Fertilizer Recommendation Guide-2024

Bangladesh Agricultural Research Council

www.barc.gov.bd

Fertilizer Recommendation Guide-2024

Bangladesh Agricultural Research Council
www.barc.gov.bd

Fertilizer Recommendation Guide-2024

Citation
Hossain, M.B., Jahiruddin, M., Chowdhury, M.A., Naser, H.M., Anwar, M.M., Islam, A., Haque, M.A., Alim, M.A., Hossain, G.M.A., Islam, M.A., Hossain, A., Satter, M.A., Alam, F. 2024. Fertilizer Recommendation Guide-2024. Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka-1215, Bangladesh

Published by
Bangladesh Agricultural Research Council
New Airport Road, Farmgate, Dhaka-1215
www.barc.gov.bd

Funded by
Krishi Gobeshona Foundation (KGF)
BARC Complex, Farmgate, Dhaka-1215

Print Copies
2,000

Published
September 2024

ISBN
978-984-35-5733-9

Cover Design
Mohammad Nazmul Islam
Graphics Designer, BARC

Illustration & Printed by
Generation PPA
GPPA House, 188 Fakirapool, 2nd Floor
Motijheel C/A, Dhaka. Cell: 01819 230 291

Bangladesh Agricultural Research Council

Farmgate, Dhaka-1215, Bangladesh

Fertilizer Recommendation Guide-2024

Editorial Board

Lt. Gen. Md. Jahangir Alam Choudhury (Retd.)
Advisor
Ministry of Agriculture
Government of the People's
Republic of Bangladesh

Message

I am delighted to know that the Bangladesh Agricultural Research Council (BARC) is going to publish the Fertilizer Recommendation Guide-2024, the latest version of the fertilizer application guidelines across the country. This is going to be an addition to a long list of valuable publications of BARC.

Bangladesh is a densely populated agricultural country. There is increasing pressure on agricultural land to meet the growing food demand due to the decreasing land for farming. Consequently, the organic matter and fertility of the soils are gradually decreasing, and arising deficiency of new plant nutrients. Optimum use of fertilizers is essential to maintain soil fertility and sustainable crop production. It is crucial to pay special attention to soil and fertilizer management to maintain soil health and sustainable crop production. It is important to use organic fertilizers and different chemical fertilizers in balanced doses according to the specific needs of the crops to maintain soil health and fertility for improved crop yield.

The application of fertilizers in optimum and balanced doses is a key factor for sustainable crop production. Policies and strategies of the present government are geared up towards ensuring adequate supplies of fertilizers to the farmers who need to be aware of the importance of proper use of subsidized fertilizers for crop production. Undoubtedly the current fertilizer guidebook bears a significant value. I appreciate BARC's efforts of regularly updating fertilizer recommendations for various crops and cropping patterns in different AEZs of the country.

I hope that this latest BARC-updated recommendation entitled "Fertilizer Recommendation Guide-2024" will be immensely useful for the key actors in the crop production arena of the country such as agricultural researchers and extension specialists in both public and private sectors. Finally, I would like to extend thanks to the scientists of NARS institutes and SRDI, and the officials of the Department of Agricultural Extension (DAE) for providing the necessary feedback for this publication and the BARC scientists and officials for diligently preparing this guidebook.

Lt. Gen. Md. Jahangir Alam Choudhury (Retd.)

Dr. Mohammad Emdad Ullah Mian
Secretary
Ministry of Agriculture
Government of the People's
Republic of Bangladesh

Message

I am pleased to learn that the latest updated version of the fertilizer application guidelines for crop production in Bangladesh is set to be published by the Bangladesh Agricultural Research Council (BARC) as a book titled **"Fertilizer Recommendation Guide-2024"**. I am confident that this document will be an invaluable guiding manual for fertilizer application in crop production of the country.

Given the fertilizer becomes one of the most important inputs in crop production systems in Bangladesh, the government is committed to ensure the timely availability of fertilizers to farmers at affordable prices. The government is also aware of over use of fertilizers that are detrimental to our biodiversity and one of the sources of wastage of resources. In such a context, our talented agricultural scientists have developed this very important book that is considered one of the milestone achievements in promoting balanced use of fertilizer for crop production.

The "Fertilizer Recommendation Guide-2024" provides fertilizer recommendations for different types of crops in various agro-ecological regions of the country. The recommendations take into account the characteristics of each region, including soil fertility and topography. This guide is developed based on data collected by the Department of Agricultural Extension and several agricultural research institutes, focusing on the main cropping systems in different agro¬ecological zones of the country.

I am excited to know that the "Fertilizer Recommendation Guide-2024" has been developed based on the up-to-date research findings related to crop responses to fertilizer application generated by the agricultural research institutes. I expect that this latest guidebook for fertilizer application will play a key role in making the best use of fertilizers through their application at optimal and balanced doses to sustainably increase crop productivity in the country. This would facilitate attaining food and nutrition security for the people as envisaged in the UN Sustainable Development Goals (SDGs) 2030.

I sincerely thank the scientists of different research institutes, extension officials of different agencies including Soil Resources Development Institute and Department of Agricultural Extension for their contribution in developing this recommendation guide book. I strongly believe that the effective application of this guide book would play an important role in promoting sustainable and profitable agriculture in Bangladesh.

Dr. Mohammad Emdad Ullah Mian

Md. Tajul Islam Patwary
Director General
Department of Agricultural Extension
Government of the People's
Republic of Bangladesh

Message

The recent release of the **"Fertilizer Recommendation Guide-2024"** by the Soils Unit of the Natural Resource Management Division of Bangladesh Agricultural Research Council (BARC) is a valuable initiative. The guide is anticipated to be beneficial for all stakeholders, including the extension workers of the Department of Agricultural Extension. This comprehensive guide includes fertilizer recommendations and relevant information for a wide range of crops, presented in clear and simple language. It covers crucial topics such as plant nutrients, fertilizer classification, symptoms of nutrient deficiency in crops, soil fertility management, organic matter, fertilizer management and the identification of adulterated fertilizers at the field level.

The book is written to ensure that farmers can benefit directly from it. I believe that the book will play a crucial role in maintaining soil health and promoting sustainable production management through proper soil and fertilizer management.

The publication of the "Fertilizer Recommendation Guide-2024" is essential given the current demands. I am confident that the book will meet the expectations of extension workers, farmers, and non-governmental organizations by addressing new technologies, crop development, and the current needs.

I extend heartfelt thanks to all those involved in the preparation and printing of the "Fertilizer Recommendation Guide-2024".

Md. Tajul Islam Patwary

Dr. Nazmun Nahar Karim
Executive Chairman
Bangladesh Agricultural Research Council

Foreword

Crop production in Bangladesh is both intensive and diversified. With the growing population, the country must consistently enhance food production to achieve food and nutrition security. In this context, the role of fertilizers and their efficient use becomes paramount. The Bangladesh Agricultural Research Council (BARC) is responsible for updating fertilizer recommendation guidelines every five years, primarily for agricultural extension workers who advice farmers in the optimal use of fertilizers for crop production. The Fertilizer Recommendation Guide-2024 (FRG-2024) is an updated version of the 2018 guide, incorporating the latest research and field data.

Efficient fertilizer use and proper soil-crop management are critical to any crop production system. A balanced fertlizer application, with appropriate timing and methods, is essential for maximizing crop yield while maintaining soil fertility. Overuse or underuse of fertilizers, as well as imbalanced application, can lead to lower crop yields, waste of valuable resources, environmental harm, and economic loss. Therefore, the release of the updated Fertilizer Recommendation Guide is crucial, grounded in research findings from NARS scientists and feedback from grassroots-level extension specialists from the Department of Agricultural Extension (DAE), NGOs, universities, and private enterprises.

Bangladesh's soil fertility varies greatly due to differences in land characteristics and hydrological conditions across it's 30 agro-ecological zones (AEZs). As in previous, the FRG-2024 provides fertilizer recommendations based on soil tests for individual crops and cropping patterns. It also offers recommendations for fruit trees, plantation crops, flowers, and fodder crops. I am confident that the guidelines and recommendations presented in FRG-2024 will be invaluable to all stakeholders, including farmers, researchers, educators, extension agents, and policymakers involved in crop production and planning.

I extend my deepest gratitude to the NARS scientists, DAE officials, and field staff for their invaluable contributions and feedback from farmers, which made this publication possible. I also wish to express my sincere appreciation to the editorial board members, BARC scientists, and support staff for their tireless efforts in compiling, editing, and publishing FRG-2024. Special thanks to the Krishi Gobeshona Foundation (KGF) for their financial support in making this guide a reality.

Dr. Nazmun Nahar Karim

Dr. Md. Baktear Hossain
Convenor
Editorial Board
Member Director (NRM), BARC

Preface

Publication with periodic updating of fertilizer application guidebook is a routine activity of the Natural Resources Management (NRM) Division of Bangladesh Agricultural Research Council (BARC). The present publication of BARC entitled **"Fertilizer Recommendation Guide-2024 (FRG-2024)"** is the latest fertilizer recommendation guidebook which is an update version of FRG-2018. It is recalled that BARC published the first FRG in 1979 under the title Fertilizer Guide for Major Crops of Bangladesh. This was followed by Fertilizer Recommendation Guide for Major Crops of Bangladesh published in 1985 that was followed by FRG-1989 and FRG-1997 using the database information of soil fertility, hydrology, and land type-wise major crops and cropping patterns in different AEZs of the country. Later, the fertilizer guidebook was further updated and published as FRG-2005 where the latest information of crops and cropping patterns, soil nutrient status, and IPNS based fertilizer management was provided. Eventually, FRG-2012 was published with the update information provided by the NARS institutes. The last Fertilizer Recommendation Guide-2018 focuses on the fertilizer recommendations for different crops and cropping patterns targeting high yielding goals.

The present Fertilizer Recommendation Guide-2024 is the eighth version of the fertilizer guidebooks published by BARC. In this guide fertilizer recommendations for some special crop cultures like hydroponics, rooftop gardening and floating beds are included. Description of some new aspects like soil fertility status in fragile ecosystems, nano fertilizers and plant growth promoting rhizobacteria (PGPR) have added value to FRG-2024. I hope, the FRG-2024 will serve as a handy reference book on judicial use of fertilizers for agricultural researchers, extension experts, academician, government planners and farmers.

I am grateful to the researchers of NARS institutes, faculties of agricultural universities and extension specialists of DAE for providing relevant data, information and feedback to prepare the manuscript of FGR-2024. The Krishi Gobeshona Foundation (KGF) has given financial support for publication of this guide which is thankfully acknowledged. My sincere thank goes to Dr. Md. Rafiqul Islam (Former Professor, BAU), Dr. Mohammad Ishaque (Former PSO, BRRI), Dr. Nirmal Chandra Shil (Former Director, BARI) and Dr. Mohit Kumar Dey (Former Director, Crops Wing, DAE) for their additional assistance and contribution. Last but not the least, I cordially thank the members of the editorial board who have worked hard to compile, edit and publish this document in a stipulated time.

Dr. Md. Baktear Hossain

Fertilizer Recommendation Guide-2024

Contents

List of Tables

List of Figures

List of Appendices

Abbreviation and acronyms

AAO	Additional Agriculture Officer
Act	Actinomycetes
ADP	Adenosine Diphosphate
AEO	Agriculture Extension Officer
AEZ	Agro-ecological zone
ATP	Adenosine Triphosphate
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BFRI	Bangladesh Forest Research Institute
BINA	Bangladesh Institute of Nuclear Agriculture
BJRI	Bangladesh Jute Research Institute
BR	Bradyrhizobium
BRRI	Bangladesh Rice Research Institute
BSRI	Bangladesh Sugar Crop Research Institute
BSTI	Bangladesh Standard Testing Institute
CD	Cowdung
CL	Critical Limit
CEC	Cation Exchange Capacity
CFU	Colony forming unit
CHT	Chittagong Hill Tracts
DAE	Department of Agricultural Extension
DAP	Di-ammonium Phosphate
DAP	Days after Planting
DAS	Days after Sowing
DAT	Days after Transplanting
EC	Electrical Conductivity
FAO	Food and Agriculture Organization
FLNFB	Free Living Nitrogen Fixing Bacteria
FRG	Fertilizer Recommendation Guide
FYM	Farm Yard Manure
GM	Green Manure
HL	Highland
HYG	High Yield Goal
HYV	High Yielding Variety
IFDC	International Fertilizer Development Centre
IPNS	Integrated Plant Nutrition System
LL	Lowland
MHL	Medium Highland
MLL	Medium Lowland

MOA	Ministry of Agriculture
NRM	Natural Resources Management
NUE	Nutrient Use Efficiency
OF	Organic Fertilizer
PSB	Phosphate Solubilizing Bacteria
SRDI	Soil Resource Development Institute
STV	Soil Test Value
STVI	Soil Test Value Interpretation
TB	Total Bacteria
TD	Topdressing
UAO	Upazila Agriculture Officer
UNDP	United Nations Development Program
VLL	Very Lowland

FERTILIZER RECOMMENDATION GUIDE – 2024

1. Introduction

1.1 Updating of Fertilizer Recommendation Guide

Fertilizer Recommendation Guide is an outcome of soil fertility and plant nutrition research in Bangladesh. The endevour of formulating fertilizer recommendation for different crops was begun in 1957 through a research scheme, Rapid Soil Fertility Survey and Popularization of the Use of Fertilizer in East Pakistan. 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, based on the origin and properties, were broadly classified into seven Tracts. The Department of Soil Survey carried out reconnaissance survey during 1961-70 and classified the soils into 20 General Soil Types and 20 Soil Units. The second Fertilizer Recommendation Guide, *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/improved varieties of crops. Bangladesh Agricultural Research Council (BARC) published the first Fertilizer Recommendation Guide (FRG) in 1979, *Fertilizer Guide for Major Crops of Bangladesh*. Based on the progress of soil fertility research, the second FRG was published in 1985, *Fertilizer Guide for Major Crops of Bangladesh*. This Guide provided fundamental principles for fertilizer recommendation on the basis of Soil Test - Crop Response correlation study.

After 1985, a good progress was 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 were developed and subsequently used in preparing the AEZ (agro-ecological zone) map of Bangladesh. Information of soil fertility and land type-wise major cropping patterns along with crop management practices in different AEZs were compiled. The FRG-1985 was updated and published, *Fertilizer Recommendation Guide-1989*. Later, with the advancement of time and research progress, the former FRG was further updated and published as *Fertilizer Recommendation Guide-1997*.

Later, the FRG was further updated and published as *Fertilizer Recommendation Guide-2005*. In this Guide, several new aspects were added such as recommendations for cropping patterns and crop varieties, interpretation of soil nutrient status, IPNS based fertilizer management and fertilizer recommendation for multiple cropping.

In this continuous process, the FRG was further updated incorporating research results of different NARS Institutes and the follow-up FRG was published as *Fertilizer Recommendation Guide-2012*. This time fertilizer recommendations for crops and cropping patterns were further updated. However, the latest FRG was published as Fertilizer Recommendation Guide-2018.

At this stage, **Fertilizer Recommendation Guide-2024** is a revised and updated version of the FRG-2018 and regarded as the 8th FRG published by the BARC. The main features of FRG-2024 are as follows:

- Fertilizer recommendation for specific crops based on soil test result, crop varieties, and HYG (high yield goal) target
- Fertilizer recommendations for major cropping patterns in different AEZs based on HYG target under irrigated condition
- Fertilizer recommendation for roof top gardening, floating agriculture, hydroponic culture and sorjan farming.
- Soil mineralogy, fertility and microbial status in different AEZs
- Fragile ecosystems (chars, haors, barinds, coasts & hills)
- Plant nutrients and their functions in plants
- Rationale of fertilizer use
- Nanofertilizers
- Biofertilizers
- Integrated nutrient management
- Biochar
- Liming
- Conservation Agriculture
- Nutrient use efficiency
- Soil organic matter management
- Identification of adulterated fertilizers

1.2 How to Use Fertilizer Recommendation Guide

Fertilizer Recommendation Guide-2024 has been developed primarily for use by the extension personnel for advising the farmers to use recommended dose of fertilizers for crops. The FRG presents the judicial and balanced use of fertilizers. It is not a blanket recommendation. Thus, the user should carefully read and follow the Guide. To consult the FRG-2024, the following steps are important.

I. Read the guide thoroughly to understand the rationale and principles of fertilizer application.
II. Follow fertilizer recommendations for cropping patterns in different AEZs (pages 160-201) when site specific soil test values are not available.
III. Develop location specific fertilizer recommendations for crops (upland and wetland) where soil test values are available. Interpret the soil test values into soil fertility classes, such as very low, low, medium, optimum, high and very high based on Appendix 8 (page 215).
IV. Prepare fertilizer recommendation for high yield target of a crop based on the tables given on pages 215 and Appendix-9. Develop fertilizer recommendations for the cropping patterns based on the rationales stated in pages 49-50.

2. Plant Nutrients

2.1 Essential nutrients and their functions in plants

Plants contain more than 90 elements, but only 17 elements are known to be essential for the normal growth and development of plants. Criteria for essentiality of a nutrient (Arnon and Stout, 1939) are: (i) omission of the element in question results in a failure to complete the life cycle of a plant, (ii) function of the element cannot be carried out by another element, and (iii) the element is directly involved in plant metabolism. Essential plant nutrients are of two types: macronutrients and micronutrients. Macronutrients are required relatively in larger quantities and micronutrients 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, chlorine and nickel. Except carbon, hydrogen and oxygen, the remaining 14 elements are taken up by plants from soils. Plants usually obtain carbon, hydrogen and oxygen from air and water.

Essential plant nutrients and their sources

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

Functions of nutrients in plants

Nitrogen: Constituent of proteins and nucleic acids, integral part of chlorophyll; helps in vegetative growth with dark green color

Phosphorus: Role in energy storage and transfer (ADP and ATP), constituent of nucleic acids, phytins and phospholipids, stimulates root growth; promotes fruit and seed formation, enhances nodulation in legumes

Potassium: Involved in activation of enzymes related to starch synthesis, translocation of carbohydrates, regulation of stomata openings, produces stiff straw in cereals, imparts disease resistance to plants, involved in maintaining turgor pressure of plant cells

Calcium: Essential to cell integrity, membrane structure and permeability, role in cell elongation and division, helps in translocation of carbohydrates and protein synthesis, detoxify heavy metals in plants

Magnesium: Constituent of chlorophyll, involved in phosphate transfer from ATP & ADP; stabilizes ribosome particles, serves as a cofactor of phosphorylatic enzymes in carbohydrate metabolism

Sulphur: Constituent of amino acids (e.g. cystine), biotin, Vitamin B_1, and coenzyme A; helps in nodulation of legumes; present in glucosides (mustard oil)

Iron: Component of cytochromes, ferrodoxins and leghaemoglobin; involved in the nitrogenase and nitrate reductase enzymatic reactions, associated with chlorophyll formation, protein synthesis

Manganese: Involved in the oxidation-reduction processes of photosynthetic electron transfer system, acts as a bridge for ATP and enzyme complex (phosphokinase), activates IAA oxidases.

