fertilizer to reach on to the soil surface.

c) After 2-3 hours of nitrogen top dressing 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: 15.0 ± 1.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–40	0–15	0–40	0–5	–	–	5	3
Medium	41–80	16–30	41–80	6–10	0.0–1.5	0.0–0.5		
Low	81–120	31–45	81–120	11–15	1.6–3.0	0.6–1.0		
Very low	121–160	46–60	121–160	16–20	3.1–4.5	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron; and half of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied at the 6th week of planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

TURMERIC (*Curcuma longa*)

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

Yield Goal: 35.0 ± 3.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					Manure (t/ha)	
	N	P	K	S	Zn	CD or PM*	
Optimum	0–40	0–12	0–35	0–5	–	5	3
Medium	41–80	13–24	36–70	6–10	0–1.5		
Low	81–120	25–36	71–105	11–15	1.6–3.0		
Very low	121–160	37–48	106–140	16–20	3.1–4.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur and zinc; and half of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied in two equal splits at 80 and 110 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

CHILLI (*Capsicum annuum*)

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

Yield Goal: 2.0 ± 0.2 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–32	0–19	0–32	0–5	0–0.5	–	5	3
Medium	33–64	20–38	33–64	6–10	0.6–1.0	0.0–0.5		
Low	65–96	39–57	65–96	11–15	1.1–1.5	0.6–1.0		
Very low	97–128	58–76	97–128	16–20	1.6–2.0	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur, zinc and boron; and half of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied in three equal splits at 25, 50 and 70 days after planting under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

CORIANDER (*Coriandrum sativum*)

(Var. BARI Dhonia-1)

Yield Goal: 2.0 ± 0.2 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–30	0–12	0–20	0–5	–	–	5	3
Medium	31–60	13–24	21–40	6–10	0–1.5	0.0–0.5		
Low	61–90	25–36	41–60	11–15	1.6–3.0	0.6–1.0		
Very low	91–120	37–48	61–80	16–20	3.1–4.5	1.1–1.5		

***CD:** Cowdung; **PM:** Poultry manure.

Method of application:

a) All of organic manure, phosphorus, potassium, sulphur and zinc; and half of nitrogen should be applied as basal during final land preparation.

b) Remaining nitrogen should be applied as top dress at 30 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

BLACK CUMIN (*Nigella sativa*)

(Var. BARI Kalozira-1 and others)

Yield goal: 1.00 ± 0.10 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					
	N	P	K	S	Zn	B
Optimum	0–25	0–10	0–15	0–6	–	–
Medium	26–50	11–20	16–30	7–12	0–1.5	0.0–0.5
Low	51–75	21–30	31–45	13–18	1.6–3.0	0.6–1.0
Very low	76–100	31–40	46–60	19–24	3.1–4.5	1.1–1.5

Method of application:

a) All of phosphorus, potassium, sulphur, zinc and boron should be applied as basal during final land preparation.

b) Nitrogen should be applied in two equal splits as topdress at 30 and 55 DAS under moist soil condition.

FENUGREEK (*Trigonella foenum-graecum*)

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

Yield goal: 1.70 ± 0.17 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)	
	N	P	K	CD or PM*	
Optimum	0–25	0–10	0–20		
Medium	26–50	11–20	21–40	5	3
Low	51–75	21–30	41–60		
Very low	76–100	31–40	61–80		

***CD** : Cowdung; **PM** : Poultry manure

Method of application:

a) All of organic manure, phosphorus and potassium should be applied as basal during final land preparation.

b) Nitrogen should be applied in two equal splits as topdress at 30 and 55 days after sowing under moist soil condition.

BLACK PEPPER (*Piper nigrum*)

(Var. Jainta gulmorich and others)

Yield goal: 4–5 kg/plant/year

Age of plant (Year)	Nutrient Recommendation (g/plant/year)			Manure (kg/pit)
	N	P	K	CD of PM*
Before planting (in pit)	–	51	55	8 4.5
1	35	15	45	-
2	70	30	90	-
≥ 3	100	40	140	–

***CD** : Cowdung; **PM** : Poultry manure

Method of application:

a) Before planting, recommended manure, phosphorus and potassium 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, nitrogen, phosphorus and potassium should be applied in two equal splits during April–May and September–October under moist soil condition and mixed thoroughly with the soil. Fertilizer should be applied around the plant and mixed thoroughly with the soil followed by irrigation.

9.1.8 FRUIT CROPS

BANANA (*Musa paradisiaca*)

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

Yield goal: 50.0 ± 5.0 t/ha

Method of application	Nutrient Recommendation (g/plant)						Cowdung (kg/pit)
	N	P	K	S	Zn	B	
Basal	–	80	–	36	1.2	0.34	10
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**	**10**

***TD:** Top dressing

Method of application:

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

b) The N and K should be applied in four splits as topdressing around the plants and mixed thoroughly with the soil followed by irrigation. The first topdressing should be done after sucker establishment, preferably about two months after planting. The next two topdressings should be done at two months interval and the last topdressing should be done after emergence of inflorescence.

PAPAYA (*Carica papaya*)

(Var. Shahi pepe and others)

Yield goal: 45.0 ± 4.5 t/ha

Method of application	Nutrient Recommendation (g/plant)						Cowdung (kg/pit)
	N	P	K	S	Zn	B	
Basal	–	100	–	43	2.5	4	10
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**	**43**	**2.5**	**4**	**10**

***TD:** Top dressing

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 seedling establishment, preferably about one month after planting 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 soil followed by irrigation.

PINEAPPLE (*Ananas sativus*)

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

Yield goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)					Cowdung (t/ha)
	N	P	K	S	Zn	
Optimum	0–75	0–28	0–75	0–10	–	3–5
Medium	76–150	29–54	76–150	11–20	0.0–1.3	
Low	151–225	55–84	151–225	21–30	1.4–2.6	
Very low	226–300	85–112	226–300	31–40	2.7–4.0	

Method of application:

a) All of cowdung, P, S and Zn should be applied as basal during final land preparation.

b) The N and K should be applied in five equal splits as side dressing at one month interval starting from 4–5 months after planting and mixed thoroughly with the soil followed by irrigation.

WATER MELON (*Citrullus colocynthis*)

(All cultivars)

Yield goal: 60.0 ± 6.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Cowdung (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–33	0–11	0–27	0–10	–	–	3-5
Medium	34–66	12–22	28–54	11–20	0.0–0.6	0.0–0.6	
Low	67–99	23–33	55–81	21–30	0.7–1.2	0.7–1.2	
Very low	100–132	34–44	82–108	31–40	1.3–1.8	1.3–2.0	

Method of application:

a) All of cowdung, phosphorus, potassium, sulphur, zinc and boron should be applied in pit 5–7 days prior to planting seedlings and mixed thoroughly with the soil.

b) Nitrogen should be applied around the plant as side dressing at 15, 35, 55 and 75 days after pla nting 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 (Hybrid), BARI Aam-5, BARI Aam-6, BARI Aam-7, BARI Aam-8, BARI Aam-9 and others)]

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						Cowdung (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting	-	100	-	54	12	9	20
0–1	46	15	25	-	-	-	10
2–4	115	32	50	18	3.6	4	15
5–7	230	53	100	36	3.6	4	20
8–10	345	84	125	45	5.4	5	25
11–15	460	105	175	63	5.4	5	30
16–20	690	158	200	72	7.2	7	40
>20	920	211	250	90	9.0	9	50

Method of application:

a) Before planting, recommended cowdung, 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 the growing trees, fertilizers should be applied annually in two equal splits, one .half immediately after harvesting of fruits during June–July and the rest half in September–October in both young and old orchards. Fertilizer should be applied around the tree up to canopy spread leaving 1.0–1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

MANGO (*Mangifera indica*)

[(Var: BAU Mango-1, BAU Mango-2, BAU Mango-3, BAU Mango-4 (Hybrid), BAU Mango-5, BAU Mango-6, BAU Mango-11, BAU Mango-14, BAU Mango-15 and others)]

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						Cowdung (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting	-	40	-	20	15	7	30
0–1	60	20	60	-	-	-	20
2–4	170	60	120	12	4	3	30
5–7	280	100	180	24	4	3	40
8–10	390	140	240	36	6	5	45
11–15	500	180	300	48	6	5	50
16–20	610	230	360	64	8	7	55
>20	720	280	400	80	10	9	60

Method of application:

a) Before planting, recommended cowdung, 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 the growing trees, fertilizers should be applied annually in two equal splits, one-half immediately after harvesting of fruits during June–July and the rest half in September–October in both young and old orchards. Fertilizer should be applied around the tree up to canopy spread leaving 1.0–1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

JACKFRUIT (*Artocarpus heterophyllus*)

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

Yield goal: 700 ± 70 kg/tree (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					Cowdung (kg/tree/year)
	N	P	K	S*	B	
Before planting	-	100	-	45	-	30
0–1	100	50	100	20	-	10
2–4	200	90	200	25	-	20
5–7	300	130	300	30	1.0	30
8–10	400	180	400	40	1.5	40
11–15	550	240	520	50	2.0	50
>15	700	300	650	60	3.0	60

Method of application:

a) Before planting, recommended cowdung, 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 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.

d) Boron should be applied with other fertilizers only in the fruiting trees.

GUAVA (*Psidium guajava*)

(Var. Kazi Payara, BARI Peyara-2, BARI Peyara-3, BAU Payara-5, BAU Payara-7, BAU Payara-8, BAU Payara-9 and others)

Yield goal: 60.0 ± 6.0 kg/tree/year (above 5 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	50	-	27	10
1	45	50	50	5	10
2	92	60	100	7	10
3	138	70	150	9	15
4	200	80	200	11	20
5	230	100	250	13	25
> 5	230	100	250	15	25

Method of application:

a) Before planting, recommended cowdung, 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 the growing trees, all fertilizers should be applied around the trees in three equal splits during February, May and September. Fertilizer should be applied around the tree up to canopy spread leaving 0.5–1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

COCONUT (*Cocos nucifera*)

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

Yield goal: 80.0 ± 8.0 nut/tree/year (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						Cowdung (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting	–	50	–	–	21	9	25
1–4	90	20	200	18	8	1.7	10
5–7	180	40	400	36	13	2.6	15
8–10	360	80	750	45	17	3.4	20
11–15	450	100	1000	63	21	5.1	25
16–20	540	120	1250	72	32	6.8	30
>20	675	150	1500	90	42	8.5	40

Method of application:

a) Before planting, recommended cowdung, P, 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 and organic manure should be applied in two equal splits, during April–May and September–October around the trees up to 2–3 meters, leaving 1.0 meter from the tree base. Fertilizers should be applied by drilling with peg to a depth of 8–12 cm and covered with the soil.

c) For the orchard, fertilizers may be broadcast and mixed with the soil by ploughing shallowly with power tiller followed by irrigation.

LITCHI (*Litchi chinensis*)

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

Yield goal: 130.0 ± 13.0 kg/tree (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					Cowdung (kg/tree/year)
	N	P	K	S	B	
Before planting	-	100	-	35	-	20
0–1	138	-	-	-	-	10
2–4	184	100	100	18	2.5	10
5–7	230	150	200	18	5.0	15
8–10	345	300	400	18	5.0	20
11–15	552	400	600	27	7.5	30
16–20	690	500	750	36	10.0	40
> 20	920	700	1000	45	12.5	50

Method of application:

a) Before planting, recommended cowdung, 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) In the first year, the organic manure and nitrogen 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, BAU Jambura-5 and others)

Yield goal: 100.0 ± 10.0 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						Cowdung (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting	-	135	-	36	-	2.0	15
1–2	90	38	75	-	3	-	10
3–4	128	70	150	18	4	1.0	15
5–7	190	130	225	27	5	1.5	20
8–10	248	191	263	36	6	2.0	25
> 10	293	214	320	45	7	2.5	30

Method of application:

a) Before planting, recommended cowdung, 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, May and October. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

MANDARIN (*Citrus reticulanta)*

(BARI Kamala-1 and others)

Yield goal: 50.0 ± 5.0 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						Cowdung (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting	-	50	-	25	-	1.0	15
1–2	90	45	75	-	3	-	10
3–4	135	65	100	18	4	1.0	15
5–7	180	120	150	27	5	1.5	20
8–10	225	180	200	36	6	2.0	25
> 10	290	225	250	45	7	2.5	30

Method of application:

a) Before planting, recommended cowdung, 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, May and September. 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.

SWEET ORANGE (*Citrus sinensis*)

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

Yield goal: 40.0 ± 4.0 kg/tree/year (Above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						Cowdung (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting	–	50	–	25	–	1.0	15
1–2	113	56	63	-	2.1	-	12
3–4	169	79	88	18	3.2	1.0	15
5–7	236	113	113	27	4.2	1.5	18
8–10	293	169	138	36	5.3	2.0	20
> 10	338	225	225	45	6.3	2.5	25

Method of application:

a) Before planting, recommended cowdung, 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). 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.

LEMON (*Citrus limon)*

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

Yield goal: 40.0 ± 4.0 kg/tree/year (above 5 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						Cowdung (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting	-	90	-	25	-	-	12
1–2	90	90	100	-	4.0	1.0	15
3–5	180	135	150	20	6.0	2.0	20
> 5	225	180	200	30	8.0	2.5	25

Method of application:

a) Before planting, recommended cowdung, 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, 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 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: 35.0 ± 3.5 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	100	-	-	15
1–2	90	17	75	9	10
3–4	128	31	150	11	15
5–7	190	55	225	13	20
8–10	248	85	263	15	25
> 10	293	95	320	18	30

Method of application:

a) Before planting, recommended cowdung and P should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

b) For growing trees, the recommended fertilizers should be applied in three equal splits, during February, May and October. Fertilizer should be applied around the tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

c) For the highly acidic soils, dolomite lime should be applied at the rate of 250 g/tree in every 3-4 year.

BER (*Ziziphus mauritiana*)

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

Yield goal: 50.0 ± 5.0 t/ha/year (above 8 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					Cowdung (kg/tree/year)
	N	P	K	S	B	
Before planting	-	50	-	45	-	25
1–2	135	50	125	12	1.0	10
3–4	225	80	200	15	1.5	15
5–6	338	140	350	18	2.0	20
7–8	450	170	425	27	2.5	25
> 8	563	200	500	45	2.5	30

Method of application:

a) Before planting, recommended cowdung, 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.

BER (*Ziziphus jujuba*)

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

Yield goal: 60.0 ± 6.0 t/ha/year (above 2 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					Cowdung (kg/tree/year)
	N	P	K	S	B	
Before planting	-	40	-	20	-	30
1	120	60	150	18	1.0	15
2	240	90	225	24	2.0	20
> 2	360	120	300	36	3.0	35

Method of application:

a) Before planting, recommended cowdung, 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: 28.0 ± 2.8 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					Cowdung (kg/tree/year)
	N	P	K	S	B	
Before planting	-	50	-	-	-	15
1–2	70	35	70	10	1.0	10
3–4	95	50	90	15	1.5	15
5–7	125	65	115	20	2.0	20
8–10	160	80	145	25	2.5	25
> 10	200	100	180	30	2.5	30

Method of application:

a) Before planting, recommended cowdung and P should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

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 leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

GOLDEN APPLE (*Spondias pinnata*)

(Var. BARI Amra-2 and others)

Yield goal: 80.0 ± 8.0 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					Cowdung (kg/tree/year)
	N	P	K	S	B	
Before planting	-	50	-	-	-	15
1–2	100	70	90	20	1.5	20
3–4	150	90	130	25	2.0	25
5–7	210	110	180	30	2.5	30
8–10	280	135	230	40	3.0	40
> 10	350	160	300	50	3.0	50

Method of application:

a) Before planting, recommended cowdung and P should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

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 leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

SAPOTA (*Achras sapota*)

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

Yield goal: 200.0 ± 20.0 kg/tree/year (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	60	-	36	25
1–3	68	40	75	9	20
4–7	180	60	200	18	25
8–10	293	100	325	36	30
11–15	383	140	425	54	40
> 15	450	160	500	72	50

Method of application:

a) Before planting, recommended cowdung, 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, June and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

CARAMBOLA (*Averrhoa carambola*)

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

Yield goal: 200.0 ± 20.0 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	–	50	-	18	15
1–3	158	55	138	18	10
4–6	225	70	175	27	15
7–10	315	90	213	36	20
> 10	405	110	238	45	30

Method of application:

a) Before planting, recommended cowdung, 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 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.

JAMUN (*Syzygium cumini*)

(All cultivars)

Yield goal: 150.0 ± 15.0 kg/tree (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	100	-	36	20
1–3	90	40	100	9	20
4–6	180	60	150	18	25
7–10	270	100	250	36	30
11–15	360	140	350	45	40
> 15	450	160	400	54	40

Method of application:

a) Before planting, recommended cowdung, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

b) For growing trees, the recommended fertilizers should be applied in two equal splits during May and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

BURMESE GRAPE (*Baccaurea ramiflora*)

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

Yield goal: 60.0 ± 6.0 kg/tree (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	100	-	18	20
1–4	100	40	100	18	15
5–10	200	60	175	30	20
11–15	300	80	250	42	30
> 15	400	100	350	55	40

Method of application:

a) Before planting, recommended cowdung, 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. 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.

AONLA (*Emblica officinalis*)

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

Yield goal: 130.0 ± 13.0 kg/tree/year (above 15 years old tree)

Time of Application	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	100	-	18	15
1–2	90	20	50	-	10
3–5	180	50	125	18	15
6–10	248	80	200	27	20
11–15	405	130	325	36	25
> 15	675	200	500	45	30

Method of application:

a) Before planting, recommended cowdung, 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 June-July and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

WAX APPLE (*Syzygium samrangense*)

(Var. BARI Jamrul-1 and others)

Yield goal: 75.0 ± 7.5 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	50	-	18	10
1–3	92	40	150	9	5
4–7	138	60	200	18	10
8–10	184	80	225	27	15
> 10	230	100	250	36	20

Method of application:

a) Before planting, recommended cowdung, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

b) For growing trees, the recommended fertilizers should be applied in two equal splits during May 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.