Zinc: Synthesis of tryptophane needed for the production of auxins; activation of dehydrogenase and carbonic anhydrase enzymes; helps in protein synthesis, high P interferes with Zn uptake by plants.

Copper: Acts as an electron carrier in photosynthesis and respiration; part of enzymes e.g. cytochrome oxidase; involved in protein and carbohydrate metabolism and N_2 fixation, helps in pollination and seed set, involved in the desaturation and hydroxylation of fatty acids.

Boron: Regulates carbohydrate metabolism; involved in protein synthesis; helps in transport of photosynthetic sugars to meristematic (growing) tissues; good role in pollen viability and seed formation.

Molybdenum: Constituent of nitrate reductase and nitrogenase enzymes; role in Fe absorption and translocation in plants

Chlorine: Involved in the evolution of O_2 in photosynthesis; increases cell osmotic pressure, stomatal regulation, increases hydration of plant tissues.

Nickel: Works as a co-factor to enable urease to catalyze the conversion of urea into the ammonium ion, which plants can use as a source of N.

Table 1. Nutrient concentration in plants

Macronutrient		Micronutrient	
Element	**Concentration (%)**	**Element**	**Concentration (µg g^{-1})**
Nitrogen	1.0-5.0	Iron	70-150
Phosphorus	0.1-0.4	Manganese	30-100
Potassium	1.0-2.5	Copper	5-15
Calcium	0.2-1.0	Zinc	20-50
Magnesium	0.1-0.4	Molybdenum	0.1-1.0
Sulphur	0.1-0.4	Boron	10-50

2.2 Beneficial elements for plants

In addition to the 17 essential nutrients, there are other four elements (cobalt, sodium, silicon and selenium) which have been found beneficial to some plants. Cobalt is required indirectly by leguminous plants as because this element is essential for *Rhizobium* bacteria which fixes atmospheric N_2 and provides it to the host legume plant. This element is important for pasture and forage crops. Sodium is useful in some halophytes and it can replace K^+ as vacuolar osmoticum. Thus, sodium can be beneficial to plants in a condition when K^+ is deficient. Silicon can alleviate toxic effects of heavy metals and provide tolerance to abiotic stresses, e.g. salt stress, drought and

it has a role to maintain stalk strength in rice. Selenium helps protect cell damage caused by environmental stress like drought, salinity, heavy metals, and heat stress.

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

Micronutrients Fe, Mn, Zn and Cu are also known as heavy metals since their atomic weight is greater than 5 g/cc. The micronutrients when present in a high concentration could have toxic effects on plants. From environmental aspect, elements Cd, Cr, Hg and Pb are called heavy metals which even at low concentration can be toxic to plants.

2.3 Nutrient deficiency symptoms in plants

When a plant is deficient of a particular element, some characteristic symptom appears. Nutrient deficiency symptom is related to nutrient functions 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. However, nutrient deficiencies are generally observed in the whole plot; but sporadic or few plants are affected in case of insect or disease damage.

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

Nutrient deficiency symptoms occur as yellowing of leaves, shortened internodes, or abnormal coloration such as red, purple, or bronze leaves. These symptoms appear on different plant parts as a result of nutrient mobility in the plant. The same symptoms may appear in different parts of the same plant depending on the mobility of nutrients. For example, in rice yellowing of older leaves arises due to N deficiency while yellowing of younger leaves occurs due to S deficiency as because nitrogen is a very mobile while sulphur is a slightly mobile element.

Description of nutrient deficiency symptoms

Nitrogen: Yellowing of older leaves, slow growth, early maturity.

Phosphorus: Purple coloration of older leaves, reduced tillers in cereals, delayed flowering.

Potassium: Chlorosis and necrosis of leaf edges, weakening of straw, susceptibility to diseases.

Calcium: Burning of leaf tips and margins (called die back or tip burn), white or grayish green nodules in legumes, discolored and softer fruits.

Magnesium: Interveinal chlorosis of older leaves, reddish- purple cast of lower leaves in cotton.

Sulphur: Yellowing of younger leaves, reddish color on the lower surfaces of leaves in cruciferous crops (e.g. cabbage).

Iron: Interveinal chlorosis of younger leaves, whole leaf white in case of severity.

Manganese: Like Fe, interveinal chlorosis of younger leaves, necrosis develops at advanced stage instead of white colour.

Zinc: Rusty brown spotted leaves in rice, clustering of small leaves (rosetting) at the top of fruit plants, white bud in corn, fern leaf in potato.

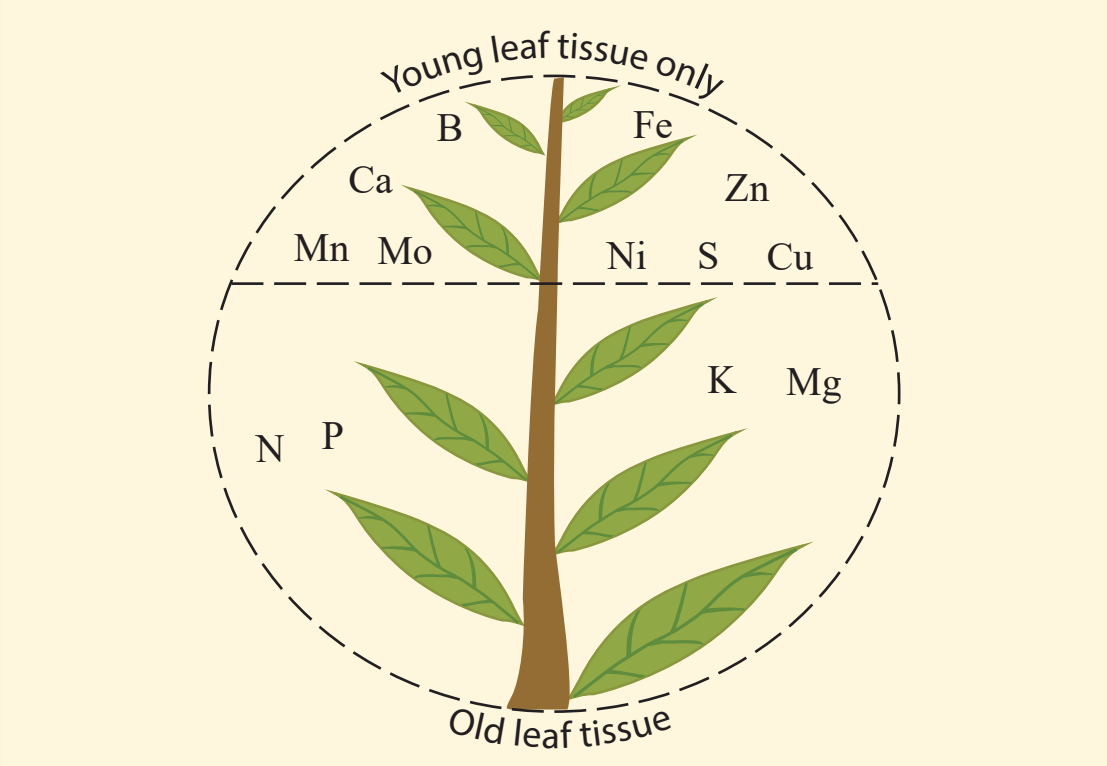
Copper: Chlorosis of younger leaves, leaf curling, susceptibility to disease (e.g. wilt), growing points die.

Boron: Grain set failure, hollow-heart in cauliflower, de-shaped papaya, cracking of mango.

Molybdenum: Interveinal chlorosis of younger leaves, poor nodulation in legumes

Chlorine: Wilting of plants, chlorosis of younger leaves.

Nickel: Necrosis of leaf tips, chlorosis of younger leaves and reduced leaf size in non-woody plants.



Deficiency symptom for N, P, K & Mg appears in order leaves and that for others in younger leaves due to variation in nutrient mobility.

Photographs showing nutrient deficiency symptoms in plants

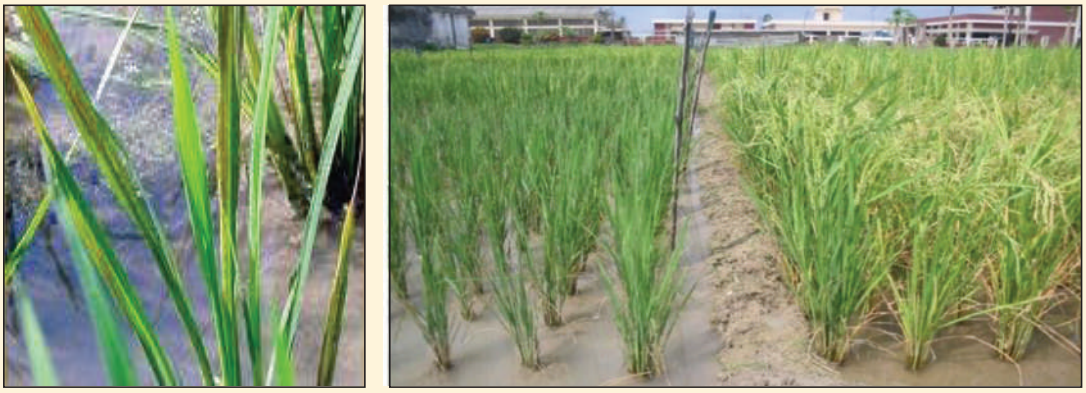
Normal rice crop (Lower left) and N deficient rice crop (Lower right)

N deficiency in maize

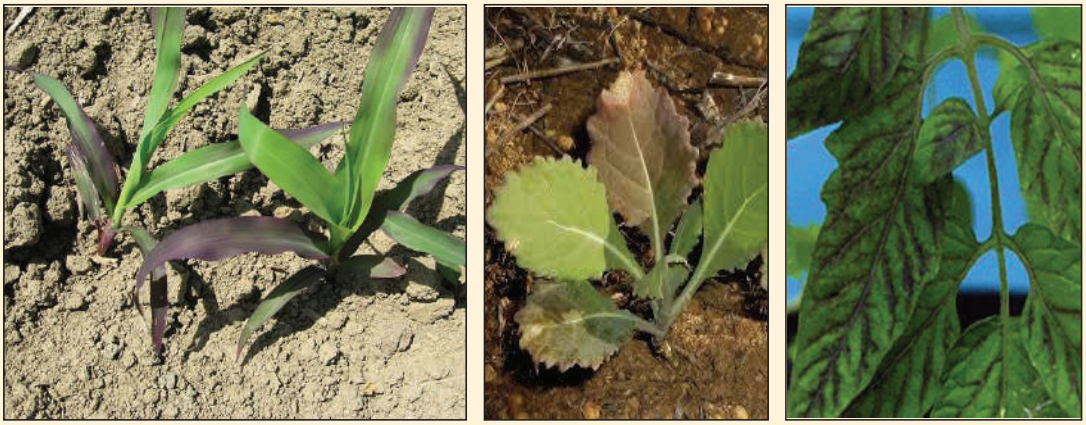
Normal (left) and N deficient tomato leaf (right)

N deficiency in Potato

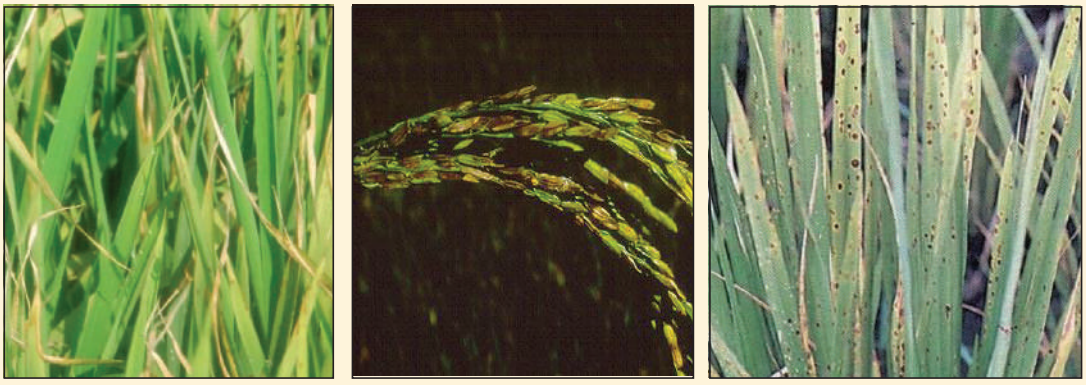
N deficiency in Chilli



P deficiency symptoms in rice (Left and middle) and normal rice crop (Right)



P deficiency in maize (left), cabbage (middle) and tomato (right)



K deficiency in rice

K deficiency in wheat (Left), maize (middle) and tomato (right)

S deficiency in rice

S deficiency in potato (left), mustard (middle) and tomato (right)

Mg deficiency in potato (left), tomato (middle) and maize (right)

Zn deficiency in rice (left and middle) and maize (right)

Zn deficiency in tomato (left), lemon (middle) and cotton (right)

Boron deficiency in mustard (left), papaya (middle) and wheat (right)

2.4 Critical limit of nutrients in soil

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

Table 2. Interpretation of soil test values on the basis of critical limit

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

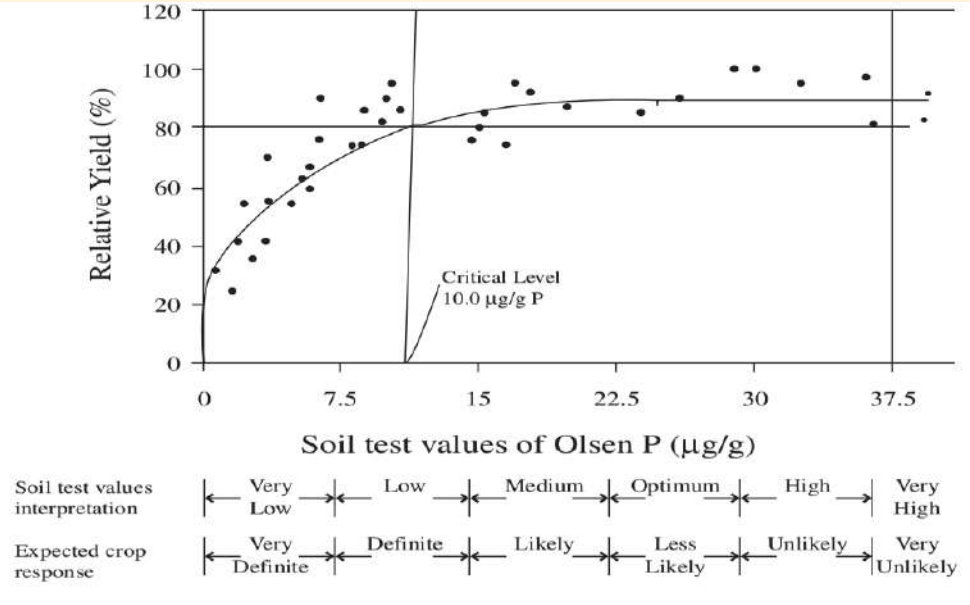


Fig. 1 Soil test value and expected crop response based on critical limit (e.g. P)

3. Soil Mineralogy, Fertility and Microbial Status in Different AEZs

3.1 General features of different AEZs

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

- Physiography (land forms and parent materials)
- Soils (soil characteristics such as soil texture, water holding capacity, fertility)
- Land types (based on depth and duration of flooding e.g. highland, medium highland, medium lowland, lowland and very lowland)
- Agro-climatology (length of kharif and rabi seasons, length of pre-kharif period, length of low winter temperature (<15^0C) and length of high summer temperature (> 40^0C).

Location, area and land types of different AEZs of Bangladesh are stated in Table 3. For detailed information about physical and chemical properties of soils, respective Upazila Nirdeshika can be consulted. However, for fertility data of a specific area soil samples should be collected for detailed analysis.

Table 3. Area, location and land types in different AEZs 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 Panchagar Dinajpur	1903 1121 958	HL MHL MLL HS+WB	58 34 1 7
2. Active Tista Floodplain (83644 ha)	Kurigram Lalmonirhat Nilphamari Rangpur Gaibandha	329 148 142 116 51	HL MHL HS+WB	2 72 26
3. Tista Meander Floodplain (946803 ha)	Rangpur Nilphamari Gaibandha Dinajupur Kurigram Naogaon Lalmonirhat Panchagar Bogura Joypurhat	1719 1489 1439 1127 957 948 935 300 290 254	HL MHL MLL LL HS+WB	35 51 4 1 9
4. Karatoya- Bangali Floodplain (257158 ha)	Sirajganj Bogura Pabna	1494 998 78	HL MHL MLL LL VLL HS+WB	23 44 14 4 1 14
5. Lower Atrai Basin (85105 ha)	Naogaon Natore Sirajganj	374 354 72	HL MHL MLL LL HS+WB	2 8 21 65 4
6. Lower Punarbhaba Floodplain (12896 ha)	Naogaon Chapai Nawabganj	72 57	MLL LL HS+WB	10 60 30

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

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)	Jashore	2281	HL	43
	Jhenaidah	1970	MHL	32
	Rajshahi	1472	MLL	12
	Kushtia	1285	LL	2
	Natore	952	HS+WB	11
	Magura	857		
	Meherpur	705		
	Chapai Nawabganj	669		
	Satkhira	638		
	Chuadanga	551		
	Pabna	543		
	Khulna	232		
	Naogaon	117		
	Rajbari	54		
12. Low Ganges River Floodplain (796751 ha)	Faridpur	1534	HL	13
	Pabna	1219	MHL	29
	Rajbari	975	MLL	31
	Madaripur	818	LL	14
	Narail	714	VLL	2
	Gopalganj	535	HS+WB	11
	Manikganj	413		
	Natore	581		
	Shariatpur	370		
	Kushtia	176		
	Bagerhat	146		
	Dhaka	126		
	Munshiganj	97		
	Sirajganj	79		
	Khulna	68		
	Barishal	60		
13. Ganges Tidal Floodplain (1706573ha)	Khulna	3436	HL	2
	Bagerhat	3131	MHL	78
	Satkhira	3024	MLL	2
	Barishal	2022	HS+WB	18
	Patuakhali	1790		
	Barguna	1496		
	Pirojpur	1228		
	Jhalakati	850		
	Shariatpur	67		

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land* type	Extent (%)
14. Gopalganj-Khulna Bils (224700 ha)	Gopalganj Khulna Jashore Bagerhat Narail Madaripur Barishal 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 Mehgna River Floodplain (155464 ha)	Cumilla 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 Chattogram Barishal Feni Shariatpur	3309 2695 1376 855 393 376 175 50	HL MHL MLL HS+WB	1 45 7 47
19. Old Meghna Estuarine Floodplain (774026 ha)	Cumilla B. Baria Habigonj Chandpur Noakhali Kishorganj Feni Barisal Munshiganj	2251 1168 817 720 627 434 307 288 275	HL MHL MLL LL VLL HS+WB	2 24 33 21 3 17

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land* type	Extent (%)
	Shariatpur	221		
	Laxmipur	201		
	Narayanganj	170		
	Gopalganj	147		
	Madaripur	71		
20. Eastern Surma-Kushiyara Floodplain (462159 ha)	Sylhet	2748	HL	5
	Moulvibazar	1003	MHL	25
	Sunamganj	473	MLL	20
	Habiganj	398	LL	36
			HS+WB	14
21. Sylhet Basin (457345 ha)	Sunamganj	2445	MHL	4
	Kishoreganj	823	MLL	19
	Netrokona	792	LL	43
	Habiganj	367	VLL	23
	B. Baria	145	HS+WB	11
22. Northern and Eastern Piedmont Plains (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		
	Cumilla	374		
	B. Baria	133		
23. Chittagong Coastal Plain (372007 ha)	Chattagram	2646	HL	17
	Cox`s Bazar	658	MHL	43
	Feni	411	MLL	13
			HS+WB	27
24. St. Martin`s Coral Island (804 ha)	St. Martin`s Coral Island	804	HL	33
			MHL	63
			MLL	2
			HS+WB	2
25. Level Barind Tract (504851 ha)	Naogaon	1408	HL	30
	Bogura	1182	MHL	55
	Dinajpur	1040	MLL	4
	Joypurhat	729	LL	2
	Sirajgonj	193	HS+WB	9
	Natore	186		
	Rajshahi	158		

AEZ number, name and area	Major districts and area coverage		Land type and extent	
	District	Area ('00 ha)	Land* type	Extent (%)
	Gaibandha	94		
	Chapai Nawabganj	50		
26 High Barind Tract (159964 ha)	Naogaon	623	HL	93
	Chapai Nawabganj	502	MHL	1
	Rajshahi	475	HS+WB	6
27. North Eastern Barind Tract (107926 ha)	Rangpur	466	HL	36
	Dinajpur	374	MHL	56
	Bogura	171	MLL	1
	Gaibandha	72	HS+WB	7
28. Madhupur Tract (424359 ha)	Gazipur	1598	HL	56
	Tangail	1033	MHL	18
	Mymensingh	795	MLL	7
	Dhaka	462	LL	9
	Narshingdi	155	HS+WB	10
	Narayanganj	133		
	Jamalpur	65		
29. Northern and Eastern Hills (1817172 ha)	Rangamati	4565	HL	92
	Bandarban	4423	MHL	2
	Khagrachhari	3167	MLL	1
	Chattogram	2328	HS+WB	5
	Cox`s Bazar	1335		
	Moulvibazar	1292		
	Habiganj	495		
	Sylhet	270		
	Cumilla	108		
	Sherpur	82		
	Feni	60		
30. Akhaura Terrace (11324 ha)	B. Baria	113	HL	55
			MHL	11
			MLL	10
			LL	15
			VLL	3
			HS+WB	6

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

According to area coverage, AEZ 29 (Northern and Eastern Hills, 1817172 ha) is the highest followed by AEZ 13 (Ganges Tidal Floodplain, 1706573 ha) and AEZ 11 (High Ganges River Floodplain, 1320549 ha).

3.2 Distribution of clay minerals in different AEZs

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. 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 minerals.

Table 4. Mineralogical distribution in different AEZs of Bangladesh

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

Agroecological Zones	Major minerals
26. High Barind Tract	Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite
27. North-Eastern Barind Tract	Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite
28. Madhupur Tract	Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite
29. Northern and Eastern Hills	Easter part: Mica, Kaolinite, Vermiculite** Norther part: Kaolinite,Mica
30. Akhaura Terrace	Mica, Kaolinite, interstratified mica-vermiculite-smectite and kaolinite-smectite

Source: Moslehuddin et al., 1999, 2006, 2008
*Partially degraded; **Partially chloritized

3.3 Soil fertility status in different AEZs

Agro-ecological regions and sub-regions are very broad units. The fertility status of these regions varies considerably. Individual farmers have divided land into smaller pieces resulting variation in land use and management of subdivided lands. Consequently, this leads to a significant variation in the fertility levels even between adjacent plots. Considering this micro-level variability, only an indicative status of soil fertility status of individual AEZ is provided. Soil fertility status in different AEZs has been updated using soil fertility data bank of SRDI.

AEZ 1: Old Himalayan Piedmont Plain (398154 ha)

This distinctive region is developed in Old Tista Alluvial fan extending out from the foot of the Himalayas. It has complex relief pattern comprising of broad and narrow floodplain ridge and linear depressions. Deep, rapidly permeable sandy loams and sandy clay loams are predominant in this region. Soils are very strongly to strongly acidic and sub-soils are moderately acidic; rich in weatherable sand minerals. Among Seven General Soil Types, the region belongs the region of which Non-calcareous Brown Floodplain soils, Black Terai soil and Non-calcareous Dark Grey Floodplain soils predominate. Organic matter contents are relatively low than that of other floodplain areas. Natural fertility of soil, except the course textured, is moderate. Soil fertility problems include low content of OM and rapid leaching of N, K, S, Ca & Mg. Generally, soils of this region have lower CEC. As a result, they have low buffering capacity that leads to rapid lowering of soil pH.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (58%)	4.3-5.6	L-M	VL-L	L-M	VL-L	VL-L	VL-L	VL-L	VL-L	VL-L
Medium highland (34%)	4.5-6.1	L-M	VL-L	L-M	VL-L	VL-L	VL-L	VL-L	VL-L	VL-L

AEZ 2: Active Tista Floodplain (83644 ha)

This region includes the active floodplains of the Tista, Dharla and Dudkumar rivers. It has complex forms of low, generally smooth ridge, inter-depressions, river channels and cut-off channels. Most areas are shallowly flooded, but depth of flooding is occasionally more during peak period. The area has irregular patterns of grey stratified sands and silts. Top soils are strongly acidic to slightly acidic and rich in weather able minerals. Four General Soil Types occur in this region of which Non-calcareous Alluvium predominates. Organic matter content is very low to low. Deficiency of N, P, K, S, Ca, Mg, Zn & B is common in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland (72%)	4.4-6.3	VL-L	VL-L	VL-L	L-M	VL-L	VL-L	VL-L	VL-L	VL-L

AEZ 3. Tista Meander Floodplain (946803 ha)

The region occupies a larger 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 basin site. Parent materials are rich in weatherable minerals. Eight General Soil Types occur in the region of which Non-calcareous Grey Floodplain soils and Non-calcareous Brown Floodplain soils predominate. Soils are very strongly acidic to neutral in reaction. Organic matter content is low to medium. Deficiency of N, P, K, S, Ca, Mg, Zn & B is common in this region

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland 35%	3.6-6.6	L-M	VL-L	L-M	L-M	VL-L	L-M	L-M	VL-L	VL-L
Medium highland (51%)	4.1-6.8	L-M	VL-L	L-M	L-M	VL-L	L-M	L-M	VL-L	VL-L

AEZ 4. Karatoya-Bangali Floodplain (257158 ha)

This floodplain apparently comprises a mixture of the Tista and Brahmaputra sediments. Most areas have smooth, broad, floodplain ridges and almost level basins. The soils are grey silt loams and silty clay loams on ridges and grey or dark grey clays in basins. Five General Soil Types occur in the region of which Non-calcareous Grey Floodplain and Non-calcareous Dark Grey Floodplain soils predominate. Soils are very strongly to slightly acidic in reaction. Organic matter content is low to medium. Deficiency of N, P, K, S, Ca, Mg, Zn & B is common in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (23%)	4.1-6.5	L-M	VL-L	L-M	L-M	L-M	L-M	L-M	VL-L	VL-L
Medium highland (44%)	4.4-6.5	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	VL-L
Medium lowland (14%)	4.3-6.5	L-M	VL-L	VL-L	L-M	L-M	L-M	L-M	L-M	VL-L

AEZ 5. Lower Atrai Basin (85105 ha)

This region comprises of low lying areas between Barind Tract and Ganges River Floodplain. The smooth, low lying, basin land occupies most of the region. Dark grey, heavy, acidic clay predominate. Seven General Soil Types occur in the region, but Non-calcareous Dark Grey Floodplain soils cover most of the areas. Soil pH ranges from very strongly acidic to slightly acidic. Organic matter content is low to medium. Deficiency of N, P, K, S, Zn & B is common in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium lowland (21%)	4.2-6.5	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	L-M	L-M
Lowland (65%)	4.5-6.7	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	L-M	L-M

AEZ 6. Lower Punarbhaba Floodplain (12896 ha)

This region occupies basins and bils separated by low floodplain ridges. The region is mostly 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. Soil pH ranges from very strongly acidic to slightly alkaline. Organic matter status is low to medium. Soils are mainly deficient in N, P, K and S.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Lowland (60%)	4.8-7.8	L-M	VL-L	VL-L	L-M	L-M	Opt	Opt	L-M	L-M

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

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

Major Land Type	Soil pH	Soil Om	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland (37%)	4.4-8.4	L-M	VL-L	VL-L	VL-L	VL-L	M-Opt	L-M	VL-L	VL-L
Medium lowland (20%)	4.8-8.3	VL-L	VL-L	VL-L	VL-L	VL-L	M-Opt	L-M	VL-L	VL-L

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

This 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; Soils are strongly acidic to neutral in reaction. General Soil Types include predominantly grey floodplain soils. Organic matter content is low to medium. Soils are mainly deficient in N, P, K, S, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (18%)	4.3-7.2	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	VL-L	VL-L
Medium highland (42%)	4.5-7.4	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	VL-L	VL-L
Medium lowland (19%)	4.6-7.6	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	VL-L	VL-L

AEZ 9: Old Brahmaputra Floodplain (723037 ha)

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 Types predominantly include Dark Grey Floodplain soil. Soil pH ranges from very strongly acidic to neutral. Soil organic matter is low to medium. Soils are mainly deficient in N, P, K, S, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (28%)	4.0-7.3	L-M	VL-L	VL-L	VL-L	VL-L	L-M	L-M	L-M	VL-L
Medium highland (35%)	4.3-7.5	L-M	VL-L	VL-L	VL-L	VL-L	L-M	M-Opt	VL-L	VL-L
Medium lowland 20%	4.4-7.6	L-M	VL-L	VL-L	VL-L	VL-L	L-M	M-Opt	VL-L	VL-L

AEZ 10: Active Ganges Floodplain (333447 ha)

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. General Soil Types predominantly include Calcareous Alluvium and Calcareous Brown Floodplain soils. Soils are slightly acidic to slightly alkaline in reaction. Organic matter content is low to medium. Soils are generally deficient in N, P, S, B, and Zn.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (12%)	6.5-8.3	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	VL-L	VL-L
Medium highland (33%)	5.9-8.3	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	VL-L	VL-L
Medium lowland (18%)	5.8-8.5	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	VL-L	VL-L

AEZ 11. High Ganges River Floodplain (1320549 ha)

This region includes the western part of the Ganges River Floodplain, which is predominantly high land and medium highland. Most areas have a complex relief of broad and narrow ridges and basins. There is an overall pattern of olive-brown silt loams and silty clay loams on the upper parts of floodplain ridges and dark grey mottled brown, mainly clay soils in basins. Most ridge soils are calcareous throughout the profile. General soil types predominantly include Dark Grey Floodplain soils and Calcareous Brown Floodplain soils. In general, pH of ridge soils is more alkaline than basin soils. It is because of higher rate of decalcification in basin soils. Organic matter content ranges from low to medium status. Apart from the most other regions, soils of this region contain enough Ca and Mg. Generally, the soils are deficient in N, P, K, S, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland 43%	4.6-8.8	L-M	VL-L	VL-L	L-M	VL-L	Opt-H	Opt-H	VL-L	L-M
Medium highland (32%)	4.8-8.9	L-M	VL-L	VL-L	L-M	VL-L	Opt-H	Opt-H	VL-L	L-M
Medium lowland (12%)	5.8-8.7	L-M	VL-L	VL-L	L-M	VL-L	Opt-H	Opt-H	VL--L	L-M

AEZ 12. Low Ganges River Floodplain (796751 ha)

This region comprises the eastern half of the Ganges River Floodplain. The region has meander floodplain landscape of broad ridges and basins. Soils of the region are silt loams and clay loams on the ridges and silty clay loam to heavy clays on lower sites. General Soil Types predominantly include Calcareous Dark Grey soils and Calcareous Brown Floodplain soils. Soils are calcareous in nature having slightly acidic to alkaline in reaction. Organic matter content is low to medium. Being calcareous in nature, these soils are mainly deficient in N, P, K, S, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (13%)	6.3-8.7	L-M	VL-L	VL-L	L-M	VL-L	Opt-H	Opt-H	VL-L	L-M
Medium highland (29%)	5.5-8.5	L-M	VL-L	VL-L	L-M	VL-L	Opt-H	Opt-H	VL-L	L-M
Medium lowland (31%)	5.6-8.4	L-M	VL-L	VL-L	L-M	L-M	Opt-H	Opt-H	VL-L	L-M
Lowland (14%)	5.8-8.0	L-M	VL-L	VL-L	L-M	L-M	Opt-H	Opt-H	VL-L	L-M

AEZ 13. Ganges Tidal Floodplain (1706573 ha)

This region occupies an extensive area of tidal floodplain in the south-west of the country. The greater part of this region has smooth relief having large areas of salinity. There is a general pattern of grey, slightly calcareous, light textured soils on river banks and grey to dark grey, non-calcareous, heavy silty clays to clay in the extensive basins. Non-calcareous Grey Floodplain soil is the major component of General Soil Types. Acid Sulphate soils also occupy significant part of the area especially in Sundarban. These soils become very strongly acidic if drained during dry season. In general, soils are strongly acidic to slightly alkaline. Organic matter content is low to medium. Soils are generally deficient in N, P, K and Zn.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland (78%)	5.1-7.9	L-M	VL-L	VL-L	L-M	Opt-H	Opt-H	Opt-H	VL-L	M-Opt

AEZ 14. Gopalganj-Khulna Bils (224700 ha)

This region occupies extensive low-lying areas between Ganges River Floodplains and the Ganges Tidal Floodplains. Almost level, low-lying basins occupy most of the region, with low ridges along rivers and creeks. The region is seasonally moderately deep to deeply flooded by clear water. Basin centers stay wet through the dry season. Soils of the area are grey to dark grey acidic heavy clays, peat or muck overlie at 25-100 cm. Soft peat and muck occupy perennially wet basin centers. General Soil Types include mainly Peat and Non-calcareous Dark Grey Floodplain soils. Peat soils generally have low bearing capacity. Soils are very strongly acidic to slightly alkaline in nature.

Being basin soils organic matter content is higher compared to the most other parts of floodplain soils. Generally, these soils are deficient in P, S, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland(13%)	4.6-7.6	Opt-H	L-M	VL-L	M-Opt	L-M	L-M	Opt	L-M	L-M
Medium lowland (41%)	4.5-7.6	H-VH	L-M	VL-L	M-Opt	L-M	L-M	H	L-M	L-M
Lowland (28%)	4.4-7.2	H-VH	L-M	VL-L	M-Opt	L-M	M-Opt	H	L-M	L-M
Very lowland (11%)	4.3-6.8	H-VH	L-M	VL-L	L-M	L-M	L-M	Opt	L-M	L-M

AEZ 15. Arial Bil (14436 ha)

This region occupies low lying basin areas between the Ganges and Dhaleshwari rivers in the south of Dhaka and north-west of Munshiganj districts. The soils of this area are dark grey; acidic heavy clays predominate. Non-calcareous Dark Grey Floodplain soil is the major General Soil Type. Soils are mainly slightly acidic. Being basin soils organic matter content is is generally higher than that of the most other parts of floodplain soils. Soils are generally deficient in N, P and K.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland (13%)	5.6-7.3	H	L-M	L-M	L-M	M-Opt	Opt-H	Opt-H	M-Opt	M-Opt
Medium lowland (73%)	5.4-6.9	H	L-M	L-M	L-M	Opt	Opt-H	Opt-H	M-Opt	M-Opt

AEZ 16. Middle Meghna River Floodplain (155464 ha)

This region occupies abandoned channel of the Brahmaputra river on the border between the greater Dhaka and Cumilla 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. Dominant General Soil Type is Non-calcareous Grey Floodplain soils. Soils are very strongly acidic to neutral in reaction. Organic matter content is low to medium. Soils are generally deficient in N, P, K, S, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium lowland (29%)	4.4-6.6	L-M	VL-L	VL-L	VL-L	VL-L	M-Opt	M-Opt	L-M	L-M
Lowland (25%)	4.2-6.5	L-M	VL-L	VL-L	L-M	VL-L	M-Opt	M-Opt	L-M	L-M
Very lowland (11%)	4.5-5.7	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	L-M	L-M

AEZ 17. Lower Meghna River Floodplain (90934 ha)

This area occupies transitional area between Middle Meghna River Floodplain and the Young Meghna Estuarine Floodplain. The region has slightly irregular relief, but with little difference in elevation between the ridges and depressions. Soils of this area are relatively uniform, silt loams occupy relatively higher areas and silty clay loams the occupy depression. Non-calcareous Dark Grey Floodplain and Calcareous Grey Floodplain soils are major components of General Soil Types. Soils are strongly acidic to neutral in reaction. Organic matter content is low to medium. Soils are generally deficient in N, P, K, S, Zn and B.

Major land types	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (14%)	5.3-6.7	L-M	L-M	L-M	L-M	L-M	M-Opt	Opt-H	L	L-M
Medium highland (28%)	4.3-7.7	L-M	L-M	L-M	L-M	L-M	M-Opt	Opt-H	VL-L	L-M
Medium lowland (31%)	4.6-7.3	L-M	L-M	L-M	L-M	L-M	M-Opt	Opt-H	VL-L	L-M

AEZ 18. Young Meghna Estuarine Floodplain (926885 ha)

This region occupies young alluvial land in and adjoining the Meghna estuary. It is almost level with very low ridges and broad depressions. The major soils are grey to olive, silt loam and silty clay loams and are stratified either throughout or at shallow depth. Mainly ridge soils are calcareous. Calcareous Alluvium and Non-calcareous Grey Floodplain soils are the dominant General Soil Types. Soils are slightly acidic to slightly alkaline. Organic matter content is low to medium. Soils are partly saline during dry season. Except Ca and Mg, soils are commonly deficient in N, P, K, S, Zn and B.