WAX APPLE (*Syzygium samrangense*)

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

Yield goal: 250.0 ± 25.0 kg/tree (above 8 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	50	-	18	20
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:

a) Before planting, recommended cowdung, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

b) For growing trees, the recommended fertilizers should be applied in two equal splits during May 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.

WOOD APPLE (*Aegle marmelos*)

(All cultivars)

Yield goal: 500.0 ± 50.0 fruits/tree (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	100	-	18	15
1–4	90	40	100	-	10
5–8	180	80	150	18	15
9–12	270	120	200	27	20
13–16	360	160	250	36	25
17–20	450	200	300	45	30
> 20	500	220	350	54	35

Method of application:

a) Before planting, recommended cowdung, 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. Fertilizer should be applied around the tree up to the canopy spread leaving 0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

ELEPHANT'S FOOT APPLE (*Feronia limonia*)

(Var. BAU Kodbel-1 and others)

Yield goal: 200.0 ± 20.0 fruits/tree (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	50	75	10	10
1–3	70	40	100	-	10
4–6	90	50	125	18	15
7–9	110	60	150	27	20
10–12	170	75	175	36	25
13–15	230	90	200	45	30
> 15	300	110	250	54	40

Method of application:

a) Before planting, recommended cowdung, 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). 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.

BULLOCK'S HEART (*Anona squamosa*)

(All cultivars)

Yield goal: 60 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	50	-	18	15
1–2	100	40	50	-	10
3–4	150	50	75	10	15
5–6	200	60	100	18	20
7–8	250	75	140	36	25
9–10	300	90	180	45	30
> 10	350	100	200	54	35

Method of application:

a) Before planting, recommended cowdung, 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 tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

CUSTARD APPLE (*Annona squamosa*)

(All cultivers)

Yield goal: 25.0 ± 0.25 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	50	-	9	15
1–2	50	20	65	-	-
3–5	100	30	80	8	10
6–8	150	40	115	12	15
9–10	200	50	145	16	20
> 10	250	60	175	20	25

Method of application:

a) Before planting, recommended cowdung, 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. 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.

VELVET APPLE (*Diospyros discolor*)

(Var. BARI Bilatigab-1 and others)

Yield goal: 120.0 ± 12.0 kg/tree (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	40	-	18	15
1–3	100	40	100	-	-
4–7	200	50	200	10	10
8–11	300	60	300	20	15
12–15	400	70	400	30	20
> 15	500	80	500	40	25

Method of application:

a) Before planting, recommended cowdung, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

b) For growing trees, the recommended fertilizers should be applied in two equal splits during May-June 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.

TAMARIND (*Tamarindus indicus*)

[Var. BARI Tentul-1 and others]

Yield Goal: 80.0 ± 8.0 kg/tree/year (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before Planting	-	60	-	18	20
1-3	100	40	150	-	15
4-6	200	80	250	10	20
7-10	300	120	400	20	25
11-15	400	170	500	30	30
>15	500	220	600	40	40

Method of application:

a) Before planting, recommended cowdung, 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 May-June, September-October and February-March. 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. BAU Tatul-1 (Misti), BAU Tatul-2 (Sour)]

Yield Goal: 30.0 ± 3.0 kg/tree/year (above 8 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before Planting	-	20	-	10	15
1-2	60	30	75	15	12
3-4	80	40	100	20	15
5-6	100	50	125	25	18
7-8	140	60	150	30	21
>8	200	80	200	40	25

Method of application:

a. Before planting, recommended cowdung, P and S should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

b. For growing trees, the recommended fertilizers should be applied in two equal splits during May-June and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 20-30 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

INDIAN DILLENIA (*Dillenia indica*)

(All cultivers)

Yield goal: 100.0 ±10.0 kg/tree (above 12 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	50	-	18	15
1–4	100	30	100	-	-
5–8	200	50	150	36	10
9–12	300	75	200	45	15
> 12	400	100	250	54	20

Method of application:

a) Before planting, recommended cowdung, 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 tree up to the canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation.

PALMYRA PALM (*Borassus flabellifer*)

(All cultivers)

Yield goal: 200.0 ± 20.0 fruits/tree (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)			Cowdung (kg/tree/year)
	N	P	K	
Before planting	-	50	-	15
1–4	100	40	100	10
5–10	200	50	200	15
11–15	300	60	300	20
16–20	400	80	400	25
> 20	500	100	500	30

Method of application:

a) Before planting, recommended cowdung and P should be applied in pit as basal dose 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

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 1.0-1.5 m from the tree base and mixed thoroughly with the soil followed by irrigation.

STRAWBERRY (*Fragaria ananassa*)

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

Yield goal: 11.0 ± 1.1 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Cowdung (t/ha)	
	N	P	K	S	Zn	B	CD or PM	
Optimum	0–45	0–18	0–40	0–9	–	–	10	6
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 manure, 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 days after planting.

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)					Cowdung (kg/tree/year)
	N	P	K	S	B	
Before Planting	-	50	-	10	-	15
1-2	100	40	90	10	-	15
3-4	150	60	120	15	1.0	20
5-6	200	80	160	20	1.5	25
7-8	250	100	200	25	2.0	30
9-10	300	120	250	32	2.5	35
>10	350	150	300	40	2.5	40

Method of application:

a) Before planting, recommended cowdung, 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 tree up to the canopy spread leaving 0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

CASHEWNUT (*Anacardium occidentale*)

(Var. BAU Kajubadam-1)

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					Cowdung (kg/tree/year)
	N	P	K	S	B	
Before Planting	-	30	-	9	-	15
1-2	75	30	70	-	1.0	10
3-4	90	40	85	15	1.5	15
5-6	105	50	100	20	2.0	20
7-8	125	60	120	25	2.5	25
>8	145	70	140	30	2.5	30

Method of application:

a) Before planting, recommended cowdung, 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 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.

9.1.9 PLANTATION CROPS

SUGARCANE (*Saccharum officinarum*)

(All varieties)

Yield Goal: 100.0 ± 10.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					
	N	P	K	S	Mg	Zn
Optimum	0–55	0–18	0–60	0–15	0–10	–
Medium	56–110	19–36	61–120	16–30	11–20	0.0–2.6
Low	111–165	37–54	121–180	31–45	21–30	2.7–5.2
Very low	166–220	55–72	181–240	46–60	31–40	5.3–8.0

Method of application:

a) For heavy textured soils, half of nitrogen and potassium and all of phosphorus, sulphur, magnesium and zinc should be applied in trench and mixed thoroughly with the soils before planting of sugarcane. Remaining nitrogen and potassium should be applied as top dress at tillering stage (120–150 days after planting).

b) For light textured soils, one-third of nitrogen and potassium, and all of phosphorus, sulphur, magnesium and zinc should be applied in trench and mixed thoroughly with the soils before planting of sugarcane. Remaining nitrogen and potassium should be applied in two equal splits as top dress at tillering stage (90–120 days after planting) and after completion of tillering (150-180 days after planting).

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

d) For transplanted sugarcane basal nitrogen should be applied 20–30 days after transplanting.

e) For ratoon cane additional 40 kg N/ha should be applied. All other nutrients should be same as of the plant cane.

TOBACCO (*Nicotiana tabacum*)

(Var. Sesmaria)

Yield goal: 2.50 ± 0.25 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–20	0–11	0–27	0–4	–
Medium	21–40	12–22	28–54	5–8	0.0–0.6
Low	41–60	23–33	55–81	9–12	0.7–1.2
Very low	61–80	34–44	82–108	13–14	1.3–2.0

Method of application:

a) All of phosphorus, potassium, sulphur, zinc and two-third of nitrogen should be applied as basal during final land preparation.

b) The remaining nitrogen should be applied at 30 days after transplanting.

c) Potassium should be applied in the form of K_2SO_4 instead of muriate of potash (MoP). The sulphur in K_2SO_4 will be enough to meet up the sulphur requirement of the crop and no additional sulphur will be necessary.

TEA (*Camellia sinensis*)

(All varieties)

Young Tea

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

Method of application:

a) Fertilizers should be applied six months after planting

b) Fertilizers should be applied under moist soil condition. Thus, the month of April–May might be ideal time for the 1st application.

Mature tea*

Yield (kg/ha)	Nutrient Recommendation (kg/ha)			
	N	P	K	Zn
Up to 1000	50	4.5	25	–
1001–2000	51–100	4.6-9.0	26-50	3.6
2001–3000	101–150	9.1-13.5	51-75	3.7-5.4

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

Method of application:

a) All of phosphorus and zinc; and half of nitrogen and potassium should be applied during April–May with on set of shower. Remaining half nitrogen and potassium should be applied within July to first week of August.

b) $(NH_4)_2SO_4$ is generally used in tea cultivation as the source of nitrogen if it is not mentioned otherwise. TSP and MoP might be used as the sources of P and K respectively.

c) Application of zinc at the early stage encourages vegetative growth. Zinc fertilizer should be applied in soil at the time of using other fertilizers.

d) If soil pH is below 5.0, dolomite [$(CaMg(CO_3)_2$] 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 of plant (year)	NPK ratio	Mixture (g/bush)	Fertilizer mixture (kg/ha)		Method of application
			Planting geometry		
			Square (6944 bushes/ha)	Triangular (8019 bushes/ha)	
1	2 : 1 : 2	30	208	240	Ring
2	2 : 1 : 2	50	347	400	Ring
3	2 : 1 : 2	70	485	560	Ring
4	2 : 1 : 2	80	530	630	Ring
> 4	2 : 1 : 2	80	530	630	Broadcast

Method of application:

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 is 100 kg/ha

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 Seed Bari

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: Same as above

BETELNUT (*Areca catechu*)

(All cultivars)

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				Cowdung (kg/tree/year)
	N	P	K	S	
Before planting	-	30	-	18	12
1–2	120	120	135	-	-
3–5	175	165	180	36	10
6–8	225	210	230	42	14
9–11	275	255	280	48	14
> 11	325	300	325	54	20

Method of application:

a) All of manure, P and S, recommended for 'before planting' application should be applied in pit as basal dose 15-20 days before planting of seedling and mixed thoroughly with the soil followed by irrigation.

b) For growing trees, the recommended fertilizers should be applied in two equal splits during May just after harvesting of fruit and September-October. Fertilizer should be applied around the tree up to the canopy spread leaving 0.5-1.0 m from the tree base and mixed thoroughly with the soil followed by irrigation.

BETEL LEAF (*Piper betle*)

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

Yield Goal: 35.0 ± 3.5 lac leaf/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				Oilcake (t/ha/year)
	N	P	K	S	
Optimum	0–20	0–8	0–8	0–4	3
Medium	21–40	9–16	9–16	5–8	
Low	41–60	17–24	17–24	9–12	
Very low	61–80	25–32	25–32	13–16	

Method of application:

a) One-third of oilcake and all of phosphorus, potassium and sulphur should be applied as basal at the time of final land preparation.

b) After 30–40 days of planting, remaining oilcake should be applied at 15–20 days interval in rows until the vine grows up to 1.0–1.5 meter in length.

c) Nitrogen should be applied in 3 equal installments before the monsoon rain and in September and December.

d) In the subsequent years, the above fertilizer doses should be applied in 3 equal installments, before the monsoon rains and in the month of September and December.

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) Phosphorus 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)

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9.1.10 FLOWERS

MARIGOLD (*Tagetes erecta*)

(French marigold)

Yield goal : 10.0 ± 1.0 ton flowers/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)
	N	P	K	CD or PM*
Optimum	0–30	0–13	0–30	5 3
Medium	31–60	14–26	31–60	
Low	61–90	27–39	61–90	
Very low	91–120	40–52	91–120	

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, P and K should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits at 25, 45 and 65 days after planting.

MARIGOLD (*Tagetes erecta*)

(African marigold)

Yield goal: 15.0 ± 1.5 ton flowers/ha

Soil analysis interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)
	N	P	K	CD or PM*
Optimum	0–45	0–20	0–40	5 3
Medium	46–90	21–40	41–80	
Low	91–135	41–60	81–120	
Very low	136–180	61–80	121–160	

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, P and K should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits at 25, 45 and 65 days after planting.

ROSE (*Rosa centiflora*)

(Class: Hybrid tea)

Yield goal : 750,000 – 800,000 flower sticks/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)		Bonemeal (kg/ha)
	N	P	K	CD or PM*		
Optimum	0–35	0–25	0–35	5	3	100
Medium	36–70	26–50	36–70			
Low	71–105	51–75	71–105			
Very low	106–140	76–100	106–140			

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, bonemeal, P and K should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal installments of 30, 60 and 90 days after planting.

TUBEROSE (*Polianthes tuberosa*)

(Var. Double)

Yield Goal: 115,000–125,000 sticks/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						Manure* (t/ha)	
	N	P	K	S	Zn	B	CD or PM	
Optimum	0–75	0–23	0–44	0–5	–	–	5	3
Medium	76–150	24–46	45–88	6–10	0.0–1.0	0.0–0.7		
Low	151–225	47–69	89–132	15–15	1.1–2.0	0.8–1.4		
Very low	226–300	70–92	133–176	16–20	2.1–3.0	1.5–2.1		

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of P, K, S, Zn, B and organic manure (cowdung or poultry manure) should applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits as topdress at 30, 45 and 60 days after planting.

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)						Manure (t/ha)	
	N	P	K	S	Zn	B	CD or PM*	
Optimum	0–50	0–19	0–38	0–8	–	–	5	3
Medium	51–100	20–38	39–76	9–16	0.0–1.0	0.0–0.7		
Low	101–150	39–57	77–114	17–24	1.1–2.0	0.8–1.4		
Very low	151–200	58–76	115–152	25–32	2.1–3.0	1.5–2.1		

***CD:** Cowdung **PM:** Poultry manure

Method of application:

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

b) Nitrogen should be applied in three equal splits as topdress at 30, 45 and 60 days after planting.

ZINNIA (*Zinnia elegans*)

Yield goal : 200,000 – 300,000 flower stick/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)	
	N	P	K	CD or PM*	
Optimum	0–25	0–8	0–15	5	3
Medium	26–50	9–16	16–30		
Low	51–75	17–24	31–45		
Very low	76–100	25–32	46–60		

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, P and K should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal installments at 25, 45 and 65 days after planting.

CHRYSANTHEMUM (*Chrysanthemum coronarium*)

(Large flowered varieties)

Yield goal : 2500,000–3000,000 flowers/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)		Bonemeal (kg/ha)
	N	P	K	CD or PM*		
Optimum	0–50	0–25	0–45	5	3	50
Medium	51–100	26–50	46–90			
Low	101–150	51–75	91–135			
Very low	151–200	76–100	136–180			

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, bonemeal, P and K should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal installments at 25, 45 and 65 days after transplanting.

CHRYSANTHEMUM (*Chrysanthemum coronarium*)

(Small flowered varieties)

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

Yield goal: 3500,000 – 4000,000 flowers/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)		Bonemeal (kg/ha)
	N	P	K	CD or PM*		
Optimum	0–45	0–22	0–40	2	1.2	15
Medium	46–90	23–44	41–80			
Low	91–135	45–66	81–120			
Very low	136–180	67–88	121–160			

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, bonemeal, P and K should be applied as basal during final land preparation.

b) Nitrogen should be applied in three equal splits at 25, 45 and 65 days after planting.

ORCHID (*Phaius tankervilleae*)

(Var. BARI Orchid-1)

Yield goal: About 18,000 flower sticks/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)			Manure (t/ha)
	N	P	K	CD or PM*
Optimum	0–22	0–10	0–20	5 3
Medium	23–44	11–20	21–40	
Low	45–66	21–30	41–60	
Very low	67–88	31–40	61–80	

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, phosphorus and potassium should be applied as basal during final land preparation.

b) Nitrogen should be applied as topdressing in three equal splits at 30, 60 and 90 days after transplanting and mixed thoroughly with the soil.

ORCHID (*Dendrobium spp.*)

(Epiphytic orchid: Dendrobium)

Yield goal: 2-3 flower sticks/plant/year

Nutrient Recommendation (g/10 plant)		
N	P	K
1.1	0.7	1.3

Method of application:

All of N, P and K should be dissolved in one litre of water and be sprayed on 10 plants. Spraying should be done regularly at one month interval.

GERBERA (*Gerbera jamesonii*)

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

Yield goal: 850,000 – 900,000 flower sticks/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				Manure* (t/ha)		Cocodust (kg/ha)
	N	P	K	S	CD or PM		
Optimum	0–45	0–20	0–30	0–8	5	3	100
Medium	45–90	21–40	31–60	9–16			
Low	91–135	41–60	61–90	17–24			
Very low	136–180	61–80	91–120	25–32			

***CD:** Cowdung **PM:** Poultry manure

Method of application:

a) All of cowdung, cocodust, P and K should be applied as basal during final land preparation.

b) Nitrogen 150 kg/ha should be applied in three equal installments of 30, 60 and 90 days after planting.

9.1.11 FODDER CROPS

NAPIER GRASS (*Pennisetum purpureum*)

(Var. IGFRI-3, IGFRI-6, IGFRI-7, IGFRI-10, CO-3)

Yield Goal (Green biomass): 370.0 ± 37.0 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)		
	N	P	K
Optimum	0–45	0–12	0–15
Medium	46–90	13–24	16–30
Low	91–135	25–36	31–45
Very low	136–180	37–48	46–60

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.

PARA GRASS
(*Brachiaria mutica*)

Yield Goal (Green biomass): 120.0 ± 12.0 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)		
	N	P	K
Optimum	0–40	0–10	0–11
Medium	41–80	11–20	12–22
Low	81–120	21–30	23–33
Very low	121–160	31–40	34–44

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 top dressed.

GERMAN GRASS
(*Echinocloa crusgalli*)

Yield Goal (Green biomass): 135.0 ± 14.0 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)		
	N	P	K
Optimum	0–35	0–10	0–11
Medium	36–70	11–20	12–22
Low	71–105	21–30	23–33
Very low	106–140	31–40	34–44

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.

DHAL GRASS
(*Hymenachne amplexicaulis*)

Yield Goal (Green biomass): 110.0 ± 11.0 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)		
	N	P	K
Optimum	0–50	0–10	0–11
Medium	51–100	11–20	12–22
Low	101–150	21–30	23–33
Very low	151–200	31–40	34–44

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.

GUINEA GRASS
(*Panicum maximum*)

Yield Goal (Green biomass): 120 ± 12 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)		
	N	P	K
Optimum	0–45	0–10	0–12
Medium	46–90	11–20	13–24
Low	91–135	21–30	25–36
Very low	136–180	31–40	37–48

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 top dressed.

JUMBO
(Hybrid sorghum)

Yield Goal (Green biomass): 120.0 ± 12.0 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)		
	N	P	K
Optimum	0–40	0–10	0–11
Medium	41–80	11–20	12–22
Low	81–120	21–30	23–33
Very low	121–160	31–40	34–44

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.

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
Optimum	0–15	0–3	0–4
Medium	16–30	4–6	5–8
Low	31–45	7–9	9–12
Very low	46–60	10–12	13–16

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.

9.2 Use of Upazila Nirdeshika for Making Location Specific Fertilizer Recommendation

Location specific balanced dose of fertilizer recommendation for different crops using Upazila Nirdeshika can be made in two different ways. These are –

⇒ Mapping unit wise average soil test value
⇒ Location specific soil test value

Steps for Making Fertilizer Recommendations Using Upazila Nirdeshika

Methodologies for calculation of balanced doses of fertilizers based on mapping unit or upazila wise average soil test value are:

1. Identification of land type-wise soil groups

Steps for identification of land type-wise soil groups using Upazila Nirdeshika are given below:

Step i: Consult upazila soil and land type map.

Step ii: Identify the Union following Union boundary provided in the Soil and Land Type Map.

Step iii: Identify your plot(s) in the mapping unit(s) present in that particular union.

Step iv: Note down soil group(s) in each mapping unit consulting upazila Soil and Land Type Map.

Step v: Identify the land type consulting Annexure-8 of the Upazila Nirdeshika.

Step vi: For confirmation with your identified soil group(s) you may dig out the soil with the help of a spade or an auger and note down the colour, texture, consistency, pH and drainage class of the soil.

2. Collect land type and soil group wise average analytical soil test values (results) from Annexure-2 of the Nirdeshika.

3. Select suitable crop and cropping pattern of your area/location

4. Calculate appropriate doses of fertilizer for different crops on the basis of average soil test value and the procedure as described in the Appendix 10 of the FRG-2012.

5. Calculate appropriate doses of fertilizers for different cropping patterns consulting rationales as described in the chapter 5.7 of the FRG-2012.

6. Methods of fertilizer application for the desired crop are given in the chapter 9.1 of the FRG-2012.

For example, land type and soil group are identified using Gazipur Sadar Upazila Nirdeshika. The land type is high land and the soil group is Chandra and the content of N = 0.11%, P = 6.41 µg/g soil, K = 0.15 meq/100g soil, and S = 23.29 µg/g soil.

If farmers' existing cropping pattern under irrigated condition is Wheat-T. aus-T. aman rice, we should calculate balanced fertilizer dose for wheat (4.5±0.45 t/ha), T. Aus (4.0±0.4 t/ha) and T. Aman rice (5.0±0.5 t/ha) based on soil test value and the procedure as described in the Appendix 10 of the FRG-2012. In calculating fertilizer dose for a cropping pattern, rationales (chapter 5.7 of FRG-2012) need to be followed.

9.3 Fertilizer Recommendation for Cropping Patterns in Different AEZs

The most efficient and economic use of chemical fertilizers and organic manure requires a knowledge about basic data of soil, climate and crops. The soil related data include pH, texture, organic matter and some other soil properties. The requirement of nutrient for a particular crop depends on overall environmental conditions as well as on the yield potential of the crop in question. The more the climate and the soil physical conditions are favorable for crop growth, the more will be the need for nutrients. High yielding varieties require more quantities of nutrients than traditional (local) varieties. Utilization of applied nutrients thus depends on the cropping system, efficiency of crop management and time and methods of fertilizer application. In fertilizer scheduling for different crops and cropping patterns, nutrient loss mechanisms and immobilization process should be kept 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 have 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.

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman rice	5.0 ±0.50	90	10	35	10	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	10	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	10	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0	3.0
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	10	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	80	36	10	2.0	1.5	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	10	-	1.0	-	-	-	-
Rabi	Radish/	60.0±6.0	150	45	80	24	-	1.5	-	-	5.0	3.0
	Cabbage/	90±9.0	180	66	50	24	-	1.5	1.0	-	5.0	3.0
	Cauliflower	30.0±3.0	120	60	76	21	-	1.5	1.0	-	5.0	3.0
Kharif 1	Okra/	16.0±1.6	90	21	30	15	-	1.5	-	-	5.0	3.0
	Brinjal	60.0±6.0	120	25	40	15	-	1.5	-	-	5.0	3.0
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Round the year	Sugarcane	100±10	165	55	120	30	20	2.5	-	-	-	-
Round the year	Sugarcane +	100±10	165	55	120	30	20	2.5	-	-	-	-
	Potato	15±1.5	70	15	45	5	2	-	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0 ±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0	3.0
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0	3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	9	-		-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	80	36	5	2.0	1.5	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Radish/	60.0±6.0	150	45	80	16	-	1.5	-	-	5.0	3.0
	Cabbage/	90±9.0	180	66	50	16	-	1.5	1.0	-	5.0	3.0
	Cauliflower	30.0±3.0	120	60	76	14	-	1.5	1.0	-	5.0	3.0
Kharif 1	Okra/	16.0±1.6	90	21	30	10	-	1.5	-	-	5.0	3.0
	Brinjal	60.0±6.0	120	25	40	10	-	1.5	-	-	5.0	3.0
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-

AEZ 3: TISTA MEANDER FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	35	Most of greater Rangpur, 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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	Poultry or manure
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	2.6	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	35	12	-	1.5	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	76	10	25	9	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.0	135	30	90	15	5	2.0	1.0	-	5.0	3.0
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	9	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	5	2.0	1.0	-	5.0	3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	15	3	2.0	1.0	-	-	-
	Boro rice	7.5±0.75	150	12	55	18	-	2.6	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Maize	10.0±1.0	255	75	80	52	10	3.0	1.5	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-		-
Rabi	Maize	10.0±1.0	255	75	80	52	10	3.0	1.5	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-		-
Rabi	Onion	16.0±1.6	90	45	80	30	-	3.0	1.5	-	5.0		3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-		-
Rabi	Radish/	60.0±6.0	150	45	80	24	-	1.5	-	-	5.0		3.0
	Cabbage/	90±9.0	180	66	50	24	-	1.5	1.0	-	5.0		3.0
	Cauliflower	30.0±3.0	120	60	76	21	-	1.5	1.0	-	5.0		3.0
Kharif 1	Okra/	16.0±1.6	90	21	30	15	-	1.5	-	-	5.0		3.0
	Brinjal	60.0±6.0	120	25	40	15	-	1.5	-	-	5.0		3.0
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Round the year	Sugarcane	100±10	165	55	120	30	20	2.5	-	-	-		-
Round the year	Sugarcane + Potato	100±10 15±1.5	165 70	55 15	120 45	30 5	20 2	2.5 -	- -	- -	- -		- -

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman	5.0 ±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	80	36	1.0	2.0	1.5	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0 ±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Onion	16±1.60	90	45	80	20	-	2.0	1.5	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	35	9	-	-	-	-	-	-
Kharif 2	T. Aman	5.0±0.5	90	10	30	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	12	2.5	1.0	1.0	-	-	-
Kharif 1	Chilli	2.0±0.2	96	40	57	10	-	1.0	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	12	2.5	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	12	2.5	1.0	1.0	-	-	-
	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0	3.0
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0	3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	9	-		-	-	-	-
Kharif 2	T.Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0	3.0
Kharif 1	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Radish/	60±6.0	150	45	80	24	-	1.5	-	-	5.0	3.0
	Cabbage/	100±10.0	180	66	40	24	-	1.5	1.0	-	5.0	3.0
	Cauliflower	35.0±3.5	120	60	90	21	-	1.5	1.0	-	5.0	3.0
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	8	-	0.6	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Radish/	60.0±6.0	150	45	80	16	-	1.5	-	-	5.0	3.0
	Cabbage/	90±9.0	180	66	50	16	-	1.5	1.0	-	5.0	3.0
	Cauliflower	30.0±3.0	120	60	76	14	-	1.5	1.0	-	5.0	3.0
Kharif 1	Okra/	16.0±1.6	90	21	30	10	-	1.5	-	-	5.0	3.0
	Brinjal	60.0±6.0	120	25	40	10	-	1.5	-	-	5.0	3.0
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	9	-	0.6	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	25	4	10	4	-	0.5	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	15	-	1.0	0.5	-	-	-
Kharif 1	Boro rice	7.5±0.75	150	12	55	18	-	1.3	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	-	2.0	0.5	-	5.0	3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	-	2.0	0.4	-	5.0	3.0
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	9	-	0.6	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Maize	10.0±1.00	255	75	80	52	5.0	2.0	0.7	-	-	-
Kharif 1	Jute	4.5±0.45	111	10	32	13	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	25	4	10	4	-	0.5	-	-	-	-
Kharif/	B. Aman rice	2.5±0.25	25	4	10	4	-	0.5	-	-	-	-
Rabi	Grasspea (relay)	1.5±0.15	15	15	12	5	-	-	-	-	-	-

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)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Boro rice	7.5±0.75	150	15	35	6	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	15	35	6	-	1.3	-	-	-		-
Kharif 1	T. Aus rice	4.0±0.40	75	6	12	3	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Water melon	35±3.5	100	25	30	10	-	-	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-

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 Manikganj district. Minor areas also occur in Dhaka, Munshiganj, Narayanganj and Chandpur districts
Medium Lowland	20	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0 ±0.50	90	10	35	8	-	1.0	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	10	2.0	1.0	1.0	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-		-
Rabi	Mustard	1.8±0.18	90	27	32	10	2.0	1.0	1.0	-	-		-
	Boro rice	7.5±0.75	150	12	55	18	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-		-
Rabi	Mustard	1.8±0.18	90	27	32	10	2.0	1.0	1.0	-	-		-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	0.5	-	-	-		-
Rabi	Potato	30.0±3.00	135	30	90	10	3.0	2.0	-	-	5.0		3.0
Kharif 1	T.Aus rice	4.0±0.40	75	10	20	6	-	0.6	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-		-
Kharif 1	T.Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-
Rabi	Potato	30.0±3.00	135	30	90	10	3.0	2.0	-	-	5.0		3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	35	9	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.5	-	-	-		-
Kharif	B.Aman rice	2.5±0.25	30	6	14	4	-	0.5	-	-	-		-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	15	50	18	-	2.2	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Groundnut	2.60±0.26	54	45	50	24	-	1.0	-	0.5	-	-	-
Kharif 1	B. Aus rice (LIV)	2.5±0.25	30	6	14	4	-	0.5	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-	-

AEZ 8: YOUNG-BRAHMAPUTRA AND 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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	15	2.5	1.0	1.0	-	-	-
	Boro	7.5±0.75	150	12	55	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	15	2.5	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	15	2.5	1.0	1.0	-	-	-
Kharif 1	Jute (C)	3.5±0.35	75	8	22	8	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	5	2.0	2.0	-	5.0	3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-		-	-	-	-
Kharif 2	T.Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	5	2.0	1.0	-	5.0	3.0
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	5	2.0	1.0	-	5.0	3.0
Kharif 1	Jute (C)	3.5±0.35	75	8	18	8	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Round the year	Sugarcane	100±10	165	55	120	45	20	2.5	-	-	-	-

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)								Manure (t/ha)	
Seasons	Crops		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	9	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Jute (C)	3.5±0.35	75	8	28	8	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	5	2.0	1.0	-	5.0	3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-		-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	5	2.0	1.0	-	5.0	3.0
Kharif 1	Fallow	-	-	-	-	-	-		-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.00	135	30	90	15	5	2.0	1.0	-	5.0	3.0
Kharif 1	Jute (C)	3.5±0.35	75	8	23	8	-		-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	40	15	2.0	1.0	1.0	-	-	-
Kharif 1	Boro rice	7.5±0.75	150	12	55	18	-	1.3	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Seasons	Crops		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Mustard	1.8±0.18	90	27	40	15	2.0	1.0	1.0	-	-	-
	Boro rice	7.5±0.75	150	12	55	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-	-
Rabi	Radish/	60±6.0	150	45	80	24	-	3.0	-	-	5.0	3.0
	Cabbage/	90±9.0	180	66	50	24	-	3.0	1.0	-	5.0	3.0
	Cauliflower	30.0±3.0	120	60	76	21	-	3.0	1.0	-	5.0	3.0
Kharif 1	Okra/	16.0±1.6	90	21	30	15	-	2.0	-	-	5.0	3.0
	Brinjal	60.0±6.0	120	25	40	15	-	2.0	-	-	5.0	3.0
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Cabbage/	90±9.0	180	66	50	24	-	3.0	1.0	-	5.0	3.0
	Cauliflower	30.0±3.0	120	60	76	21	-	3.0	1.0	-	5.0	3.0
Kharif 1	Cucumber/	16.0±1.6	60	17	22	18	-	2.0	-	-	5.0	3.0
	Ash gourd	40.0±4.0	75	25	30	18	-	2.0	-	-	5.0	3.0
Kharif 2	T. Aman rice	5.0±0.5	90	10	30	12	-	1.0	-	-	-	-
Round the year	Sugarcane	100±10	165	55	150	45	10	2.5	-	-	-	-

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 and Rajshahi 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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Okra/	16±1.6	90	21	30	10	-	1.5	-	-	5	3
	Brinjal	60±6.0	120	25	42	10	-	1.5	-	-	5	3
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	4	1.0	1.0	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	1.5	1.5	1.0	-	-	-
Kharif 1	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	1.5	1.5	1.0	-	-	-
	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	8	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0		3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	9	-		-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-

AEZ 11: HIGH GANGES RIVER FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	43	Chapai Nawabganj, Rajshahi, 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)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0 ±0.50	90	10	35	12	-	1.0	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-		-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	9	-	0.6	-	-	-		-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	35	12	-	1.0	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-		-
Kharif 1	T.Aus rice	4.0±0.40	75	10	25	9	-	0.6	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-	-
Kharif 1	Jute (O)	4.5 ±0.45	111	10	42	13	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	35	12	-	1.0	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-		-
Kharif 1	Mungbean	1.5±0.15	18	18	20	10	-	-	-	0.2	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-		-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	9	-	0.6	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-		-
Kharif 1	Sesame	1.3±0.13	78	18	27	20	-	-	0.6	-	-		-
Kharif 2	T. Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Mustard	1.8±0.18	90	27	32	15	1.5	1.0	1.0	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-
Rabi	Mustard	1.8±0.18	90	27	32	15	1.5	1.0	1.0	-	-		-
Kharif 1	Boro rice	7.5±0.75	150	12	55	18	-	1.3	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-
Rabi	Lentil	1.8±0.18	18	30	25	18	-	1.0	1.0	0.2	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-
Rabi	Lentil	1.8±0.18	18	30	25	18	-	1.0	1.0	0.2	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.5	90	10	35	12	-	1.0	-	-	-		-
Rabi	Maize	10.0±1.0	255	75	80	52	5	2.0	1.5	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-		-
Rabi	Maize	10.0±1.0	255	75	80	52	5	2.0	1.5	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-		-
Rabi	Maize	10.0±1.0	255	75	80	52	5	2.0	1.5	-	-		-
Kharif 1	Mungbean	1.5±0.15	18	18	18	10	-	-	-	0.2	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-		-
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0		3.0
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	9	-	0.6	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.5	-	-	-		-
Rabi	Potato	30.0±3.00	135	30	90	10	5	2.0	1.0	-	5.0		3.0
Kharif 1	Mungbean	1.5±0.15	18	18	18	10	-	-	-	0.2	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.5	-	-	-		-
Rabi	Onion	16.0±1.6	90	45	80	30	-	1.5	1.5		5.0		3.0
Kharif 1	Jute (O)	4.5 ±0.45	111	10	32	13	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	30	12	-	1.0	-	-	-		-
Rabi	Onion	16.0±1.6	90	45	80	30	-	1.5	1.5		5.0		3.0
Kharif 1	Brinjal	60.0±6.0	120	25	42	15	-	1.0	0.6	-	-		-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	30	12	-	1.0	-	-	-		-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Radish/	60±6.0	150	45	80	24	-	1.5	-	-	5.0	3.0
	Cabbage/	90±9.0	180	66	50	24	-	1.5	1.0	-	5.0	3.0
	Cauliflower	30.0±3.0	120	60	76	21	-	1.5	1.0	-	5.0	3.0
Kharif 1	Okra/	16.0±1.6	90	21	30	15	-	1.0	-	-	5.0	3.0
	Brinjal	60.0±6.0	120	25	42	15	-	1.0	-	-	5.0	3.0
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Radish/	60±6.0	150	45	80	24	-	1.5	-	-	5.0	3.0
	Cabbage/	90±9.0	180	66	50	24	-	1.5	1.0	-	5.0	3.0
	Cauliflower	30.0±3.0	120	60	76	21	-	1.5	1.0	-	5.0	3.0
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	30	12	-	1.0	-	-	-	-
Round the year	Sugarcane	100±10	165	55	120	30	10	2.5	-	-	-	-

AEZ 12: LOW GANGES RIVER FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	13	Natore, Pabna, Goalanda, Faridpur, Madaripur, Gopalganj and Sariatpur, 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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	35	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0 ±0.50	90	10	18	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	35	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	18	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Jute (C)	3.5±0.35	75	8	11	8	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Onion	16.0±1.6	90	45	80	30	-	1.5	1.5	-	-	-
Kharif 1	Jute (C)	3.5±0.35	75	8	9	8	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Grasspea	1.5±0.15	15	15	6	9	-	-	-	-	-	-
Kharif 1	Jute (C)	3.5±0.35	75	8	12	8	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	4	1.0	1.0	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	90	10	18	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	16	15	1.5	1.0	1.0	-	-	-
Kharif 1	Jute (O)/	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Mustard	1.8±0.18	90	27	16	15	1.5	1.0	1.0	-	-		-
	Boro rice	7.5±0.75	150	12	30	18	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T.Aman rice	5.0±0.5	90	10	18	8	-	1.0	-	-	-		-
Rabi	Lentil	1.8±0.18	20	30	20	18	-	1.0	1.0	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Onion/	16.0±1.6	90	45	40	20	-	1.5	0.7	-	5.0		3.0
	Garlic	15.0±1.5	114	48	30	30	-	2.0	2.0	-	5.0		3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Brinjal/	60.0±6.0	120	36	30	15	-	1.0	1.0	-	5.0		3.0
	Cabbage/	90.0±9	180	66	25	24	-	3.0	1.0	-	5.0		3.0
	Cauliflower/	30.0±3.0	120	60	38	21	-	3.0	0.6	-	5.0		3.0
	Tomato	80.0±8.0	135	45	25	15	-	1.0	1.0	-	5.0		3.0
Kharif 1	Jute (O)	4.5±0.45	111	10	32	13	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		
Rabi	Chickpea	2.5±0.25	33	24	25	18	-	1.0	1.0	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.5	90	10	18	8	-	1.0	-	-	-		-
Round the year	Sugarcane	100±10	165	55	60	45	10	2.5	-	-	-		-

AEZ 13: GANGES TIDAL FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Medium Highland	78	The region occupies all or most of Barisal, Jhalakati, Pirojpur, Patuakhali, Barguna, Bagerhat, Khulna and Satkhira districts. It includes the Khulna and Bagerhat Sundarbans reserved forests.