Major land types	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland (45%)	4.6-8.2	L-M	VL-L	VL-L	L-M	VL-L	Opt-H	Opt-H	VL-L	L-M

AEZ 19. Old Meghna Estuarine Floodplain (774026 ha)

This region occupies a large area, mainly low lying between the south of the Surma-Kushiyara Floodplain and the northern edge of the Young Meghna Estuarine Floodplain. It comprises smooth, almost level, floodplain ridges and shallow basins. Silt loam soils predominate in ridges and silty clay to clay in basins. Non-calcareous Dark Grey Floodplain soil is the only General Soil Type of the area. Soils are very strongly acidic to neutral in reaction. Organic matter content is low to medium. Soils are generally deficient in N, P, K, S, Zn and B.

Major land Types	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland (24%)	4.2-7.6	L-M	VL-L	VL-L	VL-L	L-M	M-Opt	H-Opt	L-M	L-M
Medium lowland (33%)	4.6-7.4	L-M	VL-L	VL-L	VL-L	L-M	M-Opt	H-Opt	L-M	L-M
Lowland (21%)	4.6-6.5	M-Opt	L-M	VL-L	L-M	L-M	M-Opt	H-Opt	L-M	L-M

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

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

Major Land Types	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium highland (25%)	3.5-6.6	L-M	VL-L	VL-L	L-M	L-M	L-M	M-Opt	L-M	L-M
Medium lowland (20%)	3.8-6.3	L-M	VL-L	VL-L	L-M	L-M	L-M	M-Opt	L-M	L-M
Lowland (36%)	3.6-6.9	L-M	L-M	VL-L	L-M	L-M	L-M	M-Opt	L-M	L-M

AEZ 21. Sylhet Basin (457345 ha)

The region occupies the lower, western side of the Surma-Kushiyara Floodplain. The area is mainly smooth, broad basins with narrow ridges of higher land along rivers. Relief is locally irregular near the rivers. The difference in elevation between river banks and adjoining basin centers is several meters. Soils of the area are grey silty clay loams and clay loam in the higher parts that dry out seasonally. On the other hand, grey clays occupy basins. Non-calcareous Grey Floodplain soils and Acid Basin Clays are the major components of the General Soil Types. Soils are very strongly acidic to slightly acidic in reaction. Organic matter is low to medium. Soils are generally deficient in N, P, K, Ca, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Medium lowland (19%)	4.5-6.0	L-M	VL-L	VL-L	L-M	M-Opt	L-M	M-Opt	L-M	L-M
Lowland (43%)	4.6-6.5	L-M	VL-L	VL-L	L-M	M-Opt	L-M	M-Opt	L-M	VL-L
Very lowland (32%)	4.6-6.6	L-M	VL-L	VL	L-M	L-M	L-M	M-Opt	L-M	VL-L

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

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

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (33%)	3.9-6.5	L-M	VL-L	VL-L	VL-L	L-M	L-M	M-Opt	L-M	L-M
Medium highland (31%)	3.8-6.8	L-M	VL-L	VL-L	VL-L	L-M	L-M	M-Opt	L-M	L-M
Medium lowland (16%)	3.8-6.4	L-M	VL-L	VL-L	L-M	L-M	L-M	M-Opt	L-M	L-M

AEZ 23. Chittagong Coastal Plains (372007 ha)

This region occupies the plain land in greater Chattogram district and the eastern part of Feni district. It is a compound unit of piedmont, river, tidal and estuarine floodplain landscapes. Seasonal salinity is the major constraint for crop production in this region. 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. Soils are very strongly acidic to neutral in reaction. Organic matter content is low to medium. Deficiency of N, P, K, S, Zn and B is generally found in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (17%)	4.0-6.5	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	VL-L	L-M
Medium highland (43%)	4.2-6.4	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	L-M	L-M
Medium lowland (13%)	4.4-6.5	L-M	VL-L	VL-L	L-M	L-M	M-Opt	M-Opt	L-M	L-M

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

This small but distinctive region occupies the whole of St. Martin's Island in the extreme south of the country. The area has very gently undulating old beach ridges and inter-ridge depressions, surrounded by sandy beaches. The soils are developed entirely on old and young coral beach sands. Calcareous Alluvium is the only General Soil Type of the area. Soils are neutral to slightly alkaline. Organic matter content is low to medium. Soils are generally deficient in N, P, K, S and Zn.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (33%)	5.2-7.6	L-M	VL-L	VL-L	L-M	L-M	Opt-H	Opt-H	VL-L	Opt-H
Medium highland (63%)	5.3-7.7	L-M	VL-L	VL-L	L-M	L-M	Opt-H	Opt-H	VL-L	Opt-H

AEZ 25. Level Barind Tract (504851 ha)

This region is developed over Madhupur Clay. The landscape is almost level, locally irregular along river channels. The predominant soils have a grey, silty having prominent plough pan, which either directly overlies grey, heavy, little weathered Madhupur Clay. 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. Soils are very strongly acidic to slightly acidic in reaction. Organic matter content is low to medium. Soils are deficient in N, P, K, S, Ca, Mg, Zn and B in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (30%)	4.1-6.4	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	VL-L
Medium highland (55%)	4.2-6.8	L-M	VL-L	VL-L	L-M	VL-L	VL-L	L-M	L-M	VL-L

AEZ 26. High Barind Tract (159964 ha)

It includes the south-western part of the Barind Tract where the underlying Madhupur clay has been uplifted and cut into by deep valleys. The top soil is grey silt loam to silty clay loam having a strong plough pan. Deep Grey Terrace soils and Grey Valley soils are the major components of the General Soil Types of the area. Soils are very strongly acidic to slightly acidic in reaction. Organic matter content is low to medium. Soils are deficient in N, P, K, S, Ca, Mg, Zn and B in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (93%)	4.3-7.1	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	VL-L	VL-L

AEZ 27. North Eastern Barind Tract (107926 ha)

This region occupies several discontinuous areas on the north-eastern margins of the Barind Tract. It stands slightly higher than adjoining floodplain land. The region has silty or loamy top soil, 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 to

slightly acidic in reaction. Organic matter of the soils is low to medium. Soils are deficient in N, P, K, S, Ca, Zn and B in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (36%)	4.0-6.6	L-M	VL-L	VL-L	L-M	VL-L	L-M	M-Opt	VL-L	VL-L
Medium highland (56%)	4.3-6.9	L-M	VL-L	VL-L	L-M	VL-L	L-M	M-Opt	VL-L	VL-L

AEZ 28. Madhupur Tract (424329 ha)

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. Deep Red Brown Terrace, Shallow Red Brown Terrace soils and Acid Basin Clays are the dominant major General Soil types. 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. Soils are mainly very strongly acidic to slightly acidic in reaction. Soil organic matter is low to medium. Soils are generally deficient in N, P, K, S, Ca, Mg, Zn and B.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (56%)	3.7-6.7	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	VL-L
Medium highland (18%)	3.9-6.8	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	VL-L

AEZ 29. Northern and Eastern Hills (1817172 ha)

This region includes the country's hill areas. Relief is complex. Hills have been dissected to different degrees over different rocks. In general, slopes are very steep and few low hills have flat summits. The major hill soils are yellow-brown to strong brown, permeable, friable, loamy; mainly very strongly acidic and low in moisture holding capacity. However, soil patterns are generally complex due to local difference in sand, silt and clay contents of the underlying sedimentary rocks and degree of soil erosion. Soils are very strongly acidic to neutral in reaction. Organic matter content is low to medium. Deficiencies of N, P, K, S, Ca, Mg, Zn and B are generally found in this region.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (92%)	3.5-7.1	L-M	VL-L	VL-L	L-M	VL-L	VL-L	L-M	VL-L	L-M

AEZ 30. Akhaura Terrace (11324 ha)

This small region occupies the eastern border of B. baria 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 Soils are very strongly acidic to slightly acidic in reaction. Organic matter content is low to medium. General fertility of the soil is very low.

Major Land Type	Soil pH	Soil OM	Nutrient status							
			N	P	K	S	Ca	Mg	Zn	B
Highland (55%)	4.8-6.3	L-M	VL-L	VL-L	L-M	VL-L	VL-L	L-M	L-M	L-M
Medium highland (11%)	5.1-6.5	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	L-M
Medium lowland (10%)	5.2-6.7	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	L-M
Lowland (15%)	5.3-6.4	L-M	VL-L	VL-L	L-M	VL-L	L-M	L-M	L-M	L-M

Table 5. Status of different nutrients in Bangladesh soils

Nutrient element	Very low (mha)	Low (mha)	Medium (mha)
Phosphorus (P)	0.889 (10.4%)	3.43 (39.9%)	1.84 (21.4%)
Potassium (K)	0.287 (3.35%)	2.43 (28.3%)	2.47 (28.8%)
Sulphur (S)	0.726 (8.46%)	2.58 (30.1%)	1.79 (20.8%)
Calcium (Ca)	0.422 (4.91%)	1.69 (19.6%)	1.32 (15.3%)
Magnesium (Mg)	0.314 (3.66%)	0.742 (8.65%)	0.840 (9.78%)
Zinc (Zn)	0.749 (8.73%)	2.01 (23.4%)	1.82 (21.2%)
Boron (B)	0.544 (6.34%)	2.10 (24.4%)	2.35 (27.4%)
Organic matter (OM)	0.408 (4.7%)	2.58 (30.1%)	5.08 (59.2%)

Values in parenthesis indicate % arable land

Source: Hasan, M. N., Bari, M. A. and Lutfar, M. R. 2020. Soil Fertility Trends in Bangladesh 2010 to 2020. SRSRF project. Soil Resource Development Institute, Ministry of Agriculture. 84 pp.

3.4 Soil fertility status in different fragile ecosystems

A fragile ecosystem is characterized by a significant loss of stability and resilience as a habitat for plants, animals and humans, the consequence being a deterioration of the ecosystem in terms of its ability to deliver commodities and services and support human lives and livelihoods. Fragile ecosystem is essentially meant ecologically challenged regions where cropping intensity is very low and normal agricultural practices do not bring about higher yields. Generally, the fertility status

of soils in these regions is low and thus less productive. In the Bangladesh Delta Plan 2100, from agriculture point of view, the five fragile ecosystems are identified as hotspots:

- Haor and Flash Flood Areas: Sylhet and Mymensingh region
- Char ecosystem (The River Systems and Estuaries): Rangpur and Dhaka region
- Barind and Drought Prone Areas: Rajshahi region
- Coastal Zones: Khulna and Barishal region
- The Chittagong Hill Tracts: Chattogram region.

Soil fertility status including pH of the five fragile ecosystems is presented below:

a) Char ecosystem

Land types	1999-2002	2003-2021	Land types	1999-2002	2003-2021
Soil pH			**Exchangeable K (Cmol kg^{-1})**		
MHL	3.5-8.7	4.1-8.5	HL	0.24	0.20
MLL	4.2-8.6	4.3-8.8	MHL	0.25	0.21
LL	4.5-8.9	4.2-8.7	MLL	0.21	0.19
VLL	7.9-8.3	4.6-8.6	LL	0.18	0.20
			VLL	0.30	0.25
SOM (%)			**Available S (mg kg^{-1})**		
HL	1.68	1.52	HL	34.8	17.2
MHL	1.68	1.67	MHL	68.9	34.7
MLL	1.67	1.40	MLL	59.3	26.8
LL	1.63	1.33	LL	68.2	27.7
VLL	2.0	1.55	VLL	43.1	24.7
Available P (mg kg^{-1})			**Available Zn (mg kg^{-1})**		
HL	6.21	9.43	HL	0.76	0.71
MHL	8.33	7.47	MHL	0.58	0.71
MLL	8.33	6.75	MLL	0.67	0.85
LL	7.11	7.76	LL	0.88	0.96
VLL	5.0	3.5	VLL	0.57	0.81

b) Haor ecosystem

Land types	1999-2002	2003-2021	Land types	1999-2002	2003-2021
Soil pH			**Exchangeable K (Cmol kg^{-1})**		
MHL	4.3-4.4	3.5-6.4	MHL	0.13	0.15
MLL	4.0-6.4	3.6-6.6	MLL	0.19	0.19
LL	4.0-6.3	3.5-6.5	LL	0.21	0.19
VLL	4.1-4.9	3.4-6.9	VLL	0.36	0.21
SOM (%)			**Available S (mg kg^{-1})**		
MHL	2.06	2.06	MHL	39.3	23.9
MLL	2.56	2.45	MLL	40.0	34.9
LL	2.84	2.67	LL	40.1	44.0
VLL	2.66	3.45	VLL	68.2	54.6

Available P (mg kg^{-1})			Available Zn (mg kg^{-1})		
MHL	5.5	6.03	MHL	-	1.3
MLL	3.54	5.46	MLL	2.2	1.8
LL	2.74	4.32	LL	2.77	2.24
VLL	1.64	4.90	VLL	-	2.29

c) Barind ecosystem

Land types	1999-2002	2003-2021	Land types	1999-2002	2003-2021
Soil pH			**Exchangeable K (Cmol kg^{-1})**		
HL	4.0-8.1	4.1-7.9	HL	0.13	0.17
MHL	4.4-7.7	4.0-7.7	MHL	0.15	0.16
MLL	4.7-7.5	4.4-6.5	MLL	0.20	0.25
LL	-	5.2-6.6	LL	-	0.34
SOM (%)			**Available S (mg kg^{-1})**		
HL	1.43	1.65	HL	17.5	14.1
MHL	1.70	1.80	MHL	15.8	14.7
MLL	1.83	2.59	MLL	15.1	14.8
LL	-	2.60	LL	-	14.3
Available P (mg kg^{-1})			**Available Zn (mg kg^{-1})**		
HL	8.53	12.1	HL	1.14	1.26
MHL	6.11	10.1	MHL	1.03	0.97
MLL	5.06	6.08	MLL	1.39	1.33
LL	-	7.39	LL	-	1.22

d) Coastal ecosystem

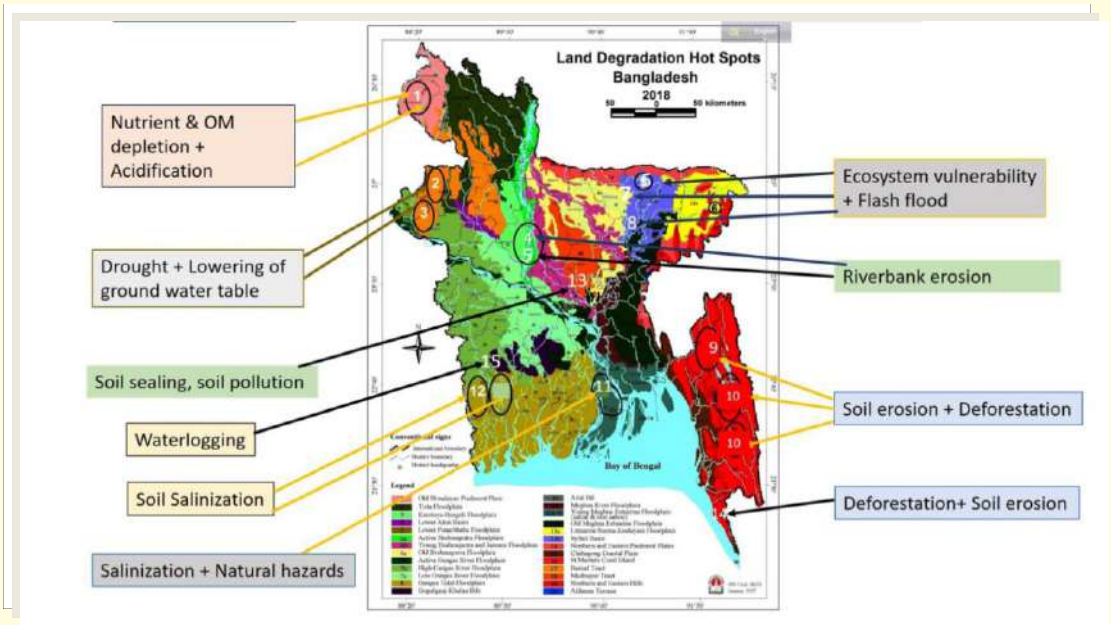
Land types	1999-2002	2003-2021	Land types	1999-2002	2003-2021
Soil pH			**Exchangeable K (Cmol kg^{-1})**		
HL	3.7 -7.9	3.9-8.0	HL	0.16	0.19
MHL	3.5-8.0	3.6-8.0	MHL	0.29	0.25
MLL	4.7-.8.0	4.4-8.0	MLL	0.33	0.28
LL	4.5-7.8	6.1-7.9	LL	0.25	0.32
SOM (%)			**Available S (mg kg^{-1})**		
HL	1.95	1.69	HL	44.4	31.7
MHL	2.19	2.16	MHL	124.4	86.7
MLL	2.74	3.52	MLL	99.6	87.5
LL	2.55	3.01	LL	60.4	36.9
Available P (mg kg^{-1})			**Available Zn (mg kg^{-1})**		
HL	5.67	8.73	HL	0.79	1.04
MHL	5.41	4.36	MHL	0.90	0.93
MLL	6.80	4.42	MLL	0.69	1.17
LL	6.51	-	LL	0.67	1.49

e) **Hill ecosystem**

Land types	1999-2002	2003-2021	Land types	1999-2002	2003-2021
Soil pH			**Exchangeable K (Cmol kg^{-1})**		
HL	3.6-7.3	3.6-6.8	HL	0.23	0.22
MHL	3.9-7.0	3.8-6.5	MHL	0.17	0.17
MLL	4.4-5.1	4.9-5.9	MLL	0.11	0.22
SOM (%)			**Available S (mg kg^{-1})**		
HL	2.23	2.39	HL	11.2	12.5
MHL	1.80	2.11	MHL	19.8	14.8
MLL	1.74	2.92	MLL	21.8	10.1
Available P (mg kg^{-1})			**Available Zn (mg kg^{-1})**		
HL	5.34	6.64	HL	0.86	0.91
MHL	5.21	6.88	MHL	1.51	1.26
MLL	5.19	4.38	MLL	1.96	1.74

HL – Highland, MHL – Medium highland, MLL- Medium lowland, LL - Lowland

***Source**: Bokhtiar, S. M., Samsuzzaman, S., Jahiruddin, M and Panaullah, G. M. 2023. Agricultural Development for Fragile Ecosystems in Bangladesh. Bangladesh Agricultural Research Council, Farmgte, Dhaka 1215.*



1 Thakurgaon, 2 Naogaon, 3 Chapai Nawabganj, 4 Tangail, 5 Sirajganj, 6 Sunamganj, 7 Netrokona, 8 Kishoreganj, 9 Khagrachari, 10 Bandarban & Rangamati, 11 Bhola, 12 Khulna & Satkhira, 13 Dhaka, 14 Cox's Bazar, 15 Jashore & Khulna.

Fig. 2 Land degradation hotspots in Bangladesh
Source: ENALULDEP/SLM Project, 2020. DoE, Bangladesh

Degradation of land is a great concern in Bangladesh, where arable lands are being degraded with time. A total of 15 land degradation hotspots are identified in this country (Fig. 2). Under the Land Degradation Neutrality-Target Setting Program (LDN-TSP), Bangladesh has set a voluntary target based on the agreed indicators and in other words to attain Sustainable Development Goal (SDG) 15: Land for life in order to achieve LDN by 2030.