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Non-Saline Areas												
Rabi	Boro rice	7.5±0.75	125	20	35	6	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	125	20	35	6	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman	5.0±0.5	75	10	18	4	-	1.0	-	-	-	-
Rabi	Brinjal/	60.0±6.0	100	36	30	5	-	1.0	-	-	5.0	3.0
	Cabbage/	90.0±9	150	66	25	8	-	1.5	-	-	5.0	3.0
	Cauliflower/	30.0±3.0	100	60	38	7	-	1.5	-	-	5.0	3.0
	Tomato	80.0±8.0	115	45	25	5	-	1.0	-	-	5.0	3.0
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.5	75	10	18	4	-	1.0	-	-	-	
Rabi	Mungbean	1.5±0.15	20	30	12	6	-	-	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	65	10	12	3	-	0.6	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.5	75	10	18	4	-	1.0	-	-	-	-
Rabi	Grasspea	1.5±0.15	15	15	6	3	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.50	75	10	18	4	-	1.0	-	-	-	-
Rabi	Chilli	2.0±0.20	80	57	32	5	-	1.0	0.25	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman rice	5.0±0.50	75	10	18	4	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Saline Areas												
Rabi	Boro rice	7.5±0.75	125	20	35	6	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Water melon/	25±2.50	65	25	18	5	-	1.0	-	-	-	-
	Chilli/	2.0±0.20	80	57	32	5	-	1.0	0.25	-	-	-
	Cowpea/	1.4±0.14	15	15	6	2	-	-	-	-	-	-
	Grasspea/	1.5±0.15	15	15	6	3	-	-	-	-	-	-
	Soybean	2.0±0.20	14	30	20	5	-	1.0	-	-	-	-
Kharif 1	T. Aus (LIV)	2.5±0.25	30	7	5	2	-	0.5	-	-	-	-
Kharif 2	T. Aman LIV)/	3.0±0.30	45	6	10	3	-	0.5	-	-	-	-
	T. Aman (MV)	5.0±0.50	75	10	18	4	-	1.0	-	-	-	-
Rabi/	Bottle gourd/	40.0±4.0	65	36	20	7	-	1.0	-	-	5	3
	Sweet gourd	40.0±4.0	65	36	20	7	-	1.0	-	-	5	3
Kharif 1	Ash gourd/	40.0±4.0	65	25	15	7	-	1.0	-	-	5	3
	Bitter gourd/	25±2.5	65	21	10	5	-	-	-	-	3	2
	Cucumber	16±1.60	50	17	12	6	-	1.0	-	-	5	3
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Brinjal/	60.0±6.0	100	36	30	5	-	1.0	-	-	5.0	3.0
	Cabbage/	90.0±9.0	150	66	25	8	-	1.5	-	-	5.0	3.0
	Cauliflower/	30.0±3.0	100	60	38	7	-	1.5	-	-	5.0	3.0
	Tomato	80.0±8.0	115	45	25	5	-	1.0	-	-	5.0	3.0
Kharif 1	Okra/	16±1.60	75	21	15	5	-	1.0	-	-	5.0	3.0
	Indian Spinach/	40.0±4.0	75	13	15	5	-	-	-	-	5.0	3.0
	Amaranth	30.0±3.0	100	20	15	2	-	-	-	-	5.0	3.0
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman (LIV)/	3.0±0.3	45	6	10	3	-	0.5	-	-	-	-
	T. Aman (MV)	5.0±0.5	75	10	18	4	-	1.0	-	-	-	-
Rabi	Sesame	1.3±0.13	78	27	16	7.0	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.Aman (LIV)/	3.0±0.30	45	6	10	3	-	0.5	-	-	-	-
	T. Aman (MV)	5.0±0.50	75	10	18	4	-	1.0	-	-	-	-

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 Madaripur, Gopalganj, Narail, Jessore, Bagerhat and Khulna districts.
Medium Lowland	41	
Lowland	28	
Very Lowland	11	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	15	70	12	-	2.6	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	15	70	12	-	2.6	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	20	6	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	15	70	12	-	2.6	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. aman rice	5.0±0.5	90	6	42	8	-	1.0	-	-	-	
Rabi	Grasspea/	1.5±0.15	15	10	5	6	-	-	-	-	-	-
Kharif 1	Cowpea	1.4±0.14	15	10	15	5	-	-	-	-	-	
Kharif 2	B. Aman rice	2.5±0.25	30	6	20	6	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	20	70	10	-	2.6	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	6	55	13	-	-	-	-	-	
Kharif 2	T. aman rice	5.0±0.50	90	6	42	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	20	70	10	-	2.6	1.0	-	-	-
Kharif 1	Jute (C)	3.5±0.35	75	5	28	5	-	-	-	-	-	
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	20	70	10	-	2.6	0.8	-	-	-
Kharif 1	Sesame	1.3±0.13	78	13	35	18	-	-	0.6	-	-	
Kharif 2	T. aman rice	5.0±0.50	90	6	42	8	-	1.0	-	-	-	-
Rabi	Lentil	1.8±0.18	18	20	30	15	-	2.0	0.8	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	6	55	13	-	-	-	-	-	
Kharif 2	T. aman rice	5.0±0.50	90	6	42	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	18	40	12	-	2.0	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	6	55	13	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	18	40	12	-	2.0	1.0	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	4	15	6	-	0.5	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Potato	30±3.0	135	20	100	5	5	2.0	1.0	-	5	3
Kharif 1	Jute (C)	3.5±0.35	75	8	27	3	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30±3.0	135	20	100	5	5	2.0	1.0	-	5	3
Kharif 1	T. Aus rice	4.0±0.40	75	6	21	3	-	1.0	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30±3.0	135	20	100	5	5	2.0	1.0	-	5	3
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	-	-	-	-	-
Rabi	Potato	30.0±3.0	135	20	100	5	5	2.0	1.0	-	5	3
	Boro rice	7.5±0.75	150	14	50	6	-	1.5	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	80	6	-	1.5	-	-	-	-
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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Potato	30.0±3.0	135	20	90	10	3	2.0	1.0	-	5	3
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	-	-	-	-	
Rabi	Potato	30.0±3.0	135	20	90	10	3	2.0	1.0	-	5	3
Kharif 1	Boro rice	7.5±0.75	150	10	55	12	-	1.3	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	18	32	10	1.5	1.0	1.0	-	-	-
Kharif 1	Boro rice	7.5±0.75	150	10	55	12	-	1.3	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	18	32	10	1.5	1.0	1.0	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	-	-	-	-	
Rabi	Boro rice	7.5±0.75	150	15	65	12	-	1.5	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	-	-	-	-	
Rabi	Boro rice	7.5±0.75	150	15	65	12	-	1.5	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	15	65	12	-	1.5	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	6	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	6	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	20	60	10	-	1.3	1.0	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	15	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	10	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	15	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	15	-	1.3	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	5	-	-	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	-	1.3	1.0	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	10	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	15	40	10	-	1.0	-	-	-	-
Rabi	Radish/	60±6.00	150	45	80	16	-	1.0	-	-	5	3
	Tomato	80±8.00	135	45	50	10	-	1.5	0.5	-	5	3
Kharif 1	Jute (O)	4.5±0.45	111	10	42	10	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Soybean	2.0±0.20	24	30	40	15	-	1.0	0.5	0.6	-	-
Kharif 1	T.Aus rice	4.0±0.40	75	10	25	8	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	10	-	1.0	-	-	-	-
Rabi	Lentil/	1.8±0.18	18	30	25	18	-	1.0	0.4	0.2	-	-
	Chickpea	2.5±0.25	33	24	30	21	-	1.0	0.5	0.2	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	10	-	1.0	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	15	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	6	35	8	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	40	8	-	1.0	-	-	-	-
Rabi	Groundnut	2.5±0.25	50	45	40	35	-	1.0	0.5	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	6	35	8	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	--	-	-
Kharif 1	T. Aus	4.0±0.40	75	10	30	6	-	0.6	-		-	-
Kharif 2	T. Aman rice	5.0±0.50	90	6	35	8	-	1.0	-	-	-	-
Rabi	Grasspea/	1.5±0.15	15	10	15	6	-	-	-	-	-	-
	Cowpea	1.4±0.14	15	10	15	5	-	-	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	6	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	6	35	8	-	1.0	-	-	-	-
Rabi	Grasspea/	1.5±0.15	15	10	15	6	-	1.0	-	-	-	-
	Cowpea	1.4±0.14	15	10	15	5	-	1.0	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	0.5	-	-	-	-

AEZ 19: OLD MEGHNA ESTUARINE FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Medium Highland	24	Kishoregani, Habiganj, B. Baria, Comilla, Chandpur, Feni, Noakhali, Laxmipur, Narshingdi, Narayanganj, Dhaka, Shariatpur, Madaripur, Gopalganj and Barisal districts.
Medium Lowland	33	
Lowland	21	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Jute (C)	3.5±0.35	75	8	22	5	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.5	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	0.5	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	30	10	-	1.0	0.5	-	-	-
Kharif 1	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	30	10	-	1.0	0.5	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	Fallow	-	-		-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	30	10	-	1.0	0.5	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	0.5	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Potato	30±3.00	135	30	90	10	-	2.0	0.4	-	5		3
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	6	-	0.6	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-		-
Rabi	Potato	30±3.0	135	30	90	10	-	2.0	0.4	-	5		3
Kharif 1	Maize	10.0±1.0	180	55	60	25	3	2.0	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Potato	30.0±3.0	135	30	90	10	-	2.0	0.4	-	5		3
Kharif 1	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Potato	30.0±3.0	135	30	90	10	-	2.0	0.4	-	5		3
Kharif 1	Jute (C)	3.5±0.35	75	8	18	5	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	10	-	1.3	0.3	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	10	-	1.3	0.3	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-
Rabi	Lentil/	1.8±0.18	18	30	24	12	-	1.0	0.4	-	-		-
	Chickpea	2.5±0.25	33	24	30	14	-	1.0	0.4	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-
Rabi	Tomato/	80±8.0	135	45	50	10	-	1.0	-	-	5		3
	Cauliflower	30±3.0	120	60	76	14	-	1.5	-	-	5		3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-

AEZ 20: EASTERN 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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	1.5	1.0	0.5	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	15	40	8	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	15	30	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	0.5	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	14	4	-	0.5	-	-	-	-

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)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	35	6	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	20	35	6	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	25	4	-	1.0	-	-	-		-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 1	T. Aus rice	4.0±0.40	75	15	20	3	-	0.6	-	-	-		-
Kharif 2	T. aman rice	5.0±0.50	90	10	25	4	-	1.0	-	-	-		-
Rabi	Boro rice	7.5±0.75	150	20	35	6	-	1.3	-	-	-		-
Kharif	B. Aman rice	2.5±0.25	30	6	6	2	-	-	-	-	-		-
Rabi	Mustard	1.8±0.18	90	27	16	5	-	1.0	-	-	-		-
Kharif	B. Aman rice	2.5±0.25	30	6	6	2	-	-	-	-	-		-

AEZ 22: NORTHERN AND EASTERN PIEDMONT PLAINS

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	33	Sherpur, Netrokona, Sunamganj, Sylhet, Moulivibazar, Habiganj. B. Baria and Comilla districts.
Medium Highland	31	
Medium Lowland	16	
Lowland	9	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	66	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	66	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	66	18	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	66	18	-	1.3	-	-	-	-
Kharif	B. Aman rice	2.5±0.25	30	6	10	6	-	0.5	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	15	30	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Tomato/	80±0.80	135	45	50	15	-	1.0	1.0	-	5	3
	Radish	60±0.60	150	45	80	24	-	1.5	-	-	5	3
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Tomato/	80±0.80	135	45	50	15	-	1.0	1.0	-	5	3
	Radish	60±0.60	150	45	80	24	-	1.5	-	-	5	3
Kharif 1	T. Aus	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	15	40	8	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 1	Jute (O)	4.5±0.45	111	15	50	13	-	2.0	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif	B. Aman rice	2.5±0.25	30	10	16	6	-	0.5	-	-	-		-
Rabi	Mustard	1.8±0.18	90	27	32	15	1.5	1.0	1.0	-	-		-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-
Rabi	Wheat	4.5±0.45	120	30	60	15	-	1.3	-	-	-		-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	66	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	6	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	15	40	6	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	1.5	1.0	0.5	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	6	-	1.0	-	-	-	-
Rabi	Cowpea	1.4±0.14	15	15	12	4	-	1.0	0.6	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	15	35	6	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	1.5	1.0	0.5	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	4	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	6	-	1.0	-	-	-	-
Rabi	Tomato	80±0.80	135	45	50	10	-	1.0	0.5	-	5	3
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	4	-	0.6	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Tomato	80±0.80	135	45	50	10	-	1.0	0.5	-	5	3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	6	-	1.0	-	-	-	-
Rabi	Tomato	80±0.80	135	45	50	10	-	1.0	0.5	-	5	3
Kharif 1	Okra	16±0.16	90	30	40	10	-	1.0	0.7	-	5	3
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Potato	30±0.30	135	30	90	8	4	2.0	0.4	-	5	3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	6	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Panikachu	30±3.0	90	36	54	12	-	-	-	-	5		3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	6	-	1.0	-	-	-		-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-		-
Kharif 1	T. Aus rice	4.0±0.40	75	15	25	4	-	0.6	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	15	40	4	-	1.0	-	-	-	-
Rabi	Cucumber	16.0±1.6	45	24	32	3	-	-	-	-	5	3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	4	-	1.0	-	-	-	-
Rabi	Onion	16.0±1.6	90	45	80	5	-	3.0	-	-	5	3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	GM	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	65	10	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	3.0	1.3	0.6	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	9	-	-	-	-	-	-
Kharif 2	T. aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	3.0	1.3	0.6	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	3.0	1.3	0.6	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Potato	30±3.00	135	30	90	10	-	2.0	0.8	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	80	36	10	2.0	1.4	-	-	-
Kharif 1	T. Aus	4.0±0.40	75	10	20	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung or	Poultry manure
Rabi	Maize	10.0±1.0	255	75	80	36	10	2.0	1.4	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Onion	16.0±1.6	90	45	80	20	-	2.0	1.4	-	3	2
Kharif 1	T. Aus rice	4.0±0.40	75	10	20	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	2.5	1.0	0.6	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	2.5	1.0	0.6	-	-	-
Kharif 1	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Cabbage/	90±9	180	66	50	16	-	1.5	1.0	-	5	3
	Tomato	80±8.00	135	45	50	10	-	1.0	1.0	-	5	3
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Round the year	Sugarcane	100±10	165	55	120	30	20	2.5	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	50	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	GM	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	65	10	50	8	-	1.0	-	-	-	-
Rabi	Chickpea	2.5±0.25	33	24	45	14	-	1.0	0.4	0.2	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	50	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	90	10	3.0	1.3	0.6	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	50	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	90	10	3.0	1.3	0.6	-	-	-
Kharif 1	GM	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	65	10	50	8	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	120	36	10.0	2.0	0.7	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	42	8	-	1.0	-	-	-	-
Rabi	Potato	30.0±3.0	135	30	135	10	5.0	2.0	0.4	-	5	3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	42	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	48	10	2.5	1.0	0.3	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	42	8	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	15	60	8	-	1.0	-	-	-	-
Round the year	Sugarcane	100±10	165	55	180	30	20	2.5	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	18	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	9	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Potato	30±3.00	135	30	135	15	5	2.0	0.4	-	5	3
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	9	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	3.0	1.3	0.3	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Potato	30±3.00	135	30	135	15	5	2.0	0.4	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T.aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Potato	30±3.00	135	30	135	15	5	2.0	0.4	-	5	3
	Boro rice	7.5±0.75	150	12	55	18	-	1.3	-	-	-	-
Kharif 2	T.aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	80	52	10	2.0	1.4	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	15	3.0	1.3	0.3	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	42	13	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	12	-	1.0	-	-	-	-
Rabi	Potato	30±3.00	135	30	135	15	5	2.0	0.4	-	5	3
Kharif 1	Jute (O)	4.5±0.45	111	10	35	13	-	-	-	-	-	-
Kharif 2	T. aman rice	5.0±0.50	90	10	30	12	-	1.0	-	-	-	-
Round the year	Sugarcane	100±10	165	55	120	45	20	2.5	-	-	-	-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Wheat	4.5±0.45	120	30	60	10	3.0	1.3	0.6	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	80	36	10	2.0	1.4	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	30	8	-	1.0	-	-	-	-
Rabi	Maize	10.0±1.0	255	75	80	36	10	2.0	1.4	-	-	-
Kharif 1	GM	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	65	10	30	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	2.5	1.0	0.6	-	-	-
Kharif 1	Boro rice	7.5±0.75	150	12	55	12	-	1.3	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Cabbage/	190±9.0	180	66	50	16	-	1.5	1.0	-	5		3
	Tomato/	80±8.00	135	45	50	10	-	1.0	1.0	-	5		3
	Brinjal/	60±6.0	120	36	60	10	-	1.0	1.0	-	5		3
	Sweet gourd	40±4.0	75	36	40	14	-	1.0	1.4	-	-		-
Kharif 1	Okra/	16±1.60	90	21	30	10	-	1.0	-	-	5		3
	Amaranth/	30.0±3.0	117	19	30	4	-	-	-	-	5		3
	Bitter gourd	25±2.50	75	21	21	10	-	-	-	-	5		3
Kharif 2	Country bean	20±2.0	45	21	21	6	-	1.0	-	-	5		3
Round the year	Sugarcane	100±10	165	55	120	30	20	2.5	-	-	-		-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Hkarif 2	T. Aman	5.0±0.50	90	15	40	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Hkarif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Boro rice	7.5±0.75	150	20	65	12	-	1.3	-	-	-	-
Kharif 1	T. Aus rice	4.5±0.45	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.18	90	27	32	10	2.5	1.0	0.6	-	-	-
Kharif 1	T. Aus rice	4.5±0.45	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Cowpea	1.4±0.14	15	15	12	5	-	-	-	-	-	-
Kharif 1	T. Aus rice	4.5±0.45	75	10	25	6	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Cowpea	1.4±0.14	15	15	12	5	-	-	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-
Rabi	Sweet gourd/	40±4.0	75	36	40	14	-	1.0	0.7	-	5	3
	Bitter gourd/	25±2.50	75	30	30	10	-	-	0.5	-	5	3
	Cucumber/	16±1.60	60	24	32	12	-	1.0	0.5	-	5	3
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-	-

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)								Manure (t/ha)		
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or	Poultry manure
Rabi	Sweet gourd/	40±4.0	75	36	40	14	-	1.0	0.7	-	5		3
	Bitter gourd/	25±2.50	75	30	30	10	-	-	0.5	-	5		3
	Cucumber	16±1.60	60	24	32	12	-	1.0	0.5	-	5		3
Kharif 1	T. Aus rice	4.0±0.40	75	10	25	6	-	0.6	-	-	-		-
Kharif 2	T. Aman rice	5.0±0.50	90	10	35	8	-	1.0	-	-	-		-
Round the year	Sugarcane	100±10.0	165	55	120	30	20	2.5	-	-	-		-

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)								Manure (t/ha)	
Season	Crop		N	P	K	S	Mg	Zn	B	Mo	Cow dung	or Poultry manure
Rabi	Boro rice	7.5±0.75	150	20	85	15	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	42	10	-	1.0	-	-	-	-
Rabi	Mustard	1.8±0.20	90	27	40	13	4	1.0	0.4	-	-	-
Kharif 1	Jute (O)	4.5±0.45	111	10	54	10	-	-	-	-	-	-
Kharif 2	Fallow	-	-	-	-	-	-	-	-	-	-	-
Rabi	Mustard	1.8±0.20	90	27	40	13	4	1.0	0.4	-	-	-
	Boro rice	7.5±0.75	150	12	72	15	-	1.3	-	-	-	-
Kharif 1	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	42	10	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif 1	T. Aus rice	4.5±0.45	75	15	38	8	-	0.6	-	-	-	-
Kharif 2	T. Aman rice	5.0±0.50	90	10	42	10	-	1.0	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-	-	-
Kharif	B. Aman	2.5±0.25	30	8	20	5	-	0.5	-	-	-	-
Round the year	Sugarcane	100±10.0	165	64	150	40	25	2.5	-	-	-	-

9.4 FERTILIZER RECOMMENDATION FOR MULTIPLE CROPPING SYSTEMS

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	255	60	140	40	10	6	2	-

*Mg for AEZ 3 only

Sowing time : December 1st week to 2nd week of December
Sowing method : Fours of Soybean (30 cm x 10cm) in between maize paired rows (37.5 cm x 150 cm/ 37.5 cm) or 2 rows of Soybean in between maize normal row (75 cm x 25 cm)
Nutrient : 1/3rd N top dressed at 35 & rest 1/3 at 65 DAS in maize rows only+1/3rd N & other fertilizer as basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
				N	P	K	S	Mg*	Zn	B	
High & medium highland AEZ: 3, 4, 11, 13	Rabi	Hybrid maize (100%) + French bean (50%)	8.0 + 9.0	255	60	140	40	10	6	2	-

*Mg for AEZ 3 only

Sowing time : Mid November to 1st week of December
Sowing method : 4 rows of French bean (40%) 25cm apart in between maize paired row (37.5cm/ 150cm/37.5cm)
Nutrient : 2/3rd N as top dressed at 30 and 35 DAS in maize rows only+1/3rd N & other fertilizer as basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	255	60	140	40	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 (37.5cm/ 150cm/37.5cm)
Nutrient : 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

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	120	50	130	40	-	4.5	1.0	-

Sowing time : Mid December
Sowing method : One row of maize (140cm) in between onion rows (30cm apart)
Nutrient : All basal except 50% N top dressed 3 & 5 weeks after transplantation

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	255	60	140	40	10	6	2.0	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
Nutrient : 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

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
				N	P	K	S	Mg	Zn	B	
Medium highland AEZ: 3a, 3b, 3c, 11, 13	Rabi (rainfed)	Tobacco (100%) + Chickpea (10%)/ Lentil (50%)	1.60 + 0.70/ 0.60	50	20	35	0	0	0	0	0

Sowing time : Mid October to- Mid November

Sowing method : Three rows of chickpea (40cm apart) in between paired rows of tobacco (37.5cm/4 cm/37.5cm), plant to plant tobacco 60cm. But in case of Lentil, broadcast (50% seed rate)

Nutrient : 1/2 N & other fertilizers as basal and 1/2 N at 30 DAS of tobacco plants

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
Medium highland AEZ: 13, 11	Rabi (Rainfed)	Chickpea (100%) + Coriander (33%)	1.0 + 0.30	20	30	30	20	-	2.0	1.5	-

Sowing time : Mid October to November

Sowing method : Broadcast (30 kg seed/ha of chickpea and 3 kg seed/ha of coriander)

Nutrient : As basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	20	30	30	20	-	2.0	0.5	-

Sowing time : Mid October to Mid November

Sowing method : One row of linseed in between two rows of chickpea (30cm x 10cm)

Nutrient : All fertilizer as basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	40	30	60	20	-	3.0	1.5	-

Sowing time : Mid October to last week of November

Sowing method : Two rows of chickpea alternate with two rows of mustard at 30cm apart

Nutrient : All fertilizer as basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	100	25	50	10	-	2.0	1.0	-

Sowing time : Mid November to last week of November

Sowing method : Two rows of wheat (20cm apart) alternate with one row of chickpea

Nutrient : All fertilizer as basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
				N	P	K	S	Mg*	Zn	B	
High plain land AEZ: 3, 11	Kharif-2 (Rainfed)	Cotton (100%) + Mungbean/ Blackgram	2.00 + 0.80/ 0.90	90	20	60	20	10	3.0	1.0	-

*Mg for AEZ 3 only

Sowing time : 1st week of August to third week of August

Sowing method : Cotton 60cm x 30cm, one row of mungbean/blackgram (30cm apart) in between cotton rows or two rows of mungbean/blackgram (30cm apart) in between paired cotton rows (30cm/30cm/30cm)

Nutrient : 2/3rd N at 30 & 50 DAS in cotton rows + 1/3rd N & other Nutrients as basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	180	26	33	20	0	0	0	0

Sowing time : Mid September

Spacing (jute) : 30cm x 10cm

Nutrient : 45 kg N at 20 DAE, 45 kg N at 35 DAE

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg*	Zn	B	
Medium highland AEZ: 3, 11, 13	Rabi	Groundnut (100%) + Kaon (25%)	1.60-1.80 + 0.50-0.70	50	30	50	20	10	2.0	1.0	-

*Mg for AEZ 3 only

Sowing time : Mid February to Mid March

Sowing method : Groundnut 25cm x 10cm (100%), broadcast Kaon (25%)

Nutrient : As basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
High & medium Highland AEZ: 12, 13, 26, 28	Rabi	Groundnut (100%) + Onion/Garlic (33%)	1.4-1.5 + 4.0	60	45	50	30	-	2.0	1.0	-

Sowing time : November to December

Sowing method : Groundnut spacing: 40cm x 10cm, in between 2 normal groundnut rows, two rows of onion/garlic (10cm x 5cm) can be planted

Nutrient : All basal except 2/3rd N at 20 & 40 DAS

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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	50	30	50	30	-	2.0	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)

Nutrient : All fertilizer as basal except 9 kg/ha of N as top dressed in sesame row 25 DAS.

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (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/ Spinach)	25.0-30.0 + 2.0-3.0	150	40	160	15	10	3.0	1.0	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

Nutrient : 1/3rd N and other fertilizer 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

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg*	Zn	B	
Rainfed highland AEZ: 3, 8d, 15, 25, 28	Rabi	Potato + Red amaranth + Sweet gourd	25.0 + 2.0 + 2.50	150	40	160	15	10	3.0	1.0	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

Nutrient : 2/3rd N & other fertilizer t 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

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg*	Zn	B	
High & medium highland AEZ: 3, 19, 28	Rabi	Cabbage (100%) + Tomato (25%)	60-70 + 10-15	140	40	70	15	10	3.0	-	3-5

*Mg for AEZ 3 only

Sowing time : Last week of October to Mid November

Sowing method : Cabbage 60cm x 45cm, in between cabbage rows one row of tomato (45cm spaced)

Nutrient : Cowdung 50% al pit, rest 50% cowdung and P at final land preparation, N and K at 1520 DAS and 35 DAS as top dress

Note : The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg *	Zn	B	
Medium highland AEZ: 3, 7, 9, 28	Rabi	Banana + Dhaincha	20-25 + 20-25 (biomass)	130	20	86	10	10	0	0	12

*Mg for AEZ 3 only

Spacing : Banana pit size: 0.6m x 0.6m x 0.4m

Nutrient : In Banana: Two weeks before planting/pit: cowdung 5 kg, TSP 25 g, MP 25 g, Three month after planting/pit: Urea 25 g, MP 25 g

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
High & medium highland AEZ: 1a, 11a, 25a	Rabi	T. Sugarcane (100%)	100	150	50	100	30	20	-	-	-
		+	+								
		Onion	10.0	75	30	75	30	-	-	-	-

Spacing : Sugarcane: 100cm x 45cm, Onion: 30cm x 10cm

Sowing method : Bulb of onion planted in two rows between Sugarcane

Nutrient : For Sugarcane: 50 kg N 20 DAT, 50 N 40 K kg at 4-6 tiller stage, 50 N 40 K at earthing up. For Onion, all fertilizer as basal

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
High and medium highland AEZ: 1a, 11a, 25a	Rabi & Kharif	Sugarcane (paired row)	100.0	150	50	100	30	20	-	-	-
		+	+								
		Potato	10.0	70	15	60	-	-	-	-	-
		+	+								
		Kangkong	10.0	28	28	30	2	-	-	-	-

Sowing time : Sugarcane: Mid October to Mid November; Potato: Mid October to Mid November; Gimakalmi: February to April

Spacing : Sugarcane: 60cm between two rows and 140 cm between two paired rows. Plant to plant 45cm.

Three lines of potato and kangkong in 30cm between 2 paired rows of Sugarcane.

Nutrient : Sugarcane: 50 kg N at 20 DAT, 50 kg N and 40 K at 4-6 tillering, 50 N and 40 K at earthing up.

Potato : 40 kg N at earthing up

Kangkong : 10 kg N after 1st harvest and 10 kg N at 2nd harvest

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
High & medium highland AEZ: 1a, 11a, 25a	Rabi + Kharif	Sugarcane (paired row)	100	150	50	100	30	20	-	-	-
		+	+								
		Potato	10	70	15	60	-	-	-	-	-
		+	+								
		Red amaranth	6	23	5	25	2	-	-	-	-

Sowing time : Sugarcane: Mid October to Mid November Potato: Mid October to Mid November Red amaranth: February to March

Spacing : Sugarcane: 60cm between two rows and 140 cm between two paired rows. Plant to plant 45cm.

Nutrient : Sugarcane: 50 kg N at 20 DAT, 50 kg N and 40 K at 4-5 tillering, 50 N and 40 K at alternative earthing up.

Potato : 40 kg N at earthing up

Red amaranth : 10 kg N at 20 DAS

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
High & medium highland AEZ: 1a, 11a, 25a	Rabi + Kharif	Sugarcane (paired row)	100	150	50	100	30	20	-	-	-
		+	+								
		Potato	10	70	15	60	-	-	-	-	-
		+	+								
		Mungbean	0.7	7	7	5	-	-	-	-	-

Sowing time : Sugarcane: Mid October to Mid November Potato: Mid October to Mid November

Spacing : Sugarcane: 60cm between two rows and 140 cm between two paired rows. Plant to plant 45cm.

Nutrient : Soybean: 50 kg N at 20 DAT, 50 kg N and 40 K at 4-6 tillering, 50 N and 40 K at earthing up.

Potato : 30 kg N at earthing up Mungbean: All as basal

Appendices

Appendix-1

Trends of Fertilizer use (ton) 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	-	118,663	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	5,00	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
2010-11	2,657,000	592,000	-	323,000	494,000	135,000	42,000	8,800	82,000	4,333,800

Source: Monthly report FDI-11 and ATDP/IFDC and MOA, MMI/DAE

Appendix-2

Trends in fertilizer nutrient use (kg/ha/yr) in some selected South and Southeast Asian countries

Country	1983	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2003	2009
Bangladesh	48	73	93	98.9	103	100	98	108	115	126	134.6	140.5	161.7	156.3	151	249.4
China	184	262	265	282	308	306	264	309	280	260	263.3	264.7	269.2	256.6	336.2	432.1
India	46	65	69	71	75	72	73	80	85	90	95.4	99.0	106.4	98.6	98.9	156.2
Indonesia	75	113	109	78.2	83	78	86	85	80	70	71.5	85.9	78.9	73.8	76.5	100.5
Korea DPR	345	338	407	416.2	403	387	390	376	300	90	85.6	78.6	136.0	175.5	-	-
Malaysia	116	151	164	130.9	134	130	126	158	160	162	164.6	184.9	190.4	187.8	156.7	182.7
Mayanmar	16	8	9	7.5	8	9	15	17	17	17	17.5	16.9	15.8	20.0	9.5	5
Nepal	-	-	-	30.9	15	20	25	30	32	35	36.2	40.9	28.6	25.6	22.9	1.4
Pakistan	59	83	91	90.4	90	102	101	102	110	115	121.0	117.3	129.5	135.1	141.7	208.5
Philippines	46	65	68	59.4	48	55	61	65	70	75	81.7	62.8	74.1	73.1	88.8	72.6
R. of Korea	331	441	441	454.1	454	466	474	467	480	500	515.6	453.9	425.8	407.3	421.3	345.3
Sri Lanka	87	97	106	90.1	93	96	112	113	110	110	110.5	123.3	136.0	128.9	127.6	142.6
Thailand	25	39	39	50.7	41	50	58	61	70	75	80.5	89.5	97.2	86.1	120.9	100.7
Viet Nam	64	68	83	87.8	116	135	134	174	190	200	204.3	254.5	265.3	285.3	253.2	262.4
Japan	-	-	-	348.2	250	255	260	270	275	280	286.0	268.7	272.7	298.8	311.2	219

Source: Selected Indicators of Food and Agriculture Development in the Asia-Specific Region (1991-2001), RAP Publication: 2002/19, Bangkok, October 2002.

Selected Indicators of Food and Agriculture Development in Asia-Specific Region (2000-2010), RAP Publication: 2011/21, Bangkok, October 2011.

Appendix-3

Nutrient composition (%) of commonly used chemical 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)	$ZnSO_4.H_2O$	-	-	-	18	36	-	-	-	-	-
Zinc sulphate, Heptahydrate	$ZnSO_4.7H_2O$	-	-	-	11	23	-	-	-	-	-
Zinc oxide	ZnO	-	-	-	-	78	-	-	-	-	-
Boric acid	H_3BO_3	-	-	-	-	-	-	-	-	17	-
Solubor	$Na_2B_80_{13}.4H_20$	-	-	-	-	-	-	-	-	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-4

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/সার-১/২০০৮/১৫৬; তারিখ: ০২ এপ্রিল ২০০৮

Appendix-5

Nutrient composition of different organic manures/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-6

Nutrient composition of green manures 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-7

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 of the material (Appendices- 5 & 6) and their mineralization.