There are two options to face the challenges of land degradation. The land fit can be made through adoption of some reclamation or mitigation measures (called remediation) or the crops or varieties fit (called adaptation) can be made for cultivation and the latter option is found better and sustainable.

3.5 Soil microbial status in different AEZs

Soil microorganisms are most abundant in soil. They are responsible for driving organic matter decomposition, carbon sequestration, nutrient cycling, soil nutrient availability, GHG emissions and ecosystem dynamics. Fertile soil contains a wide variety of microbes which include different types of bacteria, fungi, protozoa, algae, and actinomycetes. Mostly they are found in the rhizosphere where they decompose organic matter into humus which is the storehouse of nutrients and influences soil fertility. Many microbes are involved in making up numerous transformations, which change plant nutrients to readily available forms and stabilize desirable soil structure. Phosphorus solubilizing bacteria and fungi carry out a significant function in converting insoluble phosphatic compound such as rock phosphate, bone meal etc. and also the chemically fixed soil phosphorus into available form. Mycorrhiza (fungus-plant root relationship) plays a very good role in supplying nutrients to crop plants through increasing root surface area. A thorough understanding of soil biodiversity in agriculture has significant value to arrive at some measures that can act as indicators of soil quality and crop productivity. It is, therefore, important to know the types of organisms present in soils and to assess the functions and services they provide in agroecosystems. Recently the microbial status of Bangladesh soils has been studied through a project coordinated by BARC and implemented by four NARS institutes (BARI, BRRI, BINA and BSRI). The soil microbial status of different AEZs is depicted in tabular form below.

AEZ 1: Old Himalayan Piedmont Plain

District	Upazila	Microbial population (cfu/g soil)					
		TB	F	Act	R	FLNFB	PSB
Thakurgaon	Baliadangi	9.16×10^5-6.83×10^9	6.33×10^5-5.16×10^7	2.96×10^7 - 5.9×10^7	2.9×10^7-4.2×10^7	5.1×10^6-4.9×10^7	1×10^6 - 2.25×10^6
	Thakurgaon sadar	2.26×10^5-5.0×10^8	5.3×10^5-3.0×10^7	2.4×10^6-3.06×10^7	2.35×10^7-3.75×10^7	6.6×10^5-5.75×10^6	1×10^6 - 2.25×10^6
Dinajpur	Dinajpur Sadar	11×10^6-7.25×10^9	8.5×10^5-6.5×10^7	2×10^5-1.75×10^7	4.1×10^6-4.5×10^7	5.85×10^6-5.05×10^7	2×10^5 - 3×10^6
	Birgonj	7.16×10^5-4.03×10^9	9.9×10^5-7.6×10^7	2.63×10^5-2.56×10^7	3.5×10^7-4.5×10^7	5×10^5-4.9×10^7	4.5×10^4 - 4×10^5

R=*Rhizobium*, BR= *Bradyrhizobium*, TB=Total bacteria, F= Fungi, Act=Actinomycetes, PSB= Phosphate solubilizing bacteria, FLNFB= Fee living N_2 fixing bacteria, cfu= Colony forming unit

AEZ 2: Active Tista Floodplain

District	Upazila	Microbial population (cfu/g soil)						
		R	BR	TB	F	Act	PSB	FLNFB
Kurigram	Fulbari	1.0×10^{5}-8.8×10^{8}	1.0×10^{5}-6.0×10^{7}	2.0×10^{5}-1.65×10^{9}	1.0×10^{7}-9.0×10^{7}	1.0×10^{7}-2.0×10^{7}	1.0×10^{5}-1.3×10^{9}	1.0×10^{5}-6.7×10^{8}
	Nagessori	6.0×10^{5}-4.2×10^{8}	8×10^{5}-1.4×10^{8}	5.7×10^{6}-6.5×10^{9}	1×10^{7}-6.3×10^{8}	8×10^{5}-6.6×10^{9}	7.0×10^{5}-3.7×10^{8}	5.0×10^{5}-5.4×10^{9}
Rangpur	Taraganj	1×10^{5}-9.2×10^{8}	3×10^{5}-1×10^{7}	1.4×10^{7}-1.09×10^{9}	3.6×10^{6}-5.6×10^{8}	1.0×10^{4}-1.0×10^{5}	4.0×10^{5}-1.6×10^{9}	1.0×10^{5}-1.7×10^{8}
	Badarganj	6.0×10^{5}-7.3×10^{8}	1.0×10^{5}-1.0×10^{7}	1.9×10^{8}-8.1×10^{9}	1.0×10^{5}-4.0×10^{7}	4.0×10^{5}-8.0×10^{7}	2.0×10^{5}-3.0×10^{8}	5.0×10^{5}-8.3×10^{8}

AEZ 3: Tista Meander Floodplain

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Rangpur	Rangpur Sadar	1.2×10^{7}-6.5×10^{7}	0.8×10^{5}-8.4×10^{5}	1.3×10^{4}-14.0×10^{4}	0.12×10^{6}-3.4×10^{6}	1.6×10^{5}-4.6×10^{5}	0.3×10^{5}-3.4×10^{5}	0.5×10^{5}-5.6×10^{5}
	Mithapukur	1.9×10^{7}-7.6×10^{7}	1.2×10^{5}-4.4×10^{5}	1.4×10^{4}-18×10^{4}	0.4×10^{6}-5.4×10^{6}	0.8×10^{5}-3.2×10^{5}	2.2×10^{5}-12.6×10^{5}	1.4×10^{5}-6.6×10^{5}

AEZ 4: Karatoya-Bangali Floodplain

District	Upazila	Microbial population (cfu/g soil)					
		TB	F	Act	R	FLNFB	PSB
Sirajgonj	Raigonj	16.78×10^{7}-18.71×10^{8}	13.28×10^{7}-17.14×10^{7}	4.92×10^{7}-7.07×10^{7}	4.37×10^{7}-6.06×10^{7}	4.50×10^{5}-6.90×10^{5}	4.0×10^{5}-5.1×10^{5}
	Ullahpara	19.08×10^{7}-17.5×10^{8}	15.57×10^{7}-17.14×10^{7}	5.71×10^{7}-6.01×10^{7}	3.14×10^{7}-3.35×10^{7}	3.56×10^{5}-4.96×10^{5}	2.8×10^{5}-3.4×10^{5}
Pabna	Bera	16.78×10^{7}-17.28×10^{9}	14.28×10^{7}-18.57×10^{7}	5.21×10^{7}-8.07×10^{7}	3.42×10^{7}-7.07×10^{7}	7.07×10^{5}-13.21×10^{5}	2.4×10^{5}-5.1×10^{5}

AEZ 5: Lower Atrai Basin

District	Upazila	Microbial population (cfu/g soil)					
		TB	F	Act	R	FLNFB	PSB
Natore	Singra	20.14×10^{7}-19.57×10^{8}	16.50×10^{7}-19.64×10^{7}	3.20×10^{7}-5.92×10^{7}	6×10^{7}-7.8×10^{7}	6.64×10^{7}-8.78×10^{7}	3.2×10^{6}-3.6×10^{6}
	Natore Sadar	19.28×10^{7}-18.71×10^{8}	16.71×10^{7}-19.28×10^{7}	3.92×10^{7}-7.07×10^{7}	6.64×10^{7}-8.78×10^{7}	5.50×10^{7}-10×10^{7}	3.2×10^{6}-4.2×10^{6}
Naogaon	Raninagar	18.52×10^{7}-12.64×10^{8}	14.35×10^{7}-18.77×10^{7}	3.7×10^{7}-5.51×10^{7}	6.07×10^{7}-9.07×10^{7}	8.35×10^{7}-9.60×10^{7}	2.78×10^{6}-4.2×10^{6}
	Naogaon Sadar	17.64×10^{7}-17.78×10^{9}	15.21×10^{7}-20.21×10^{7}	3×10^{7}-4.57×10^{7}	5.99×10^{7}-7.78×10^{7}	6.78×10^{7}-8.78×10^{7}	3.91×10^{6}-4.3×10^{6}

AEZ 6: Lower Punarbhaba Floodplain

District	Upazila	Microbial population (cfu/g soil)						
		R	BR	TB	F	Act	PSB	FLNFB
Naogaon	Badalgachhi	1.3×10^5-5.2×10^8	2×10^5 -1×10^7	5.5×10^6-1.12×10^9	2×10^5-1.0×10^8	2×10^5-2.8×10^8	1.0×10^5-6.2×10^8	1.2×10^6-1.1×10^8
	Dhamoirhat	1.5×10^4-3.5×10^8	1.6×10^4-5×10^7	2.9×10^6-1.2×10^8	1×10^4-1.0×10^8	1×10^5-2.8×10^8	1.0×10^4-6.2×10^8	1.0×10^5-2.09×10^8
Chapai Nawabganj	Gomastapur	1×10^5-2.5×10^8	1×10^5-1×10^7	1.0×10^6-1.5×10^9	9×10^5-1.4×10^8	1.2×10^5-5.0×10^7	5.0×10^5-2.6×10^8	1.0×10^4-4.2×10^7

AEZ 7: Active Brahmaputra-Jamuna Floodplain

District	Upzila	Microbial population ranged (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Sirajganj	Rajarhat	1.2×10^7-8.0×10^7	1.6×10^5-8.2×10^5	1.4×10^5-6.5×10^5	1.2×10^5-7.2×10^6	1.6×10^5-7.4×10^5	3.0×10^5-7.8×10^5	1.1×10^5-5.6×10^5
	Olipur	8.3×10^7-14.4×10^7	1.4×10^5-5.4×10^5	1.5×10^5-6.4×10^5	7.2×10^6-1.0×10^6	1.6×10^5-7.4×10^5	1.0×10^5-4.3×10^5	1.2×10^5-5.4×10^5
	Shahzadpur	0.2×10^7 -2.3×10^7	0.3×10^5 -3.7×10^5	0.4×10^5 -2.2×10^5	1.1×10^5 -7.5×10^5	1.2×10^4 -9.5×10^4	0.4×10^5 -5×10^5	0.2×10^4 -2.5×10^4
	Belkuchi	1.4×10^7-3.2×10^7	0.6×10^5-3.1×10^5	0.8×10^5-4×10^5	0.1×10^5-3.1×10^5	3.8×10^4-7.2×10^4	0.5×10^5-4.2×10^5	0.2×10^4-5.1×10^4

AEZ 8: Young Brahmaputra and Jamuna Floodplain

District	Upazila	Microbial population (cfu/g soil)					
		TB	F	Act	R	FLNFB	PSB
Sherpur	Sherpur Sadar	8.75×10^7-15×10^9	10×10^7-18×10^7	9.15×10^5-10×10^7	10.95×10^5-9×10^6	5.1×10^5-4.5×10^7	1.1×10^5 -1.5×10^7
	Nakla	15.05×10^5-4.95×10^9	7.4×10^6 – 8×10^7	5.95×10^5-8.75×10^7	11.35×10^5-11.6×10^7	3.95×10^7-5.1×10^7	9.5×10^4-8.5×10^7
Narsindhi	Narsindhi Sadar	10×10^5-9×10^9	6.66×10^5 -6.6×10^7	1.8×10^7-2.9×10^7	4.35×10^7-7.21×10^7	6.28×10^5-8.78×10^6	1.4×10^6 -3.5×10^6
	Madhobdi	23.35×10^7-25×10^8	12.85×10^7-13.85×10^7	3.07×10^7-6.78×10^7	4.28×10^7-5.57×10^7	3.42×10^7-5.57×10^7	1.4×10^6-2.1×10^6

AEZ 9: Old Brahmaputra Floodplain

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Mymen-singh	Mymen-singh Sadar	2.4×10^7-6.5×10^7	1.3×10^5-7.5×10^5	1.6×10^5-8.9×10^5	2.5×10^6-5.7×10^6	1.9×10^4-5.9×10^4	2.2×10^4-6.2×10^4	3.2×10^5-8.3×10^5
	Nandail	0.8×10^7-6.1×10^7	1.2×10^5-4.7×10^5	2.2×10^5-6.1×10^5	1.0×10^6-4.3×10^6	1.9×10^4-5.3×10^4	2.2×10^4-6.5×10^4	2.0×10^5-3.3×10^5

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Netrokona	Netrokona Sadar	2.5×10^{7}-9.9×10^{6}	2.9×10^{5}-8.9×10^{5}	2.9×10^{5}-6.5×10^{5}	2.1×10^{6}-5.7×10^{6}	2.1×10^{4}-5.8×10^{4}	1.0×10^{4}-5.5×10^{4}	2.8×10^{5}-6.1×10^{5}
	Purbadhala	2.2×10^{7}-7.1×10^{7}	2.2×10^{5}-3.8×10^{5}	2.8×10^{5}-5.5×10^{5}	1.1×10^{6}-5.3×10^{6}	1.7×10^{4}-8.2×10^{4}	3.0×10^{4}-8.1×10^{4}	1.5×10^{5}-3.9×10^{5}

AEZ 10: Active Ganges Floodplain

District	Upazila	Microbial population (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Faridpur	Faridpur Sadar	2×10^{6} – 2×10^{9}	1×10^{4} – 3×10^{5}	2×10^{5} - 5×10^{5}	3×10^{3}- 9×10^{3}	1×10^{3}- 6×10^{3}	8×10^{4} – 1×10^{6}

AEZ 11: High Ganges River Floodplain

District	Upazila	Microbial population (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Jashore	Jikorgacha	2×10^{7}- 3×10^{7}	6×10^{5}- 2×10^{6}	2×10^{5}- 3×10^{5}	1×10^{4}- 6×10^{4}	1×10^{4}- 8×10^{4}	5×10^{5}- 8×10^{5}
	Monirumpur	3×10^{6}- 4×10^{7}	3×10^{5} – 3×10^{6}	1×10^{4} – 3×10^{5}	1×10^{4} – 9×10^{4}	4×10^{4} – 2×10^{5}	9×10^{4} – 2×10^{6}
Rajshahi	Durgapur	7×10^{6} – 3×10^{7}	6×10^{5} – 2×10^{6}	2×10^{5} – 4×10^{5}	1×10^{2} – 6×10^{2}	4×10^{3} – 1×10^{4}	2×10^{5} – 4×10^{5}
	Paba	4×10^{6} – 2×10^{7}	4×10^{5} – 1×10^{6}	9×10^{5}- 5×10^{5}	3×10^{2} – 1×10^{3}	3×10^{3} – 1×10^{4}	9×10^{5} – 8×10^{5}

AEZ 12: Low Ganges River Floodplain

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Faridpur	Sadarpur	1.1×10^{7}- 12.2×10^{7}	1.2×10^{5}- 3.6×10^{5}	1.6×10^{5}- 5×10^{5}	1×10^{6}- 4.2×10^{6}	1×10^{5}- 3.3×10^{5}	2.1×10^{5}- 5.2×10^{5}	0.7×10^{5}- 5.3×10^{5}
	Bhanga	2.1×10^{7}- 6.1×10^{7}	1×10^{5}- 3.1×10^{5}	1.5×10^{5}- 5×10^{5}	1.2×10^{6}- 5.5×10^{6}	1.3×10^{5}- 6.1×10^{5}	0.9×10^{5}- 5.2×10^{5}	0.7×10^{5}- 5.1×10^{5}
Pabna	Pabna Sadar	1.5×10^{7}- 5.1×10^{7}	2.2×10^{5}- 5.1×10^{5}	1.3×10^{5}- 3×10^{5}	2×10^{5}- 5×10^{5}	2×10^{4}- 6.5×10^{4}	2.3×10^{5}- 7.1×10^{5}	1.0×10^{5}- 4.1×10^{5}
	Sathia	1.3×10^{7}- 7.1×10^{7}	1×10^{5}- 4.1×10^{5}	1.5×10^{5}- 3.3×10^{5}	1.3×10^{5}- 5.3×10^{5}	2.4×10^{4}- 6.2×10^{4}	2×10^{5}- 4.1×10^{5}	2×10^{5}- 7.5×10^{5}

R=*Rhizobium*, BR= *Bradyrhizobium*, TB=Total bacteria, F= Fungi, Act=Actinomycetes, PSB= Phosphate solubilizing bacteria, FLNFB= Fee living N_2 fixing bacteria, cfu= Colony forming unit

AEZ13: Ganges Tidal Floodplain

District	Upazila	Microbial population (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Satkhira	Ashashuni	9×10^5 – 1×10^7	6×10^4 – 2×10^6	8×10^4- 3×10^5	1×10^2 - 1×10^3	3×10^3- 1×10^4	5×10^4 – 3×10^5
	Shyamnagar	1×10^6 – 3×10^7	8×10^4 – 2×10^6	1×10^4 - 5×10^5	1×10^2 - 8×10^2	1×10^3 - 2×10^4	1×10^4 – 7×10^5
	Kaliganj	4.0×10^3- 3.0×10^5	3×10^5- 7.7×10^8	1.0×10^7- 3.7×10^9	2.0×10^5- 1.3×10^8	1.0×10^5- 1.1×10^8	6.0×10^5- 1.1×10^9
Khulna	Dacope	5.0×10^3- 2.0×10^7	3.0×10^4- 5.0×10^7	1.0×10^5- 1.7×10^8	2.0×10^4- 2.0×10^7	1×10^4- 1.0×10^8	1.0×10^5- 1.0×10^6
	Batiaghata	2.0×10^5- 1.8×10^8	2.0×10^5 – 5.0×10^7	2.0×10^4 - 3.0×10^8	1.2×10^3- 1.0×10^7	1.4×10^5- 1.0×10^8	1.0×10^3 - 1.1×10^7

AEZ 14: Gopalganj-Khulna Bils

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Gopalganj	Gopalganj Sadar	2.4×10^7 -11.5×10^7	1.0×10^5 -8.0×10^5	1.4×10^5 -5.5×10^5	1.0×10^6- 9.5×10^6	4.3×10^5 -8.3×10^5	1.2×10^5- 6.2×10^5	1.2×10^5 -8.2×10^5
	Moksedpur	12.6×10^7 -15.8×10^7	1.5×10^5 -9.2×10^5	1.4×10^5 -8.3×10^5	1.2×10^6- 7.2×10^6	1.1×10^5 -8.4×10^5	1.2×10^5- 16×10^5	1.7×10^5 -8.8×10^5
	Terokhada	11.4×10^7 -13.3×10^7	2.4×10^6 -14×10^6	0.4×10^6 -12×10^6	0.23×10^6 -22×10^6	3.1×10^5 -6.6×10^5	0.33×10^6 -4.2×10^6	0.5×10^5 -6×10^5
	Dumuria	11.8×10^7 -18.5×10^7	1.4×10^6 -9.5×10^6	0.24×10^6 -30×10^6	0.78×10^6 -6.6×10^6	1.5×10^5 -6.4×10^5	1.4×10^5- 8.2×10^5	1.5×10^5 -13×10^5

AEZ 15: Arial Bil

District	Upazila	Microbial population ranges (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Munshiganj	Sreenagar	2×10^6 – 3×10^8	3×10^5- 1×10^6	1×10^5 – 4×10^5	1×10^3 – 4×10^3	1×10^3 - 9×10^3	9×10^4 - 4×10^5
		1×10^6 – 6×10^8	2×10^5 – 2×10^6	4×10^4 – 3×10^5	2×10^3 – 7×10^3	2×10^3 - 1×10^4	1×10^5 - 7×10^5

AEZ 16: Middle Mehgna River Floodplain

District	Upazila	Microbial populationranges (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Munshiganj	Gajaria	9×10^5 - 1×10^7	1×10^4 - 4×10^6	1×10^4 -4×10^5	1×10^3 - 1×10^4	1×10^3 - 1×10^4	5×10^4 - 5×10^5
Brahmanbaria	Bancharampur	7×10^6 - 3×10^7	3×10^5 - 3×10^6	1×10^5 -4×10^5	1×10^3 - 5×10^3	1×10^3- 8×10^3	1×10^5 - 2×10^6

AEZ 17: Lower Mehgna River Floodplain

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Chandpur	Faridganj	2.7×10^7-10×10^7	1.1×10^5-4.1×10^5	2.3×10^5-4.1×10^5	2×10^5-17×10^5	3.5×10^4-8×10^4	3×10^4-14×10^4	7.9×10^4-11.8×10^4
	Chandpur Sadar	2.1×10^7-4.3×10^7	0.8×10^5-6.1×10^5	2×10^5-4×10^5	1.4×10^5-5.3×10^5	0.2×10^4-15×10^4	2.1×10^4-17.5×10^4	1×10^4-6.4×10^4
Laxmipur	Laxmipur Sadar	1.1×10^7-6×10^7	3.7×10^4-5.6×10^4	2.9×10^4-6.8×10^4	$1.2\times1\ 0^5$-6.6×10^5	3.6×10^4-10.1×10^4	3.4×10^4-12.1×10^4	2.9×10^4-12.5×10^4
	Raipur	0.9×10^7-4.3×10^7	2.5×10^4-9.3×10^4	1.3×10^4-9×10^4	0.7×10^5-3.9×10^5	6.2×10^4-14.5×10^4	1×10^4-5.1×10^4	0.4×10^4-10.1×10^4

AEZ 18: Young Meghna Estuarine Floodplain

District	Upazila	Microbial population (cfu/g soil)						
		R	BR	TB	F	Act	PSB	FLNFB
Patuakhali	Dumki	2.0×10^4-2.4×10^8	1.0×10^5-2.0×10^6	3.0×10^5-2.5×10^8	1.0×10^6-7.0×10^7	4.0×10^5-2.0×10^7	1.0×10^5-1.5×10^7	1.0×10^5-5.0×10^6
	Patuakhali Sadar	6.0×10^3-5.0×10^7	2.0×10^4-2.0×10^6	3.0×10^6–2.2×10^8	2.0×10^4-5×10^7	4.0×10^3-3.0×10^7	3.0×10^5-1.0×10^7	5.0×10^5-1.0×10^6
Barishal	Gowronodi	1.0×10^5-1.0×10^8	1.0×10^5-2.8×10^8	6.0×10^5-3.5×10^9	1.0×10^5-5.1×10^8	1.0×10^5-2.0×10^7	2.0×10^5-2.0×10^7	1.0×10^5-3.9×10^8
Bhola	Bhola Sadar	1.0×10^5-2.3×10^8	5.0×10^5-2.8×10^8	6.4×10^6-4.8×10^8	1.0×10^5-2.0×10^7	1.0×10^5-2.0×10^7	3.0×10^5-1.0×10^7	8.0×10^5-2.2×10^8
	Borhanuddin	9.8×10^6-7.7×10^8	1.0×10^5-3.3×10^8	4.2×10^6-6.0×10^9	9.0×10^5-4.7×10^8	1.0×10^5-1.0×10^7	3.0×10^7-1.3×10^8	3.0×10^5-1.2×10^9

AEZ 19: Old Meghna Estuarine Floodplain

District	Upazila	Microbial population (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Cumilla	Burichang	2×10^5 -8×10^7	3×10^4-8×10^6	4×10^4-1×10^5	1×10^3-6×10^3	4×10^3-1×10^5	8×10^4-4×10^7
	Deviddar	2×10^6-4×10^7	8×10^4-1×10^6	6×10^4-2×10^5	1×10^3-1×10^4	1×10^3-3×10^4	3×10^3-1×10^6
	Mithamoin	1×10^7 -2×10^7	5×10^5 –3×10^6	1×10^5 –1×10^5	1×10^2-1×10^3	3×10^3-1×10^4	2×10^5 –2×10^6
	Itna	1×10^7 -3×10^7	2×10^6 -2×10^6	4×10^4-3×10^5	6×10^2-9×10^3	4×10^3 –6×10^3	1×10^6-2×10^6

R=*Rhizobium*, BR= *Bradyrhizobium*, TB=Total bacteria, F= Fungi, Act=Actinomycetes, PSB= Phosphate solubilizing bacteria, FLNFB= Fee living N_2 fixing bacteria, cfu= Colony forming unit

AEZ 20: Eastern Surma-Kushiyara Floodplain

District	Upazila	Microbial population (cfu/g soil)					
		TB	F	Act	R	FLNFB	PSB
Sylhet	Sylhet Sadar	4.35×10^{7}-12.57×10^{8}	1×10^{7}-3.42×10^{7}	4.07×10^{7}-6.35×10^{7}	2.33×10^{7}-5.86×10^{7}	1.14×10^{7}-4.71×10^{7}	1.4×10^{6}-4.2×10^{6}
	Goiyanghat	9.35×10^{7}-12.35×10^{9}	1.88×10^{7}-3.55×10^{7}	3.64×10^{7}-4.6×10^{7}	3.35×10^{7}-4.71×10^{7}	2.33×10^{5}-7.86×10^{5}	2.4×10^{5}-4.2×10^{5}
Habiganj	Habiganj Sadar	9.07×10^{7}-16.21×10^{8}	2.64×10^{7}-9.08×10^{7}	3×10^{7}-6.42×10^{7}	3.28×10^{7}-6.5×10^{7}	1.35×10^{7}-3.71×10^{7}	5.5×10^{6}-2.82×10^{7}
	Nabiganj	7.08×10^{7}-18.27×10^{8}	2.65×10^{7}-11.78×10^{7}	3.40×10^{7}-6.78×10^{7}	2.39×10^{7}-4.35×10^{7}	1.55×10^{7}-6.17×10^{7}	1.8×10^{7}-1.9×10^{7}

AEZ 21: Sylhet Basin

District	Upazila	Union	Microbial population (cfu/g soil)					
			TB	F	Act	R	FLNFB	PSB
Sunam-ganj	Dhirai	Korimpur	9.07×10^{7}-18.21×10^{9}	2.64×10^{7}-5.30×10^{7}	2.14×10^{7}-6.62×10^{7}	8.5×10^{6}-6.14×10^{7}	1.35×10^{7} - 6.07×10^{7}	8.5×10^{6} - 2.28×10^{7}
		Pathariya	14.0×10^{7}-14.9×10^{8}	5.21×10^{7}-11.78×10^{7}	3.10×10^{7}-5.78×10^{7}	6.5×10^{6}-5.14×10^{7}	1.44×10^{7} - 4.30×10^{7}	8.5×10^{6}-2.82×10^{7}

AEZ 22: Northern and Eastern Piedmont Plains

District	Upazila	Microbial population (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Habiganj	Chunarughat	7×10^{6} - 1×10^{9}	7×10^{4} – 2×10^{6}	5×10^{4} - 8×10^{5}	1×10^{3} – 7×10^{3}	4×10^{3} – 2×10^{4}	7×10^{4} - 3×10^{6}
Moulvibazar	Srimangal	2×10^{6}- 1×10^{9}	$2.\times10^{5}$ – 7×10^{5}	2×10^{5} – 2×10^{6}	1×10^{3} – 2×10^{3}	3×10^{3}- 2×10^{5}	1×10^{5} - 2×10^{5}
	Moulvibazar Sadar	2×10^{6}- 2×10^{7}	1×10^{5} – 2×10^{6}	8×10^{4} – 5×10^{5}	1×10^{3} – 8×10^{3}	2×10^{3} – 2×10^{4}	1×10^{5} - 1×10^{6}

AEZ 23: Chittagong Coastal Plain

District	Upazila	Microbial population (cfu/g soil)						
		R	BR	TB	F	Act	PSB	FLNFB
Chattogram	Sitakunda	2.4×10^{6}-4.4×10^{8}	3.0×10^{4}-2.0×10^{7}	4.0×10^{5}-1.5×10^{9}	1.0×10^{5}-3.0×10^{7}	2.0×10^{5}-5.0×10^{7}	1.3×10^{5}-3.6×10^{8}	3.0×10^{4}-8.5×10^{8}
	Mirsharai	1.0×10^{4}-3.5×10^{8}	2.0×10^{5}-2×10^{7}	3.4×10^{4}-7.9×10^{8}	3.0×10^{5}-3.0×10^{7}	5.0×10^{3}-2.0×10^{7}	1.0×10^{5}-5.0×10^{7}	1.0×10^{5}-1.0×10^{7}
Cox's Bazar	Ramu	3.0×10^{5}-9.3×10^{8}	1.3×10^{5}-1.1×10^{9}	1.4×10^{5}-1.4×10^{9}	1.0×10^{4}-2.1×10^{8}	3.0×10^{5}-6.0×10^{6}	1.5×10^{5}-7.4×10^{8}	3.0×10^{5}-6.0×10^{8}
	Cox's Bazar Sadar	1.2×10^{4}-4.6×10^{8}	1.0×10^{5}-1.0×10^{7}	3.0×10^{5}-5.0×10^{6}	1.0×10^{5}-5.0×10^{6}	1.0×10^{5}-1.8×10^{7}	1.0×10^{5}-2.0×10^{7}	1.0×10^{5}-5.3×10^{8}

AEZ 24: St. Martin's Coral Island

District	Upazila	Microbial population (cfu/g soil)						
		R	BR	TB	F	Act	PSB	FLNFB
Cox's Bazar	Teknaf	1.3×10^5-2.5×10^8	1.0×10^5-1.0×10^7	1.0×10^6-1.5×10^9	9.0×10^5-1.4×10^8	1.0×10^5-5.0×10^7	5.0×10^3-2.6×10^8	2.1×10^4-4.2×10^7

AEZ 25: Level Barind Tract

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Bogura	Shibganj	7.2×10^7-17.8×10^7	1.4×10^5-18×10^5	2.5×10^5-8×10^5	3.4×10^5-8.6×10^5	2.4×10^5-12.8×10^5	5.4×10^4-72×10^4	2.6×10^4-18×10^4
	Bogura Sadar	3.2×10^7-27.6×10^7	1.2×10^5-8×10^5	1.5×10^5-8×10^5	8×10^5-19.6×10^5	14×10^5-34×10^5	2.5×10^4-7.4×10^4	1.5×10^4-8×10^4
Naogaon	Naogaon Sadar	1.3×10^7-2×10^7	2×10^4-7.5×10^4	2×10^4-22.5×10^4	2×10^5-5×10^5	2.1×10^4-33×10^4	12×10^4-22×10^4	1×10^4-12×10^4
	Badal-gachi	1.5×10^7-6.3×10^7	3.8×10^5-12.5×10^5	3.25×10^5-10.1×10^5	2.5×10^5-17.5×10^5	7×10^4-30×10^4	1.5×10^4-6×10^4	1.2×10^4-10×10^4

AEZ 26: High Barind Tract

District	Upazila	Microbial population (cfu/g soil)						
		TB	R	BR	FLNFB	PSB	F	Act
Chapai-Nawabganj	Nachol	3.6×10^7-14×10^7	3.8×10^4-14×10^4	3×10^4-8.2×10^4	19.7×10^5-34×10^5	14×10^4-36×10^4	4.2×10^4-15.6×10	6×10^4-10×10^4
	Gomostapur	7.7×10^7-26×10^7	15×10^4-18×10^4	2.4×10^4-9.3×10^4	22×10^5-35×10^5	14×10^5-36×10^5	10.8×10^4-24×10^4	6×10^4-16×10^4
Rajshahi	Godagari	6.4×10^7-22.6×10^7	10×10^4-23×10^4	2×10^4-8×10^4	6.6×10^5-36×10^5	10×10^4-44×10^4	12×10^4-45×10^4	8×10^4-24×10^4
	Paba	2×10^7-8.2×10^7	2.5×10^5-12.5×10^5	1×10^5-3×10^5	2.5×10^5-15×10^5	10×10^4-25×10^4	12.5×10^4-34×10^4	2.5×10^4-10×10^4

AEZ 27: North Eastern Barind Tract

District	Upazila	Microbial population (cfu/g soil)					
		TB	FLNFB	PSB	Act	F	R
Rangpur	Mithapukur	1×10^6 – 5×10^8	2×10^5 - 1×10^6	2×10^5 – 10×10^6	2×10^3 -2×10^4	3×10^3 -1×10^4	1×10^6 – 6×10^8
	Badarganj	9×10^5- 1×10^7	3×10^5 – 9×10^5	2×10^5 – 4×10^5	2×10^3 -1×10^4	5×10^3 -2×10^4	6×10^5 – 3×10^6
Bogura	Shahjahanpur	2×10^6 – 2×10^7	1×10^5 – 2×10^6	8×10^4 – 5×10^5	1×10^3 -8×10^3	2×10^3 -2×10^4	1×10^5 – 1×10^6
	Bogura Sadar	2×10^6 – 1×10^7	3×10^5 – 8×10^5	8×10^4 – 3×10^5	1×10^3 -3×10^3	2×10^3 -9×10^3	3×10^5 – 8×10^5

AEZ 28: Madhupur Tract

District	Upazila	Microbial population (cfu/g soil)					
		TB	F	Act	R	FLNFB	PSB
Tangail	Dhanbari	9.9×10^{7}-14.35×10^{8}	5.2×10^{7}-10.35×10^{7}	3.3×10^{7}-5.05×10^{7}	4.85×10^{7}-9.95×10^{7}	2.45×10^{7}-4.9×10^{7}	2.5×10^{6} -8.5×10^{6}
	Madhupur	12.7×10^{7}-15.35×10^{7}	7.85×10^{7}-9.45×10^{7}	4.20×10^{7}-5.10×10^{7}	9.05×10^{7}-12.55×10^{7}	1.2×10^{7}-4.15×10^{7}	2.5×10^{6}-8.5×10^{6}
Gazipur	Kaliakoir	10×10^{5}-6.26×10^{8}	5.7×10^{5}-5.5×10^{7}	3.4×10^{6}-3.3×10^{7}	4.5×10^{7}-5.78×10^{7}	5×10^{7}-10.35×10^{7}	2.1×10^{6} -5.7×10^{6}
	Gazipur Sadar	9.96×10^{5}-8.9×10^{7}	6.56×10^{6}-6.64×10^{7}	1.56×10^{7}-3.36×10^{7}	5.5×10^{5}-2.42×10^{7}	8.07×10^{5}-4.42×10^{7}	1.4×10^{6}-5×10^{6}

AEZ 29: Northern and Eastern Hills

District	Upazila	Microbial population (cfu/g soil)						
		R	BR	TB	F	Act	PSB	FLNFB
Bandarban	Naikhongchari	1.0×10^{5}-1.6×10^{9}	1.0×10^{5}-3.0×10^{6}	5.0×10^{5}-3.9×10^{7}	5.0×10^{5}-3.8×10^{7}	1.0×10^{5}-8.9×10^{7}	1.0×10^{5}-4.0×10^{6}	6.0×10^{5}-6.3×10^{8}
	Bandarban Sadar	8.0×10^{5}-6.4×10^{8}	1.0×10^{5}-8.0×10^{6}	4.1×10^{5}-1.2×10^{8}	2.0×10^{5}-2.5×10^{7}	2.0×10^{5}-5.0×10^{7}	1.0×10^{5}-2.2×10^{7}	2.0×10^{5}-7.3×10^{8}
Khagrachari	Dighinala	1.0×10^{5}-2.1×10^{8}	2.0×10^{5}-1.0×10^{7}	6.0×10^{7}-2.2×10^{9}	1.0×10^{5}-1.4×10^{8}	1.0×10^{5}-3.2×10^{8}	3.0×10^{5}-9.0×10^{7}	1.0×10^{5}-1.4×10^{8}
	Matiranga	1.0×10^{5}-1.3×10^{8}	1.0×10^{5}-3.0×10^{7}	6.0×10^{5}-8.9×10^{9}	1.0×10^{5}-3.0×10^{7}	1.0×10^{5}-6.3×10^{8}	7.0×10^{5}-1.2×10^{9}	2.9×10^{6}-1.1×10^{9}

AEZ 30: Akhaura Terrace

District	Upazila	Microbial population (cfu/g soil)						
		R	BR	TB	F	Act	PSB	FLNFB
Brahman-baria	Akhaura	1.5×10^{4}-1.0×10^{8}	1.0×10^{5}-4.9×10^{8}	1.2×10^{6}-1.7×10^{8}	6.0×10^{5}-8.0×10^{6}	1.0×10^{4}-8.0×10^{8}	1.0×10^{4}-1.7×10^{8}	1.0×10^{5}-6.7×10^{8}
	Kasba	4.0×10^{5}-4.0×10^{7}	1.2×10^{5}-1.0×10^{8}	1.2×10^{6}-1.7×10^{7}	2.0×10^{6}-1.1×10^{7}	1.0×10^{5}-1.8×10^{8}	2.0×10^{3}-2.0×10^{6}	3.0×10^{4}-3.0×10^{7}
Habiganj	Madhabpur	1.0×10^{5}-2.1×10^{8}	2.0×10^{4}-6.8×10^{8}	2.0×10^{6}-2.7×10^{9}	1.0×10^{5}-1.0×10^{7}	1.0×10^{5}-2.0×10^{7}	1.0×10^{5}-3.0×10^{7}	4.0×10^{5}-6.4×10^{8}

R=*Rhizobium*, BR= *Bradyrhizobium*, TB=Total bacteria, F= Fungi, Act=Actinomycetes, PSB= Phosphate solubilizing bacteria, FLNFB= Fee living N_2 fixing bacteria, cfu= Colony forming unit

4. Fertilizers and Their Use in Bangladesh

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

4.1 Types of fertilizer

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

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

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

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

Compound fertilizer: Fertilizer which contains two or more nutrient elements, e.g. DAP (18%N, 20%P).