Appendix-8

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-9

Interpretation of soil test values based on critical limits

A: Loamy to Clayey Soils for 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 method)	≤ 7.5	7.51-15.0	15.1-22.5	22.51-30	30.1-37.5	>37.5
P (µg/g) (Bray & Kurtz method)	≤ 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 extraction
Ca (meq/100g)	2.0	N NH_4OAc extraction
Mg (meq/100g)	0.5	N NH_4OAc extraction
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 method)	≤ 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 method)	≤ 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 extraction
Ca (meq/100g)	2.0	N NH_4OAc extraction
Mg (meq/100g)	0.5	N NH_4OAc extraction
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 for Wetland Rice 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) (Olsen method)	≤ 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 method)	≤ 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 extraction
Ca (meq/100g)	2.0	N NH_4OAc extraction
Mg (meq/100g)	0.5	N NH_4OAc extraction
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-10

Location specific and yield goal basis fertilizer recommendation for crops based on soil test values

For example: Crop-Wheat; Yield Goal = 4.5 ± 0.45 t/ha

Location: Village.....Upazila.....District

Soil analysis	Soil test value	Soil test value interpretation (Appendix- 9A)	Range of values used within the interpretation class (Appendix- 9A)
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 # 88) 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,

$\mathbf{F_r}$: Fertilizer nutrient required for given soil test value

$\mathbf{U_f}$: Upper limit of the recommended fertilizer nutrient for the respective STVI class

$\mathbf{C_i}$: Units of class intervals used for fertilizer nutrient recommendation

$\mathbf{C_s}$: Units of class intervals used for STVI class

$\mathbf{S_t}$: Soil test value

$\mathbf{L_s}$: Lower limit of the soil test value within STVI class

Example:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$= 13.34 \times \frac{100}{16} = 83.38 \text{ kg Gypsum/ha}$$

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

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

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

$$= 1.04 \times \frac{100}{36} = 2.9 \text{ kg Zinc sulphate (mono-hydrate)/ha}$$

$$B\ (kg/ha) = 1.0 - \frac{0.5}{0.15} \times (0.2 - 0.151)$$

$$= 1.0 - \frac{0.5}{0.15} \times 0.049$$

$$= 0.837 \text{ kg B/ha}$$

$$= 0.837 \times \frac{100}{17} = 4.92 \text{ kg Boric acid/ha}$$

Note:

When zinc sulphate is used sulphur is also supplied (approximately 18% S in $ZnSO_4.H_2O$). Thus, if 2.9 kg of zinc sulphate is used

$$\frac{2.9 \times 18}{100} = 0.52 \text{ kg of S will be added per hectare}$$

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 = 252.2	2.17
P = 16.1	TSP = 80.5	5.00
K = 70.3	MoP = 140.6	2.00
S = 13.34	Gypsum = 83.38	6.25
Zn = 1.04	Zinc sulphate, monohydrate = 2.9	2.79
B = 0.837	Boric acid = 4.92	5.88

Appendix-11

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	Nutrient 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	Nutrient 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-12

Symbol and Atomic Weight of Elements

Element	Symbol	Atomic Weight	Element	Symbol	Atomic Weight
Aluminium	AI	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	CI	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-13

Useful Chemical Conversion Factors

$N \times 1.22 = NH_3$	$HNO_3 \times 0.22 = N$
$P \times 2.29 = P_2O_5$	$H_3PO_4 \times 0.32 = P$
$P_2O_5 \times 0.44 = P$	$Ca_3(PO_4)2 \times 0.20 = P$
$K \times 1.20 = K_2O$	$KCI \times 0.52 = K$
$K_20 \times 0.83 = K$	$K_2SO4 \times 0.45 = K$
$Ca \times 1.40 = CaO$	$CaSO_4 \times 0.29 = Ca$
$MgO \times 0.60 = Mg$	$MgCO_3 \times 0.28 = Mg$
$S \times 3.00 = SO_4$	$H_2SO_4 \times 0.33 = S$
$SO_4 \times 0.33 = S$	$CaSO_4 \times 0.24 = S$

Some useful conversion factors

1 sqm	$= 1 \times 10^{-4}$ ha	1 ha = 10,000 sqm
1 kg	= 2.2046 pounds	1 Ib = 0.4535 kg
	Kg/ha × 0.892	= pound/acre
	Pound/acre × 1.121	= kg/ha

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 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 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 Types

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-}, PO_4^{3-}	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_3^{2-}	Minerals, Fertilizers
Molydenum	MoO_4^{2-}	Minerals, Fertilizers
Chlorine	$C1^-$	Minerals, Fertilizers

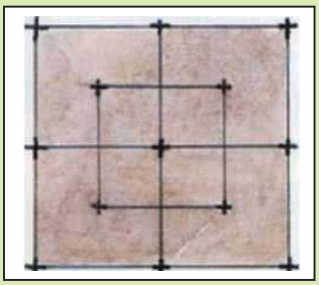
Appendix-19

Methods of soil sample collection

For continuing sustainable crop harvest from a piece of land, maintenance of soil health is a must. Soil analysis is done to understand the nutrient status of particular field and use of fertilizer as per need of the soil. As such correct soil sampling is of great importance and the sample must be representative.

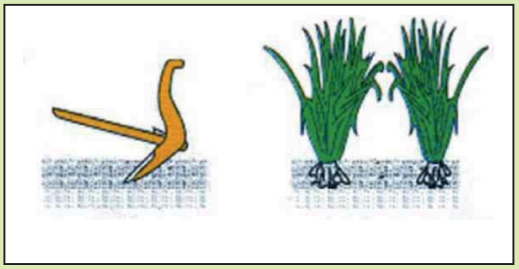
Step 1: Collection of equipment and stationeries for soil sampling: Considering the field condition and the availability the following equipments are needed for soil sampling.

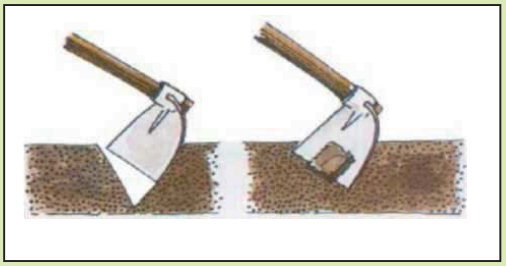
a) Country spade, shovel, push anger, weeding tools, Dutch auger, etc (any one).
b) Plastic bucket or polyethylene sheet.
c) Thick poly bag and thread ball.
d) Level (tag), pencil or pen, towel, permanent marker.



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 the bottom. Put the soil slice in the bucket or on the plastic sheet. Collect sub-samples from all the pre-demarcated spots in the same way. Take care that all the sub-samples you have taken are almost of the same volume.

Step 5: Mix up the sub-samples thoroughly and make a composite soil sample for a field. The samples should be made free from stubbles, grasses, rubbish, plant roots and stems etc. at this stage.

Step 6: Divide the mixed composite sample into 4 components on a plastic sheet. Discard any two component samples from the opposite corners and mix up the remaining two samples again. Continue this process until the volume of the sample reaches to about 400-500 grams.

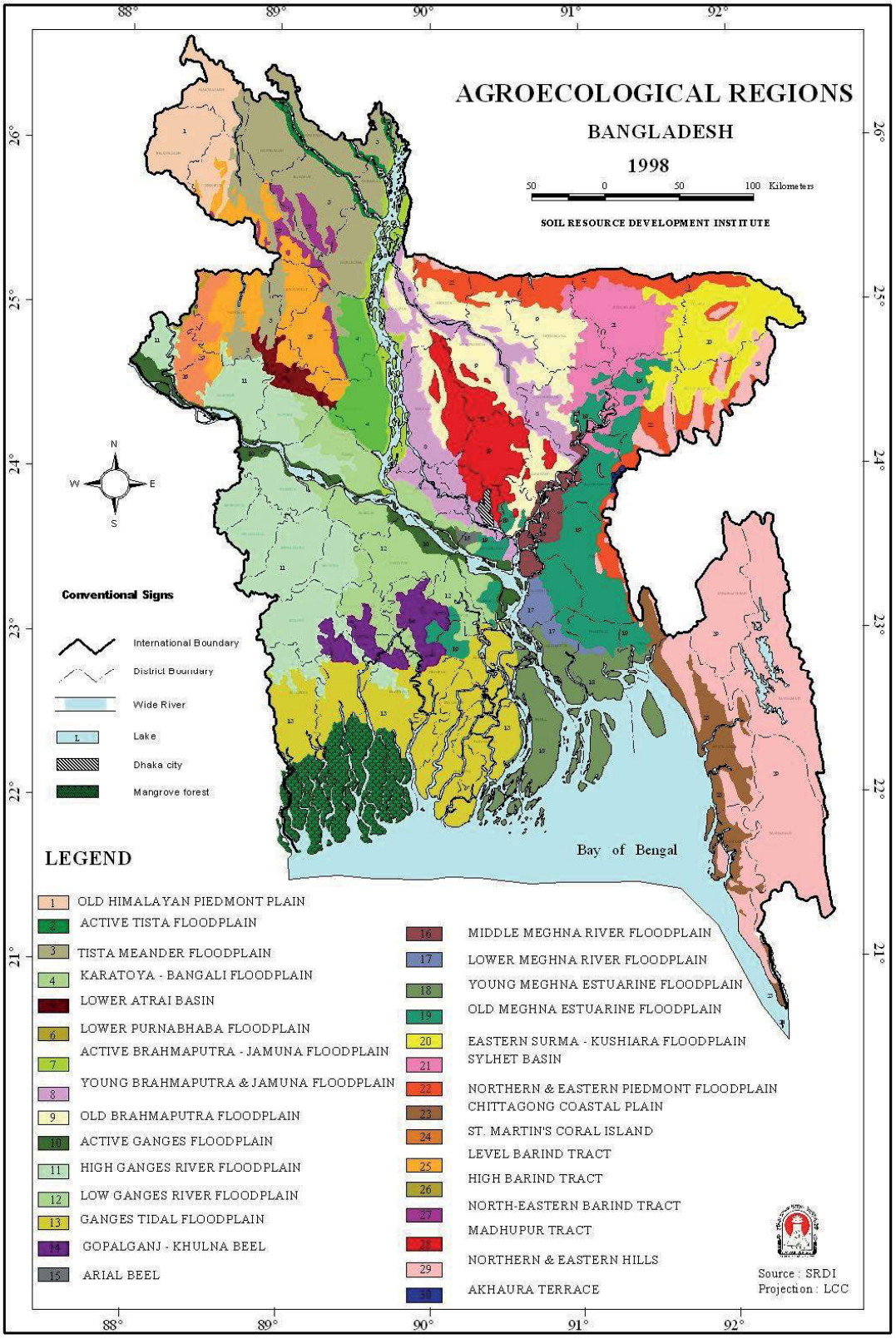
Step 7: From the composite sample take 400-500 grams into a plastic bag. The samples should be dried in shady place and pulverized with a wooden hammer.

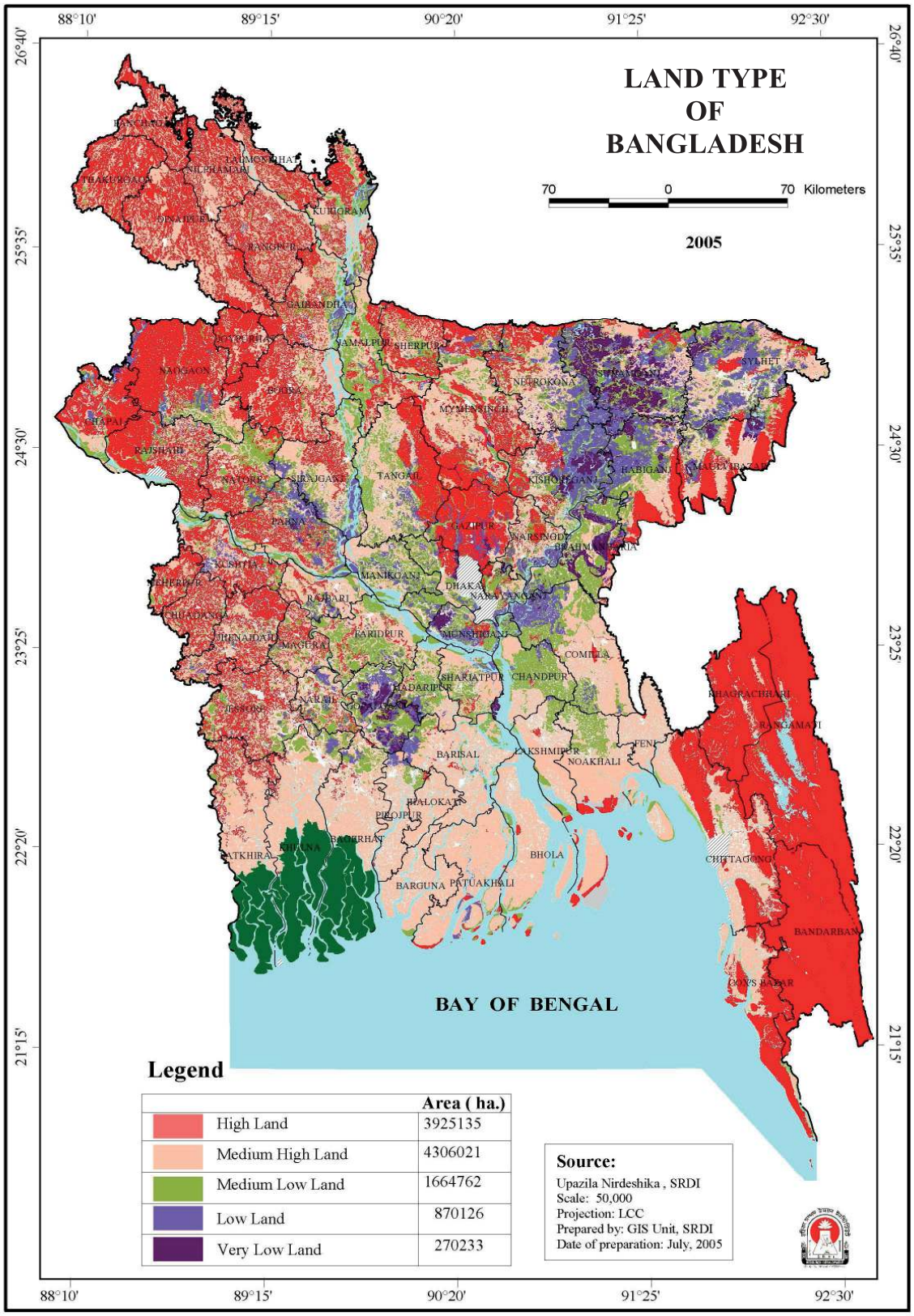
Step 8: The plastic bag with soil sample should be tightly closed with thread and placed inside another plastic bag. An information sheet (Tag) should be placed between two plastic bags and again the bag should be tightly closed with thread. An additional information sheet (Tag) should be tied at the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

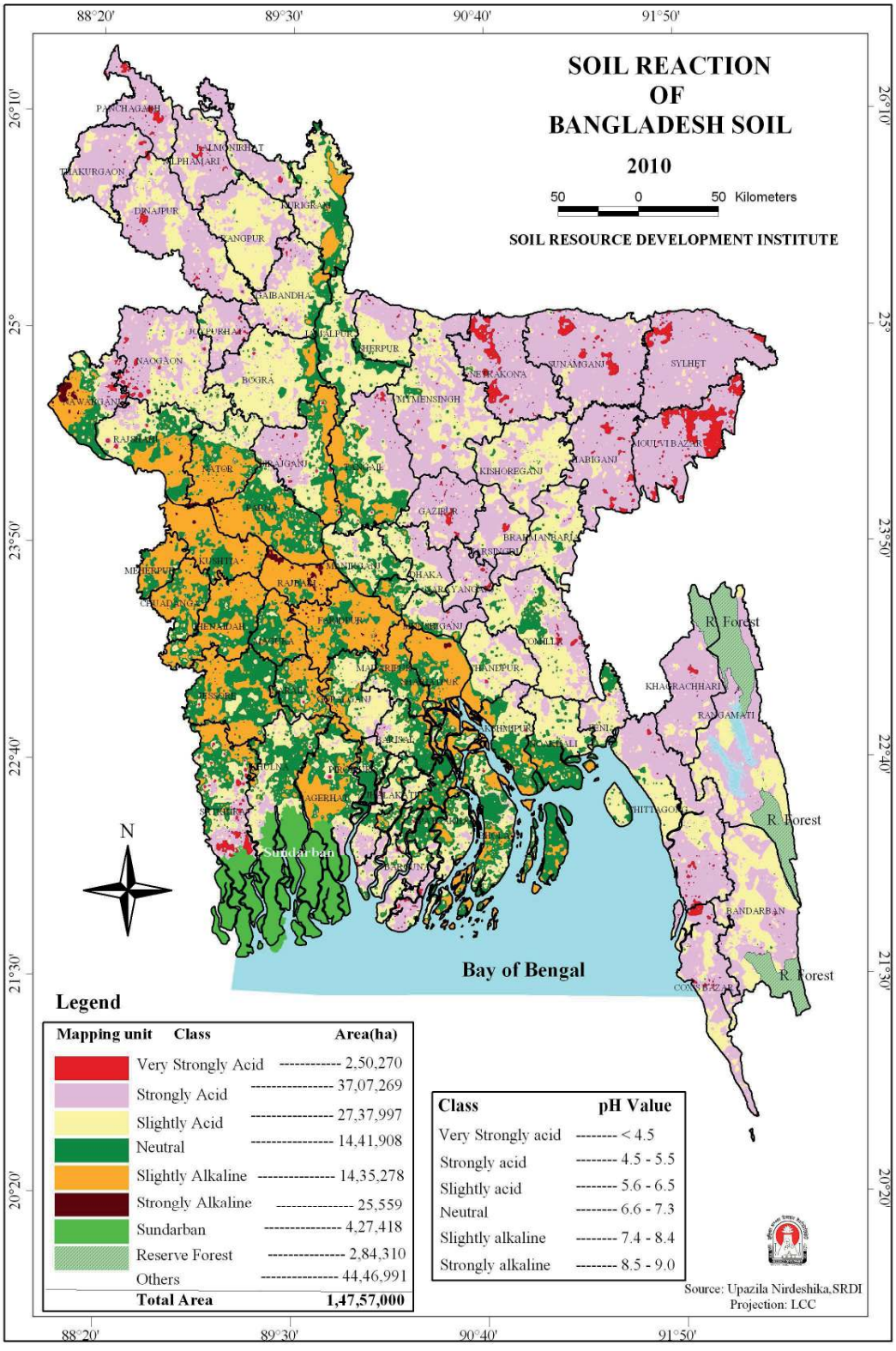
Note: Samples should not be collected from the nearby places to the road/embankment, brick filed, compost/cowdung heap, straw burned area etc. and from very recently fertilized land. Do not wipe out the grasses or other plants from the surface of the sampling spots before collecting soil samples. This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