Granular fertilize: 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. neem coated urea. Coated fertilizers are slow release fertilizers.

Liquid fertilizer: Fertilizer that is in suspension or solution, e.g. liquor ammonia.

Nanofertilizers- Fertilizers that are of nano sizes particles (below 100 nm).

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

Plant Growth Regulator (PGR): Plants along with sunlight, water, oxygen and mineral nutrients also require certain organic compounds to signal, regulate and control this growth. These organic substances are collect PGR e.g. auxin, cytokinins, gibberellins, ethylene etc.

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

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

Liming material: An inorganic soil conditioner containing Ca or Ca and Mg, generally in the form of oxide, hydroxide, or carbonate, principally intended to raise the pH of a soil. Dololime [$CaMg(CO_3)_2$] is commonly used in Bangladesh.

4.2 Nanofertilizer

Nanofertilizers are developed by the use of nanotechnology. Use of nanofertilizers has many benefits such as improving nutrient use efficiency (N, P, Zn etc.), reducing nutrient loss (erosion, leaching), maintaining soil health, lowering environmental pollution (heavy metals) and thus increasing crop yield. Nano size particles of nanofertilizers (size below 100 nm) provide a high surface area-to-volume ratio that enables plants to take up nutrients slowly and sustainably as needed. One nanometer is one-billionth of a meter i.e. 10^{-9}.

Nano fertilizers may be considered as new frontiers of modern agro-inputs and can revolutionize the field of soil fertility and fertilizer management in Bangladesh. Many researchers have formulated nanofertilizers by incorporating hydroxyapatite $\{Ca_{10}(PO_4)_6(OH)_2\}$ and urea $\{CO(NH_2)_2\}$ to increase delivery of nutrients to the plants. It is evidenced that hydroxyapatite (HA) has many biomedical and agricultural applications because of its excellent bioactivity and biocompatibility.

Nanotechnology has brought numerous developments in the agricultural sector through green nanomaterials, nanofertilizers, nanoagrochemicals, nanopesticides, nanoherbicides, nano biosensors, and nano-based treatment of agricultural wastes to increase the food productivity by foliar and soil application as well as to establish the sustainable agricultural management. Nano-trapped fertilizer filled with biological agents (microorganisms, enzymes) can render long-term profits for crop production.

Although the use of nanofertilizers is a new approach towards smart and sustainable agriculture, their potential threat to plants, soil organisms, and human health should also be carefully considered before commercial application. Accumulation of nanomaterials in the environment and food chain may pose a risk to human health.

4.3 Deep placement of urea

Urea Super Granules (USG) and Urea Mega Granules (UMG) are used to increase nitrogen use efficiency. Urea Super Granules (USG) are small sized granules, each weighing 0.9g or 1.8g and Urea Mega Granules (UMG) are large sized granules, each 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 week of transplanting of rice at 8-10 cm soil depth at the centre of four hills between rows 1 and 2, between rows 3 and 4, and so on. It is possible to save 30% urea-N by using USG or UGM.

With USG, recovery of deep placed N in wetland rice is greater than the N recovery from surface applied and/or incorporated ordinary urea. Fertilizer recovery in the wetland rice plant tops was found significantly higher for deep placed N as USG/UMG/^{15}N (50-60%) than for split-applied Urea ^{15}N (25-34%). About 35% N can be saved by using USG or UMG in rice and 20% in vegetable and fruit crops (viz. cabbage, cauliflower, tomato, potato and papaya).

The main benefit of USG/UMG placement is that the N loss through NH_3 volatilization, denitrification, leaching and surface runoff are significantly minimized. Deep-placed N as USG/UMG is less subject to algal immobilization and uptake by aquatic weeds than broadcast and/or incorporated urea. These two factors contribute to the improved nitrogen use efficiency.

4.4 Biofertilizers

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

Rhizobial biofertilizer

Rhizobial biofertilizer/inoculants are made with bacterial strains that can fix atmospheric N_2 in symbiosis with legumes. They are the members of five bacterial genera: *Rhizobium, Mesorhizobium, Bradyrhizobium, Sinorhizobium* and *Azorhizobium*. The beneficial effect of these organisms in increasing yield of leguminous crops (lentil, chickpea, cowpea, mungbean, blackgram, pigeonpea, grasspea, pea, groundnut and soybean) from fixation of atmospheric nitrogen is well established.

Methods of application of rhizobial biofertilizers

i) Take an amount of seed in a container/bowl.

ii) Add sugarcane molasses (2-3% for large seeds viz. groundnut, soybean etc. and 3-5% for small seeds viz. lentil, mungbean, etc.) and mix with seeds to make them sticky.

iii) Add peat based inoculant (2-3% for large seeds and 3-5% for small seeds) to sticky seeds.

iv) Mix seeds with inoculum until they are coated and appear uniformly black.

v) Dry seeds under shade on a paper. Do not dry in direct sunlight.

vi) There should be a minimum 24-hour gap between seed treatment with fungicide and biofertilizer application.

vii) Use double quantity of biofertilizer in case of pesticide treated seeds.

viii) Sow the inoculated seeds and cover the seeds with soil immediately.

Azolla biofertilizer

Azolla is a floating fern and it fixes atmospheric N_2 in symbiosis with *Anabaena azollae.* In wet land rice, the average N contribution by Azolla is equivalent to 25-40 kg N/ha. Azolla should be applied to standing water @ 3-4 t/ha at 1-2 weeks after transplanting of rice. After 2-3 weeks of its application, water needs to be drained out and Azolla should be incorporated into the soil. Azolla can be grown in the rice field more than once.

4.5 Time and methods of fertilizer application

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

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

- Fertilizers should not be applied too close to seeds, young roots and stems of plants
- Fertilizers should not be applied to plant leaves when they are young and wet.

- Manure and fertilizers should be mixed thoroughly with the soil.
- Urea should not be applied to soil with standing water.
- Manure should be applied 7-10 days before sowing/planting.

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

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

i) During rabi season, if there is no facility for irrigation, the full dose of urea should be applied and mixed with the soil during final land preparation. If irrigation facility is available, urea should be applied in three equal splits, during final land preparation, rapid vegetative growth stage, and 5-7 days before primordial initiation.

ii) In case of rice (except B. Aman rice), urea should be applied in three equal splits, the first split at final land preparation or immediately after seedling establishment, the second split at rapid tillering stage and the third split at 5-7 days before panicle initiation (PI) stage. In case of broadcast rice culture, nitrogen fertilizer should be applied in two equal splits, the first one as basal and the second one at maximum tillering stage.

iii) For vegetables, 2-3 split applications of urea should be adjusted with the growth periods of the crop. For short duration crops the full dose of urea may be applied during final land preparation.

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

v) Phosphate fertilizer should be applied 1-2 days prior to final land preparation and zinc fertilizer should be applied during final land preparation.

vi) The full dose for potassium, sulphur, magnesium and boron fertilizers should be applied as basal during final land preparation. In coarse-textured soils, the potassium fertilizer may be applied in two splits, the one-half at final land preparation and the rest half at rapid tiller stage. Zinc and P fertilizers should not be mixed during storage.

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

viii) For onion, potassium should be applied as K_2SO_4 instead of KCl (MOP).

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

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

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

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

4.6 Rationale of fertilizer use

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

i) More than 60% of added N is lost from soil in different ways (denitrification, volatilization and leaching) and very little or no residue is left into the soil for use by the next crops. Thus, urea fertilizer should be applied at a full rate to every crop. The N rate for T. Aman rice could be reduced by 25-30 kg ha^{-1} if 12-15 tons green biomass of dhaincha (*Sesbania*) is incorporated. This reduction could be 8-10 kg ha^{-1} when stover of grain legumes (*e.g.* mungbean) is incorporated to soil.

ii) Phosphorus availability is low in both acid and calcareous soils. Plant uptake of this element is usually 15-25% of the added amount, thus it produces residual effect on the subsequent crops. Hence, the P rate for the second and third crops could be reduced by 40-50% for rice and jute, and by 30-40% for vegetables.

iii) Potassium availability is low in light textured, terrace and piedmont soils. The K requirement for rice, tuber, jute, sugarcane, fruit and vegetable crops is high. Potassium application should be considered as a maintenance dose even at optimum level of soil K. Potassium application can be reduced by 30-40% in the subsequent crops after potato, sugarcane and vegetables when recommended dose of K fertilizer was 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.

iv) Sulphur availability is low under wetland condition. The S fertilizer (*e.g.* gypsum) has substantial residual effect on the next crops. So, wetland rice should receive full dose of S. Cultivation of rabi crops after harvest of T. Aman rice should receive 50% of the recommended dose of S except for oil seed, maize, potato and vegetable crops, which should receive full dose of S. For 3-rice and 3-vegetables cropping patterns, the 2nd and 3rd crops would receive 50% S dose.

v) Magnesium availability is generally low in piedmont and Tista floodplain soils. Magnesium fertilizer should be applied to rabi crops and also to kharif crops e.g. jute. For wet land rice cultivation, magnesium application is not needed. If dololime ($CaCO_3.MgCO_3$) is used to raise soil pH, application of Mg fertilizer is not needed within three years.

vi) Zinc availability is low in calcareous and wetland rice soils. Zinc fertilizers should be applied to both rabi and kharif crops when grown in calcareous soils (AEZs 10, 11, 12 and 13). For the rice-rice cropping pattern, full dose of Zn should be applied to the 1st crop and 50% dose to the 2nd crop. There is no need to apply Zn fertilizer to the rabi crops when the preceding T. Aman rice has received Zn at a full rate. Maize, potato, vegetables and spices as the 2nd or 3rd crop should receive 50% rate of Zn.

vii) Boron availability is low under dry land condition. Rabi crops should receive boron once a year. In the cropping pattern where rabi is the fallow period then full recommended dose of boron should be applied to the kharif-1 crop.

viii) If organic manure such as cowdung, poultry manure, bioslurry and compost are used, the amount of nutrients from manure should be adjusted with the rates of chemical fertilizers, taking into account of 50% mineralization.

ix) Under rainfed condition, the yield reduction could be 15% for rice and jute, 20% for potato and sugarcane, and 35% reduction for wheat, oilseed, vegetables and spices, for which all the recommended fertilizer nutrients (N, P, K, S, Mg, Zn and B) should be reduced by 25% compared to that with irrigated condition.

x) For an intercropping system, fertilizer dose for the companion crop should be 20-50% of the recommended dose for the crop depending on population and the main crop should receive 100% recommended dose of fertilizers.

4.7 Crop response to added fertilizers

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

Soil test values would be of no value unless they are positively correlated with crop response. Yield responses from applied nutrients can be more closely related to the status of nutrient availability in the soil as determined by soil analysis. A soil test measures part of the total nutrient status in the soil and represents 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 a crop, the soil test values must be calibrated against nutrient rate that 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 an applied nutrient, successive increments of nutrient give successively smaller increases in crop growth or yield. Such curves are known as growth response curves (Fig. 3). From the response function equation, the value of an added nutrient that maximizes crop yield is estimated as follows:

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

Where, Y is the maximum crop growth or yield
a, b and c are co-efficients and
x is 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 an added nutrient depends on soil-crop-climatic variables and production practices. In general, most of the crops are responsive to N fertilizer. Upland and rabi crops grown under strongly acidic and alkaline soil conditions are more responsive to P fertilizers. Oil seed crops and wetland rice are responsive to S fertilizers. Sugarcane and tuber crops are more responsive to K fertilizers. Crops grown on light textured soils respond more to K fertilizers. Crops grown on the calcareous and saline soils respond more to Zn fertilizers. Fertilizer response is more pronounced under irrigated than under rainfed ecosystems. Crops may differ markedly in their requirements of different nutrients. Nonetheless, soil moisture content may affect the response of a crop to fertilizers. Furthermore, fertilizer response of a crop depends on the kinds of fertilizers used, and also on the time and methods of their application. To obtain the maximum benefits from fertilizer use 4R Nutrient Stewardship should be followed – Right source, Right rate, Right time and Right place

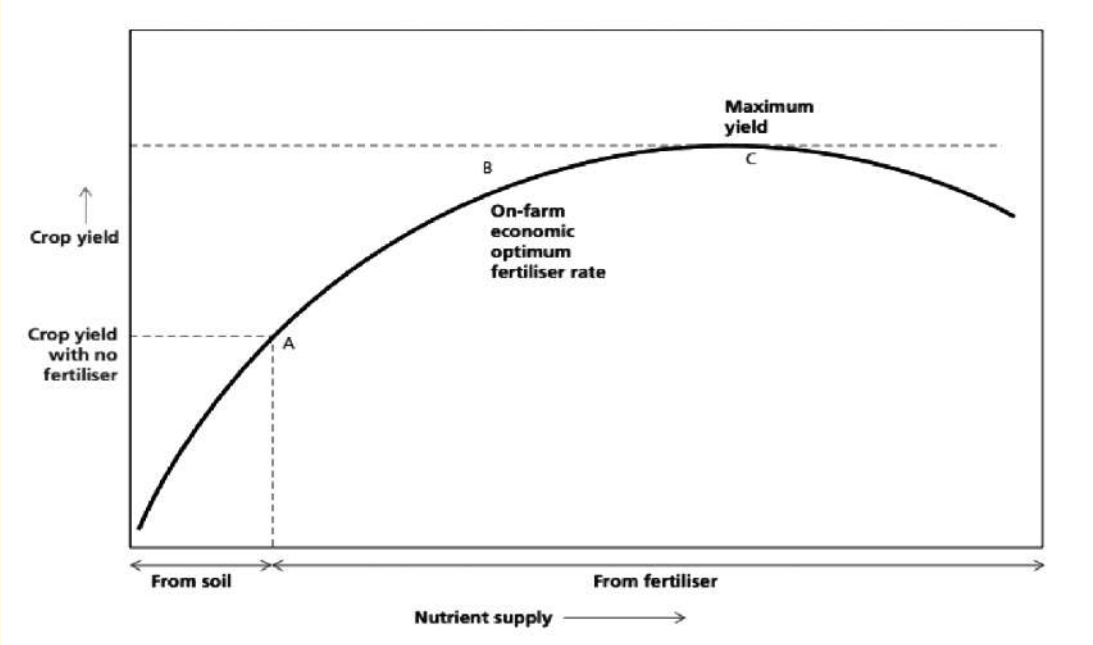


Fig. 3 Crop yield as influenced by nutrient supply from soil and fertilizer sources

4.8 Nutrient use efficiency

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

Agronomic efficiency (AE)

It represents the marginal benefit from investment in nutrient inputs**.**

The formula for AE is:

$AE = GY_{NA}\text{-}GY_{NO}/N_R$

where,

AE = Agronomic efficiency

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

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

N_R = Rate of added nutrient (kg/ha)

Recovery efficiency (RE)

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

Physiological efficiency (PE)

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

4.9 Trend of fertilizer use in Bangladesh

Inorganic fertilizers have been introduced in this country during early 1950's as a supplemental source of plant nutrients. But their use steadily increased from the mid 1960's along with the introduction and expansion of modern high yielding varieties of crops accompanied by the development of irrigation facilities. The increasing trend of fertilizer use, particularly urea-N, still continues (Appendix-1). Until 1980, three primary major plant nutrients (N, P & K) along with one secondary major nutrient (Ca) were supplied from fertilizer to this country's soils. The importance of S and Zn for rice culture in particular was recognized during early 1980's. Gypsum and zinc sulphate, respectively were then introduced to supply these nutrients. Very recently, the deficiencies of Mg, B and Mo have been reported for some soils and crops. Of the total nutrients

used in the country, N alone constitutes about 80 percent, which may lead to nutrient imbalance in soil-plant systems. If this trend of fertilizer use continues along with intensive cultivation of high yielding crop varieties, the productivity of soils is likely to be seriously affected. Factor productivity of nutrients has already been declined. To avert this potential danger, the limiting nutrients must be identified and the soils should be enriched with the addition of those nutrients in a properly balanced fertilization programme. Prior to 1990, only TSP was used by the farmers as a source of P because it was the only P containing fertilizer available in the market that time. After 1990, DAP, another source of P, had been made available in the market. Since these materials vary in their P content, variable amounts of these materials would be required to meet a specific P fertilizer recommendation. It is to be noted that SSP contains S and DAP contains N in addition to P. Therefore, there is a need to adjust for S and N fertilizer application if either SSP or DAP is used as a source of P instead of TSP. A list of commonly used fertilizers with their nutrient content is given in Appendix-2.

Looking at the fertilizer consumption over the years from 1980-81 to 2020-21, use of every nutrient (N, P & K) has increased as the time has advanced, except during 2006-2008 in which time cost of fertilizer became too high which the farmers could not afford (Fig. 4). The N consumption in 1980-81 was 365881 tons which in 2015-16 increased to 1183024 tons. Between P and K, the trend of K use is higher than that of P use. Fertilizer consumption has much increased since the government has given subsidy on fertilizer price (urea, TSP, DAP, MOP and Gypsum).

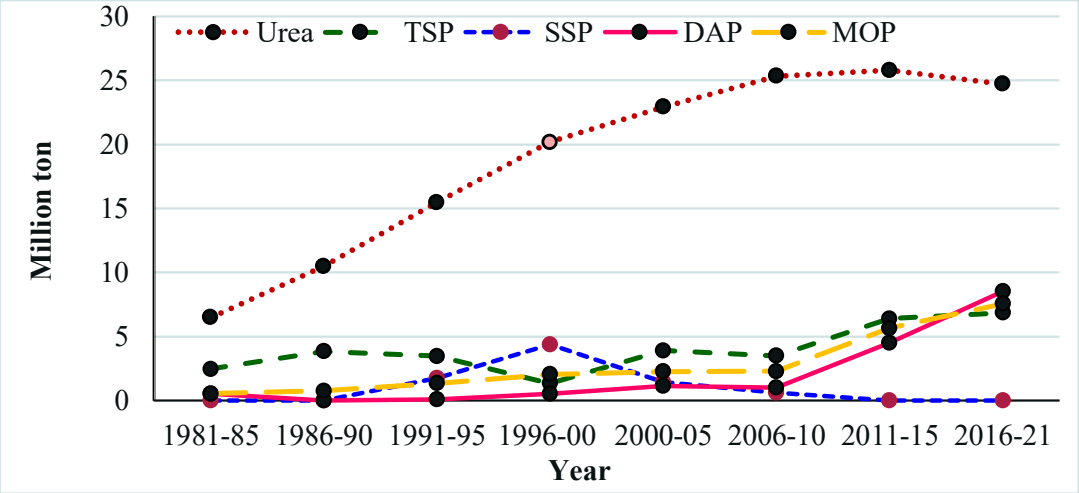


Fig. 4 Consumption of N, P and K fertilizers in Bangladesh during 1981 to 2021. (Annual N+P+K use: Bangladesh 320 kg/ha, India 170 kg/ha, world average 200 kg/ha)

4.10 Negative effects of excess use of fertilizers

Fertilizer application is a prerequisite to supply nutrients (when deficient in soil) to plants for achieving higher and sustained crop yield. Nevertheless, the use of chemical fertilizers can have negative impacts *on* soil, water and crops particularly when *an* excess amount is used. Excess use of fertilizers causes excess uptake of nutrients producing toxic effect on crops. Their residual and unused amounts will become pollutants for air, water, and soil. Overuse of fertilizers can cause soil acidification, soil crust and GHG emissions.