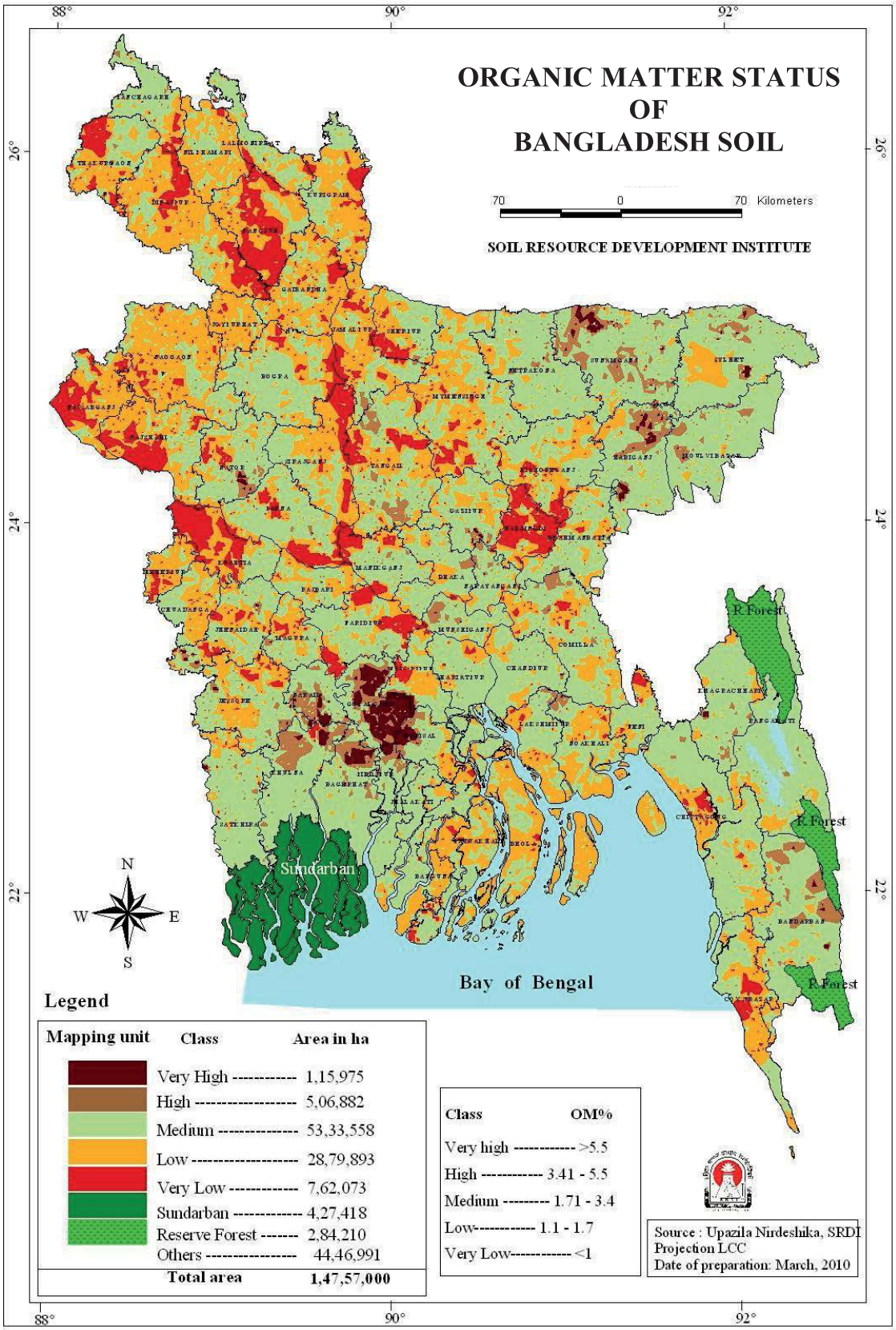
Information Sheet

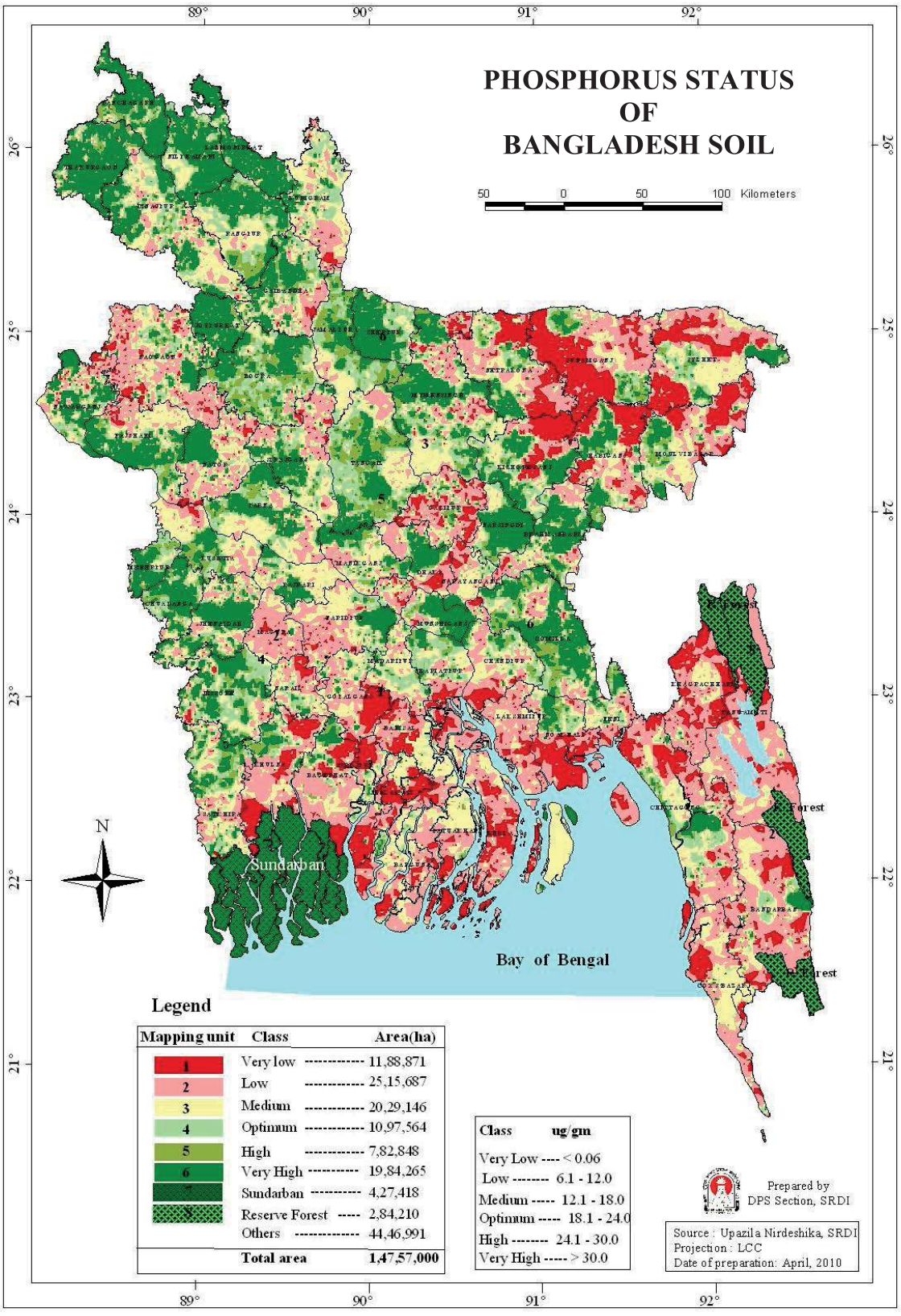
Name of the farmer	:	Soil sample No.	:
Father's Name	:	Land type	:
Mother's Name	:	Flooding Depth(cm)	:
Vill/Mouza	:	Soil series/Dal	:
Union/Block	:	Existing cropping pattern	:
Upazila & District	:	Crops to be cultivated	:
Date of Collection	:	Lab. Code No.	:

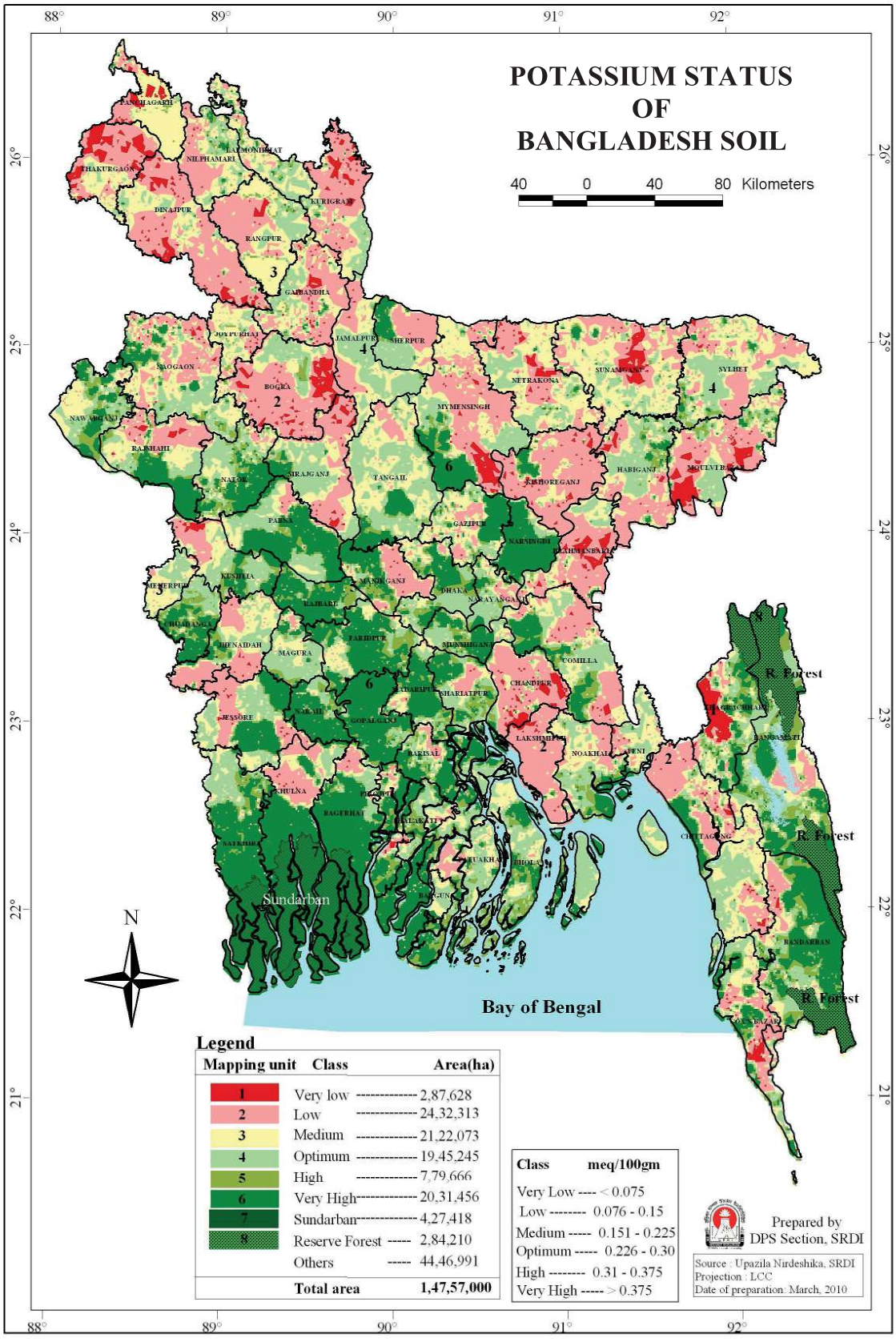

AGROECOLOGICAL REGIONS
BANGLADESH
1998
50 0 50 100 Kilometers
SOIL RESOURCE DEVELOPMENT INSTITUTE
88° 89° 90° 91° 92°
26° 25° 24° 23° 22° 21°
N
W E
S
Conventional Signs
International Boundary
District Boundary
Wide River
Lake
Dhaka city
Mangrove forest
Bay of Bengal
LEGEND
1 OLD HIMALAYAN PIEDMONT PLAIN
2 ACTIVE TISTA FLOODPLAIN
3 TISTA MEANDER FLOODPLAIN
4 KARATOYA - BANGALI FLOODPLAIN
5 LOWER ATRAI BASIN
6 LOWER PURNABHABA FLOODPLAIN
7 ACTIVE BRAHMAPUTRA - JAMUNA FLOODPLAIN
8 YOUNG BRAHMAPUTRA & JAMUNA FLOODPLAIN
9 OLD BRAHMAPUTRA FLOODPLAIN
10 ACTIVE GANGES FLOODPLAIN
11 HIGH GANGES RIVER FLOODPLAIN
12 LOW GANGES RIVER FLOODPLAIN
13 GANGES TIDAL FLOODPLAIN
14 GOPALGANJ - KHULNA BEEL
15 ARIAL BEEL
16 MIDDLE MEGHNA RIVER FLOODPLAIN
17 LOWER MEGHNA RIVER FLOODPLAIN
18 YOUNG MEGHNA ESTUARINE FLOODPLAIN
19 OLD MEGHNA ESTUARINE FLOODPLAIN
20 EASTERN SURMA - KUSHIARA FLOODPLAIN
21 SYLHET BASIN
22 NORTHERN & EASTERN PIEDMONT FLOODPLAIN
23 CHITTAGONG COASTAL PLAIN
24 ST. MARTIN'S CORAL ISLAND
25 LEVEL BARIND TRACT
26 HIGH BARIND TRACT
27 NORTH-EASTERN BARIND TRACT
28 MADHUPUR TRACT
29 NORTHERN & EASTERN HILLS
30 AKHAURA TERRACE
Source : SRDI
Projection : LCC

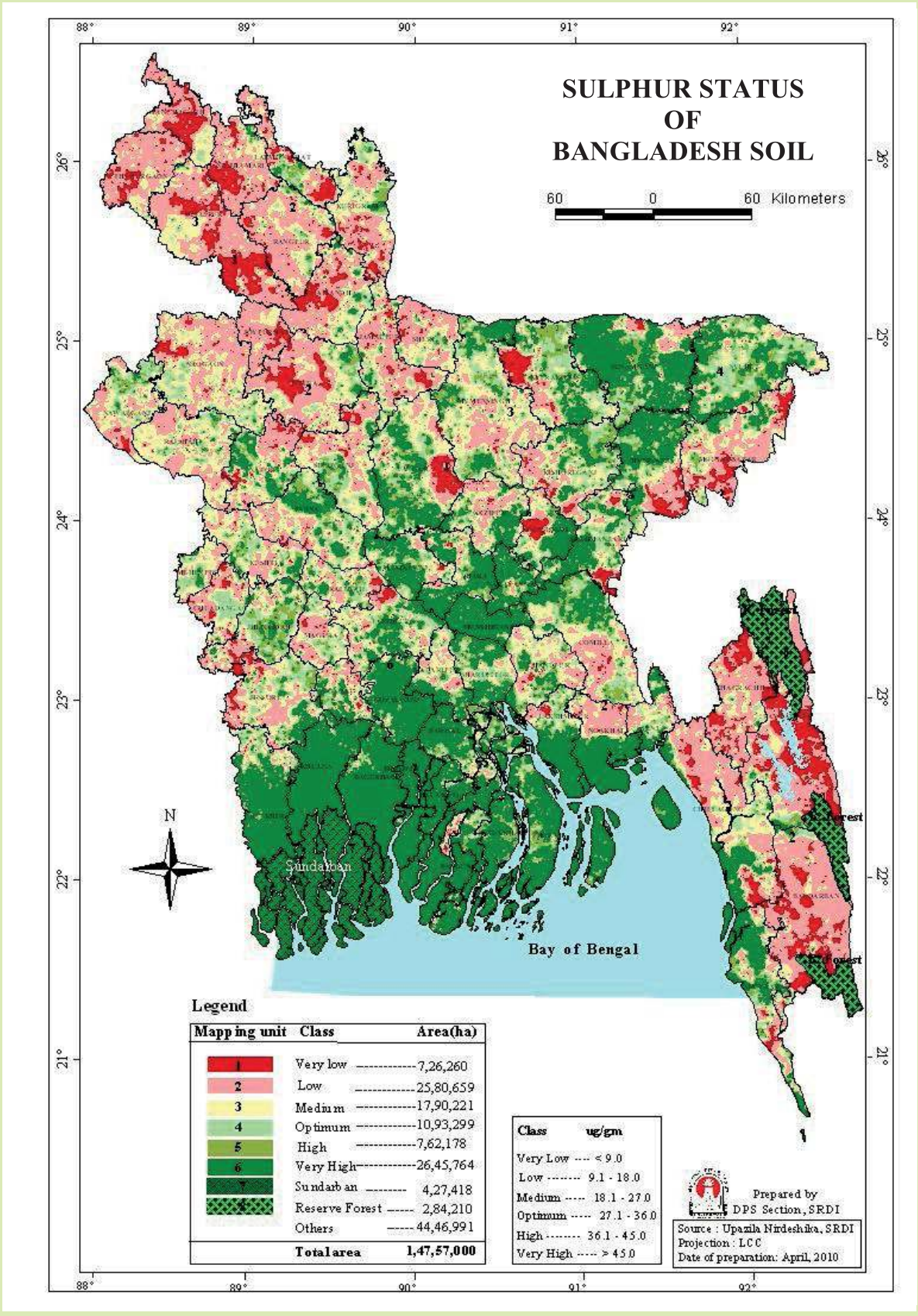

LAND TYPE
OF
BANGLADESH
70 0 70 Kilometers
2005
88°10'
89°15'
90°20'
91°25'
92°30'
26°40'
25°35'
24°30'
23°25'
22°20'
21°15'
BAY OF BENGAL
Legend
Area (ha.)
High Land 3925135
Medium High Land 4306021
Medium Low Land 1664762
Low Land 870126
Very Low Land 270233
Source:
Upazila Nirdeshika , SRDI
Scale: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

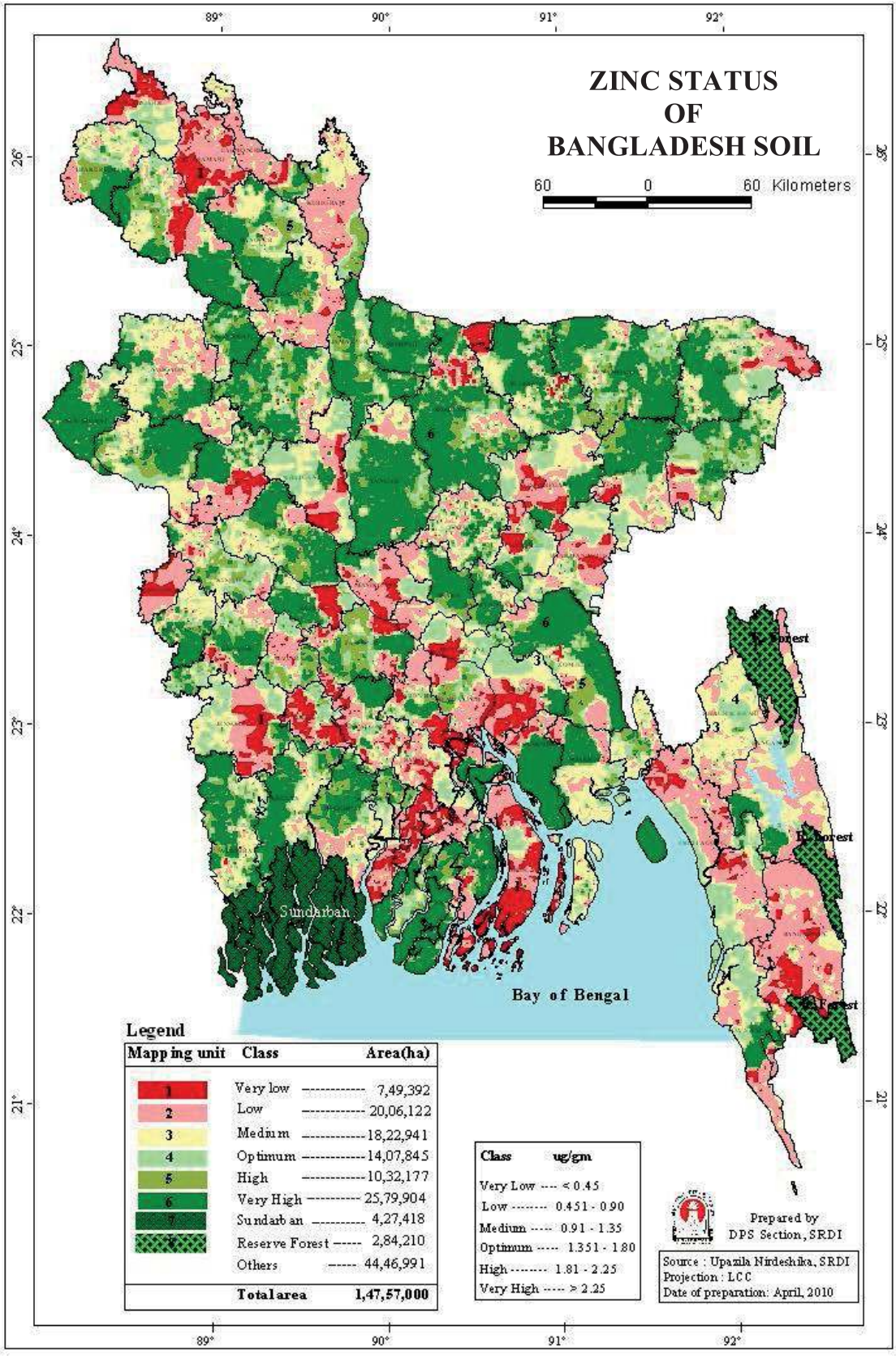

SOIL REACTION
OF
BANGLADESH SOIL
2010
50 0 50 Kilometers
SOIL RESOURCE DEVELOPMENT INSTITUTE
88°20'
89°30'
90°40'
91°50'
26°10'
25°
23°50'
22°40'
21°30'
20°20'
N
Sundarban
Bay of Bengal
R. Forest
R. Forest
R. Forest
Legend
Mapping unit Class Area(ha)
Very Strongly Acid ---------- 2,50,270
Strongly Acid ---------- 37,07,269
Slightly Acid ---------- 27,37,997
Neutral ---------- 14,41,908
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 Nirdeshika,SRDI
Projection: LCC

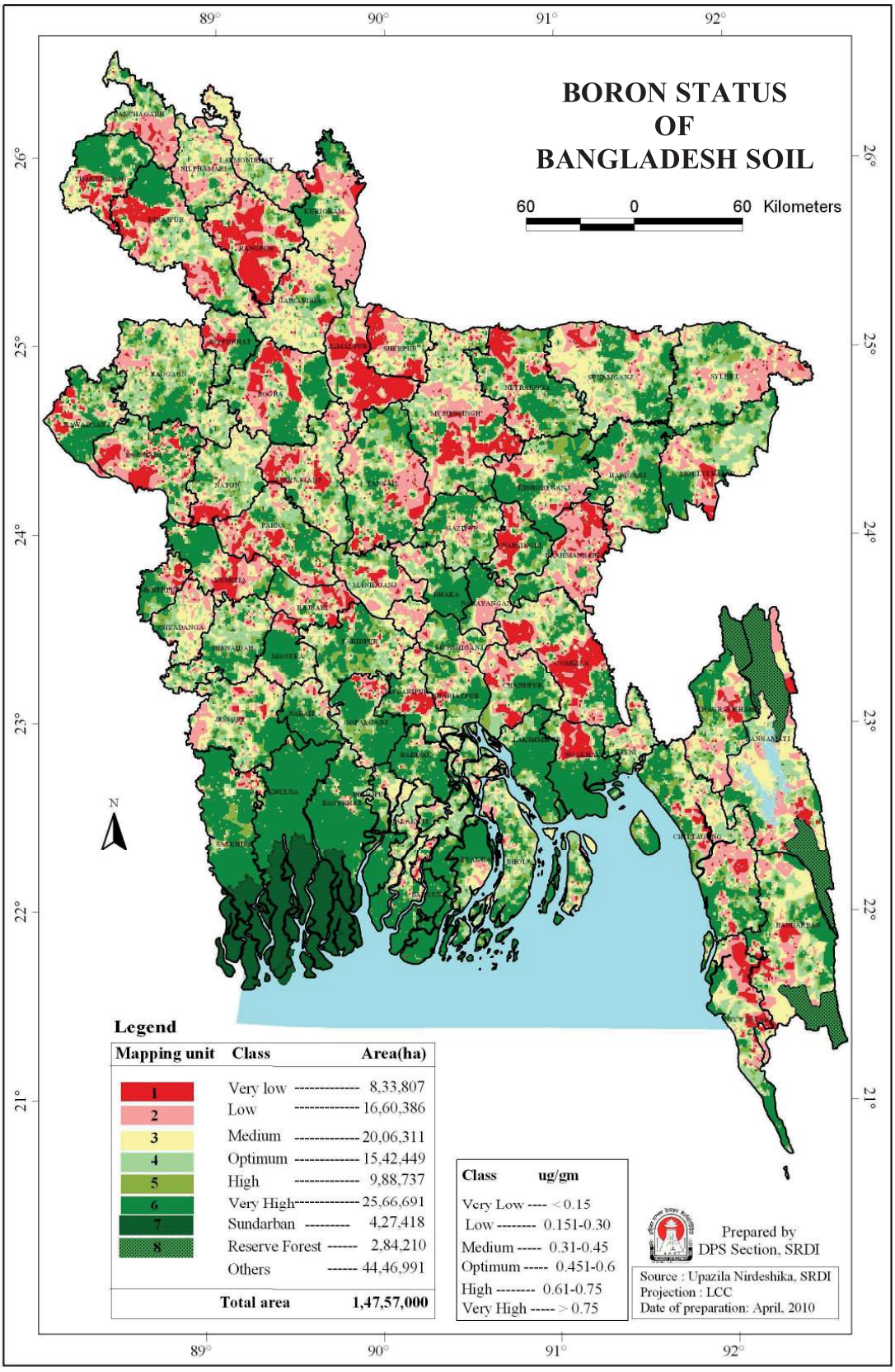

ORGANIC MATTER STATUS
OF
BANGLADESH SOIL
70 0 70 Kilometers
SOIL RESOURCE DEVELOPMENT INSTITUTE
88°
90°
92°
26°
24°
22°
N
W
E
S
Sundarban
R.Forest
R.Forest
R.Forest
Bay of Bengal
Legend
Mapping unit Class Area in ha
Very High ---------- 1,15,975
High ---------- 5,06,882
Medium ---------- 53,33,558
Low ---------- 28,79,893
Very Low ---------- 7,62,073
Sundarban ---------- 4,27,418
Reserve Forest ------- 2,84,210
Others ---------- 44,46,991
Total area 1,47,57,000
Class OM%
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

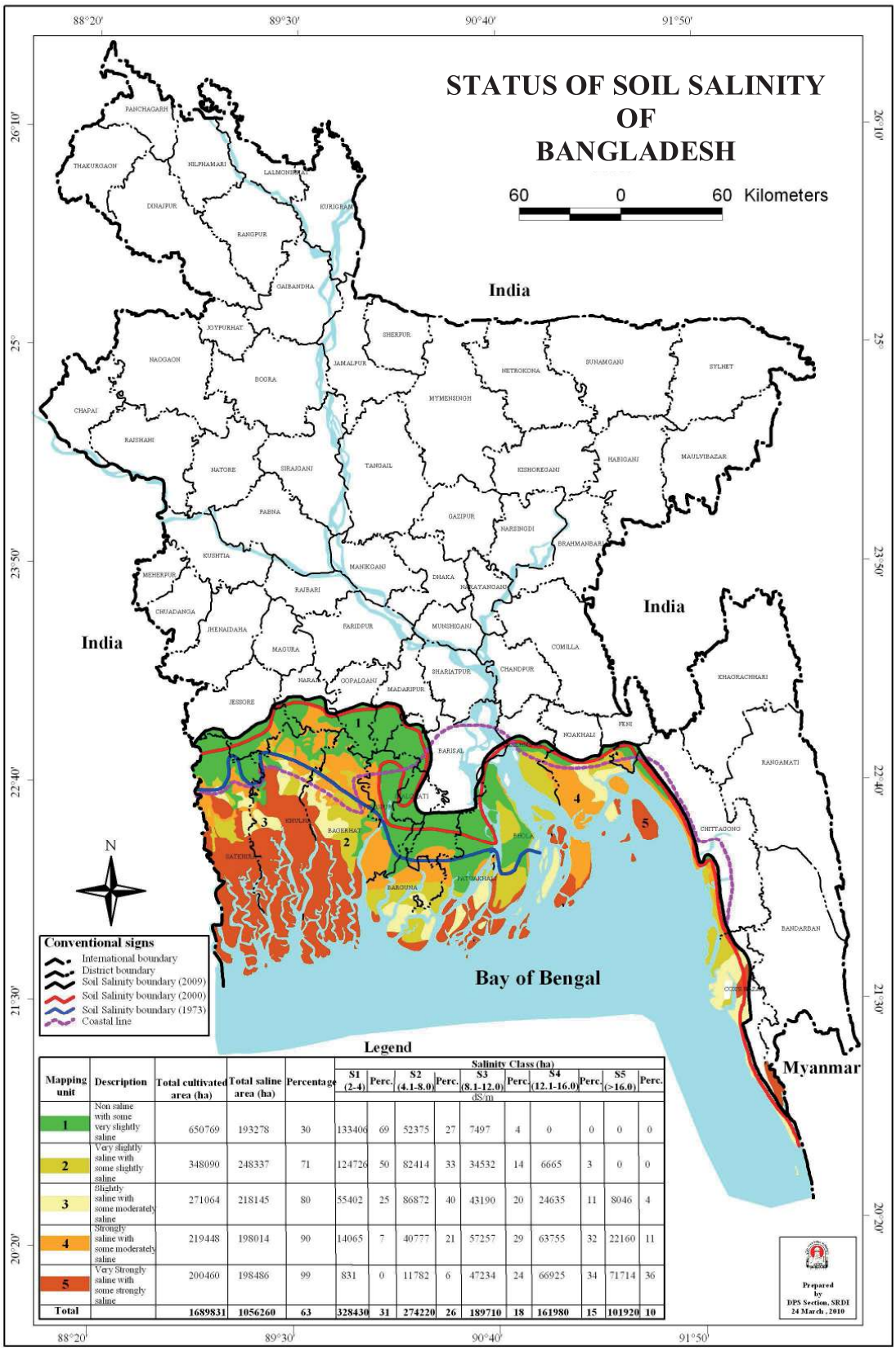

PHOSPHORUS STATUS
OF
BANGLADESH SOIL
50 0 50 100 Kilometers
89° 90° 91° 92°
26° 25° 24° 23° 22° 21°
N
Sundarban
Bay of Bengal
Forest
Legend
Mapping unit Class Area(ha)
1 Very low ---------- 11,88,871
2 Low ---------- 25,15,687
3 Medium ---------- 20,29,146
4 Optimum ---------- 10,97,564
5 High ---------- 7,82,848
6 Very High ---------- 19,84,265
7 Sundarban ---------- 4,27,418
X 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
DPS Section, SRDI
Source : Upazila Nirdeshika, SRDI
Projection : LCC
Date of preparation: April, 2010


POTASSIUM STATUS
OF
BANGLADESH SOIL
40 0 40 80 Kilometers
88° 89° 90° 91° 92°
26° 25° 24° 23° 22° 21°
Sundarban
Bay of Bengal
R. Forest
R. Forest
R. Forest
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 Sundarban ---------- 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
DPS Section, SRDI
Source : Upazila Nirdeshika, SRDI
Projection : LCC
Date of preparation: March, 2010


SULPHUR STATUS
OF
BANGLADESH SOIL
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 ug/gm
Very Low --- < 9.0
Low ------- 9.1 - 18.0
Medium ---- 18.1 - 27.0
Optimum ----- 27.1 - 36.0
High ------- 36.1 - 45.0
Very High ----- > 45.0
Prepared by
DPS Section, SRDI
Source : Upazila Nirdeshika, SRDI
Projection : LCC
Date of preparation: April, 2010


ZINC STATUS
OF
BANGLADESH SOIL
60 0 60 Kilometers
89°
90°
91°
92°
26°
25°
24°
23°
22°
21°
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 ---------- 10,32,177
6 Very High ---------- 25,79,904
7 Sundarban ---------- 4,27,418
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
DPS Section, SRDI
Source : Upazila Nirdeshika, SRDI
Projection : LCC
Date of preparation: April, 2010


BORON STATUS
OF
BANGLADESH SOIL
60 0 60 Kilometers
89° 90° 91° 92°
26° 25° 24° 23° 22° 21°
N
Legend
Mapping unit Class Area(ha)
1 Very low ---------- 8,33,807
2 Low ---------- 16,60,386
3 Medium ---------- 20,06,311
4 Optimum ---------- 15,42,449
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
DPS Section, SRDI
Source : Upazila Nirdeshika, SRDI
Projection : LCC
Date of preparation: April, 2010



Legend

Mapping unit	Description	Total cultivated area (ha)	Total saline area (ha)	Percentage	Salinity Class (ha) dS/m									
					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	Non saline with some very slightly saline	650769	193278	30	133406	69	52375	27	7497	4	0	0	0	0
2	Very slightly saline with some slightly saline	348090	248337	71	124726	50	82414	33	34532	14	6665	3	0	0
3	Slightly saline with some moderately saline	271064	218145	80	55402	25	86872	40	43190	20	24635	11	8046	4
4	Strongly saline with some moderately saline	219448	198014	90	14065	7	40777	21	57257	29	63755	32	22160	11
5	Very Strongly saline with some strongly saline	200460	198486	99	831	0	11782	6	47234	24	66925	34	71714	36
Total		1689831	1056260	63	328430	31	274220	26	189710	18	161980	15	101920	10

ABBREVIATION

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 Nutrition System
KUET : Khulna University of Engineering and Technology
MoA : Ministry of Agriculture
NRM : Natural Resources Management
NUE : Nutrient Use Efficiency
SRDI : Soil Resource Development Institute
STVI : Soil Test Value Interpretation
UAO : Upazila Agriculture Officer
UNDP : United Nations Development Program

Integrated Plant Nutrition System

The nation that destroys its soil destroys itself

- Franklin D. Roosevelt, 1937