Long-term use of chemical fertilizers viz. urea can decrease soil pH, which in turn affects bacterial activity. Excess and/or continuous use of fertilizers may lead to heavy metal accumulation, eutrophication and accumulation of phosphate and nitrate in plants. Eutrophication is the process by which water body (pond, lake) becomes progressively enriched with mineral nutrients, particularly nitrogen and phosphorus which encourages the growth of algae (algal blooms). Triple superphosphate fertilizer may contain heavy metals such as cadmium and arsenic that may accumulate in soils, plants and enter human body via food chains. Thus, excessive use of fertilizers is detrimental to crop yield, food quality, soil microbial growth and pond water quality (eutrophication. heavy metals pollution). The adverse effects of these synthetic chemicals on human health and the environment can be reduced or eliminated by adopting new agricultural technological practices, preferably following GAP protocols including the use of organic inputs such as manure, biofertilizers, slow-release fertilizers, nanofertilizers, etc.

4.11 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 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.

Good quality urea solution

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 colour and contains 20% total P and 17.4% water soluble P with acidic taste. A good quality TSP is strong acidic in taste with pungent smell but adulterated TSP has no acidic taste and pungent smell.

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

Good quality (Left) and adulterated TSP solution

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)

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

Place one to two teaspoonful of DAP fertilizer on a dry paper and keep it open for one to two hours. If it becomes wet, the fertilizer is of good quality but if it does not wet the DAP is adulterated. For quality testing, pour one teaspoonful of DAP into 100 ml of water in a beaker or glass. The good quality DAP will be dissolved quickly. After dissolution, add half teaspoonful of barium chloride ($BaCl_2$) into the solution. In case of good quality DAP, $BaCl_2$ will be settled down at the bottom of the beaker or glass. On the other hand, adulterated DAP will produce turbid/muddy/hazy precipitate in the solution due to presence of sulphur.

Good quality (Left) and adulterated (Right) DAP solution

Identification of adulterated muriate of potash (MOP)

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

Good quality (Left) and adulterated (Right) MOP solution

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.
If MOP is mixed with synthetic dye (red or any other color), there will be a layer of colour at the upper surface of the solution when dissolved in water. In such cases, undoubtedly, the MOP is adulterated. The colour will stick on to the finger when dipped into the solution. The good quality

MOP will produce light homogenous red colour solution. The colour will not stick on to the finger if deep into the solution.

Identification of adulterated gypsum

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

Good quality Gypsum

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.

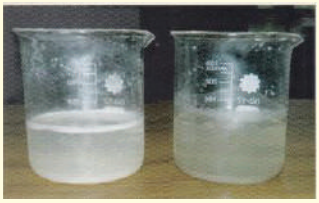
Identification of adulterated zinc Sulphate, heptahydrate ($ZnSO_4.7H_2O$)

Zinc sulphate, heptahydrate is crystalline like sugar. It contains 21% Zn and 10.5% S. The Government of Bangladesh has also approved granular zinc sulphate, heptahydrate for marketing and use in Bangladesh. Good quality zinc sulphate, heptahydrate must be in crystalline form and friable. To know about the quality, pour one teaspoonful of zinc sulphate, heptahydrate in 100 ml water in a glass container or beaker and stir. The good quality zinc sulphate will be totally dissolved and no sediment will be found at the bottom of the beaker or glass container. But in case of adulterated zinc sulphate, heptahydrate there will be sediment at the bottom of the beaker or glass container. Zinc sulphate, heptahydrate is lighter than zinc sulphate, monohydrate in weight.

Good quality $ZnSO_4$ (Hepta-hydrate) solution

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

Zinc Sulphate, monohydrate must be granular and contains 36% Zn and 17.5% S. Good quality Zinc Sulphate, monohydrate is pale white in color but adulterated zinc sulphate may be milk white in colour. To know the quality of zinc sulphate, monohydrate, pour one to two teaspoonful of the fertilizer into 100 ml cool water in a glass container or beaker and stir. The fertilizer will not be dissolved fully and will produce turbid solution.



Good quality (Left) and adulterated (Right) $ZnSO_4$ monohydrate solution

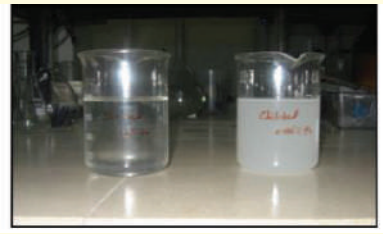
For quality testing, dissolve one to two teaspoonful of zinc sulphate, monohydrate into 100 ml of water in a beaker or glass container, at first some cotton like materials (sediment) will be seen in the whole solution. Allow it for 5-10 minutes, layer of sediment/ precipitate will be seen at the surface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

at the surface. But in case of adulterated fertilizer, precipitation of $MgCO_3$ will be seen at the bottom of the beaker or glass container.

Identification of adulterated chelated zinc

Chelated zinc is a high quality zinc fertilizer. It is a compound of zinc and organic salt containing 10% Zn. Good quality chelated zinc is yellowish powder or fine crystalline in form and very light in weight.

For quality testing, pour one teaspoonful of chelated zinc into 200 ml of cool water in a beaker or glass and stir it. The fertilizer will be dissolved quickly and will produce a clear solution. Add little amount of barium chloride to the clear solution. There will be no precipitation or sedimentation since there is no sulphur. In case of adulterated chelated zinc, when it is poured into cool water, it will not be dissolved quickly. Upon addition of barium chloride white precipitate or sediment will be produced.



Good quality (Left) and adulterated (Right) chelated Zinc solution

Identification of adulterated boron fertilizers

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

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

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

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

Boric acid is heavier in weight than solubor.

Adulterated (Left) and good quality (Right) Boric acid solution

Adulterated (Left) and good quality (Right) 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
- dark grey to black in colour
- odorless
- devoid of bad smell

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

5. Climate Smart Soil Management Practices

5.1 Soil organic matter management

Soil organic matter comes from plant and animal remains. It influences the physical, chemical and biological properties of soil. It improves soil physical conditions viz. soil structure, water holding capacity, aeration, soil erosion etc. It's a storehouse of plant nutrients, chiefly N, P & S. It serves as a food and energy for beneficial organisms viz. N_2 fixing bacteria (e.g *Rhizobium, Azobtobacter*), earthworms. It is the 'life force of a soil'.

Organic matter status

A good soil should have at least 2.5% organic matter, but in Bangladesh most of the soils have less than 1.5%, and some soils have even less than 1% organic matter. As the time advances, organic matter content in soil declines. This is particularly true under high land and medium high land conditions. The long-term fertilizer trials indicate that in the rice-rice (anaerobic-anaerobic) cropping system, the soil organic matter has slightly increased (BRRI and BAU reports) and in the wheat-rice (an aerobic-aerobic) system the soil organic matter has rather decreased (BARI report). Hence, depletion of soil organic matter cannot be generalized across the country. Organic matter status of Bangladesh soils is categorized as very low (0.408 mha, 4.7% arable land), low (2.58 mha, 30.1%) and medium (5.08 mha, 59.2%) (Hasan et al., 2020).

Organic matter mineralization

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

Sources of soil organic matter

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

Crop residues

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

Animal manure

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

Fresh animal manure should not be applied to standing crops, because the heat and CO_2 generated during vigorous decomposition is harmful for the young roots. Substantial quantities of animal manure and their nutrient content are lost due to careless handling. Animal manure should be stored in pits under a shade. The cattle urine is rich in N and should be preserved with the dung. The manure in the pit should be kept moist in order to reduce the volatilization of N. Animal manure generally takes 2-3 months for its decomposition.

Compost

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

like straw, sugarcane trash, rice husk etc. which decomposes very slowly. Microbial accelerator (e.g. *Trichoderma*), if available, may also be used for rapid composting; this is called trichocompost.

In composting, earthworms can play a good role. Earthworms convert organic wastes such as manure or household refuse to valuable compost. This is known as **vermicompost**. Earthworm inhabits organic matter lying on soil surface; eat fallen leaves and other non-decomposed litter. It has also been found to be especially efficient in breaking down the toughest organic wastes like sugarcane trash. Epigeic earthworms are most widely used in vermicomposting, owing to their tolerance to a wide range of temperature and moisture and consumption of large amounts of organic wastes daily. The species most often used for composting include *Eisenia fetida* (red wiggler or tiger worm), then others viz. *Eisenia andrei, Eudrilus eugeniae* and *Lumbricus rubellis.*

Bio-slurry

Bio-slurry is an anaerobically decomposition product of animal manure. Commonly used cowdung or poultry manure is an aerobically decomposition product. After extraction of biogas (chiefly CH_4), bio-slurry comes out of digester. Bio-slurry can be a potential source of organic matter. Fertilizer value of original manure (cowdung, poultry manure) is not hampered when it is turned to bio-slurry. Bio-slurry pit should be shaded to protect it from scorching sunshine and rains. A major limitation of the utilization of bio-slurry is to carry it from the pit to the distant crop field.

Green manure

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

Any herbaceous plant may be used for green manuring, but plants of the family leguminosae are preferred because of the added advantage of getting fixed N. The common GM plants include dhaincha *(Sesbania aculeata),* African dhaincha *(S. rostrata),* sunhemp (*Crotalaria juncea*), cowpea, grasspea, soybean, mungbean, blackgram etc. The crops should be ploughed down when the plants are 50-55 days old. Rhizobial inoculation would be useful to obtain higher biomass in a given period over uninoculated legumes. Dhaincha needs to be incorporated to soil within a week before T. Aman rice planting. A green manure crop may add 10 - 15-ton biomass (fresh weight) per hectare and 60-120 kg of N/ha to the soil. *Azolla* (water fern) can also be used as a green manure in Boro rice field.

Carbon sequestration

Carbon sequestration (carbon sink) is a biochemical process by which atmospheric carbon is absorbed by living organisms including trees, soil microorganisms and crops and involving the storage of carbon in soils with the potential to reduce atmospheric CO_2 levels.

Carbon sequestration is capturing and securely storing carbon dioxide emitted from the global energy system. A large amount of carbon is stored in soils and vegetation, which is our natural carbon sink. Increasing carbon fixation through photosynthesis, slowing down or reducing decomposition of organic matter, and changing land use practices can enhance carbon uptake in these natural sinks. Terrestrial carbon sequestration is the process through which carbon dioxide (CO_2) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and

stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils. Therefore, a carbon sink occurs when carbon sequestration is greater than carbon releases over some time period.

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

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

5.2 Integrated Nutrient Management

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

The INM based fertilizer requirement can be calculated as follows:

$$A = B - C$$

A = Amount of nutrient needed from fertilizer source
B = Total need of a nutrient for a crop on soil test or AEZ basis
C = Amount of nutrient supply from manure application

Example: *Nutrient addition from manure and fertilizers for potato*

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

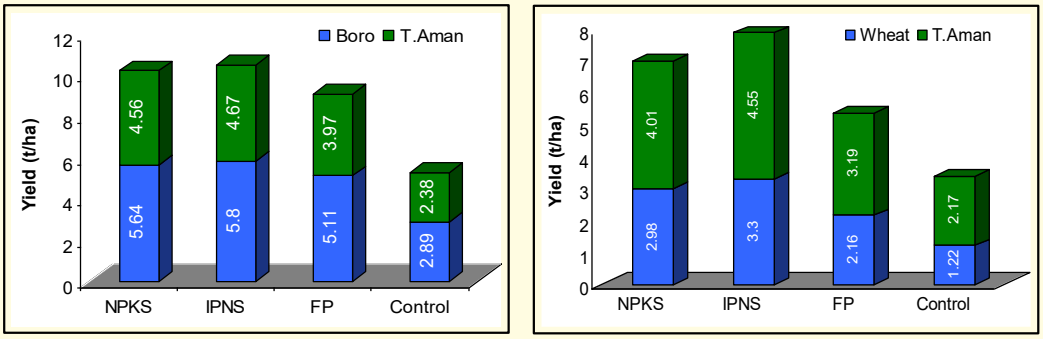


Fig. 5 Effects of different types of nutrient management on the yield of crops

5.3 Biochar

Biochar is a carbon-rich product generated from the pyrolysis of waste biomass under an oxygen-limited condition at relatively low temperature (<700°C). Waste biomass includes sawdust, rice husk, rice straw, wheat straw, sugarcane bagasse, animal litters etc. Biochar application has multiple benefits. It helps carbon sequestration, improvement of soil properties (increase of water holding capacity, decrease of soil acidity, increase of CEC, increase of N, P & K contents, reduction of CO_2 emission, and improvement of crop yield. The method for biochar production includes physical activation, chemical activation, and blending modification, which can improve the properties of biochar such as surface area, pore structure, functional groups, and nutrient contents.

Biochar has high surface area and porous structure, which allows it to retain moisture and nutrients in the soil, and its ability to act as a habitat for beneficial soil microbes. This can be especially useful in areas having light soil texture and very low soil organic matter. Another benefit is that it can help reduce greenhouse gas emissions. When organic matter is heated to create biochar, it undergoes a process called pyrolysis, which releases carbon dioxide. However, the carbon in the biochar is then sequestered in the soil, where it can remain for hundreds of years. So, biochar has the potential to offset some of the carbon emissions that released during the pyrolysis process.

When producing biochar for long-term carbon sequestration in soils, carbon content is almost the sole consideration, but when producing biochars to improve agricultural productivity, the carbon content of the biochar is not the main focus. Other factors of greater importance include structural characteristics and ion exchange capabilities. Due to its aromatic structure, biochar carbon is also chemically and biologically more stable than carbon in the original biomass. This has important implications for carbon sequestration.

Despite of its some potential advantages, biochar use has some disadvantages such as low sorption ability for heavy metals and organic contaminants. It is not commercially available in the market in Bangladesh as because it is still at research stage. Biochar production requires specialized equipment and facilities, which could be costly and unaffordable to smallholder farmers. Additionally, there is still a lack of research on the long-term effects of biochar on soil health indicating that its efficacy is not yet fully understood. Biochar treatment has a detrimental impact

on the growth of heterotrophic soil microorganisms (depend on organic matter for both carbon and energy), many of them are beneficial (*Rhizobium, Azotobacter, Azospirillum* etc.). For this reason, the annual rate of biochar addition to soil should not exceed 2 tons per hectare. Biochar addition enhances CH_4 emissions by 10–14.0%.

5.4 Liming

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

Limimg materials are calcium carbonate ($CaCO_3$), calcium oxide (CaO), calcium hydroxide [Ca(OH)2], magnesium carbonate ($MgCO_3$) and dolomite (dololime). Dololime ($CaCO_3$. $MgCO_3$) is now commonly used in this country. Wood ash, press mud from sugar mills, lime sludge from paper mills and sludge from water treatment plants can also be used as limimg materials.

Liming reactions begin with the neutralization of H^+ in the soil solution by either OH^- or HCO_3^- producing from liming materials. The continued removal of H^+ from the soil solution will ultimately result in the precipitation of free aluminium and iron into insoluble hydroxide forms and their replacement on soil exchange sites with basic cations. Consequently, the soil pH increases with increasing percent base saturation. In Bangladesh dolomitic lime, $CaMg(CO_3)_2$ (called dolochun, imported from Bhutan) is commonly used. Liming increases Ca^{2+} concentrations in the soil solution and thus increases soil pH through the reaction: $CaCO_3 + H^+ = Ca^{2+} + CO_2 + H_2O$. The amount of liming necessary to neutralize soil acidity depends on the soil pH, organic matter and clay contents. Liming is applicable to soils having pH below 5.5 at rate of 1-2 t/ha as dololime. After lime application it takes about 3 months' time to attain a maximum soil pH. Liming should be done in dry season at 3-4 weeks before the next crop is grown. Further liming may not be required within three years.

5.5 Conservation Agriculture

According to FAO (2006), Conservation Agriculture (CA) is a concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment. CA is based on enhancing natural biological processes above and below the ground. This farming system can prevent losses of soil fertility while regenerating degraded soil fertility. It is a promising approach in Bangladesh agriculture having environmental and economic benefits.

Conservation Agriculture (CA) stands on three pillars – Minimum tillage, Crop residue retention and Suitable crop rotations. Minimum tillage refers to minimum soil disturbances which could be zero tillage, strip planting or bed planting. For residue retention, crops will be cut at certain height, may be 30 cm for rice. Crop rotation could be preferably legume based. The 8th World Congress of Conservation Agriculture Declaration (2021) advocated for transformation of paddy rice systems into CA systems with legumes and cover crops.

There are numerous success stories of CA practice leading to sustained soil health, improved crop yields, reduced GHG emissions and cost savings. In Bangladesh, Conservation Agriculture (CA)

is still a relatively new approach for intensively cultivated (3 crops/year) rice-based cropping systems that delivers significant crop produce and residues annually. Recently comprehensive field studies had been completed under the umbrella of CA based NUMAN (nutrient management) project funded jointly by ACIAR and KGF. One of these studies reveal that after 9 years, CA practice with high residue retention under strip tillage, the crops had higher N use efficiency, crop yield, system yield and increased annual gross margin in the rice-wheat-mungbean cropping system while the N fertilizer requirement increased minimally. By eliminating the need for tillage, farmers can save fuel costs and reduce carbon footprint. This can lead to more productive and sustainable farms as a long-term effect.

Despite many benefits, there are some limitations to CA. The one limitation is that the benefits of CA are not usually visible before five years which could be discouraging to many farmers. Another limitation is the increased reliance on herbicides, as the lack of tillage can lead to increase weed growth. Further potential limitation is the initial cost of implementing conservation agriculture; as specialized machinery is expensive. However, these costs may be offset by the long-term economic and environmental benefits of the system Nevertheless, the smallholder farmers can't afford the cost of CA machineries. There are also challenges to uptake and scaling up of the CA practice. The government strategies towards pertinent demonstration and training along with soft loan could help for farmers' realization of CA benefits and thereby wide scale adoption of this noble approach may be possible in the country.

5.6 Organic Agriculture

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

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

6. Fertilizer Management for Special Farming Systems

6.1 Multiple cropping

Multiple cropping is an important practice to minimize risks and increase crop production. The idea of multiple cropping is maximizing crop production per unit area with the minimum soil deterioration. As an approach towards planning of resources, multiple cropping is a time dimension land use effort within a calendar year through repeated cropping. It's a labour intensive and highly productive cropping practice which can lead to an increased crop production, greater income, and an opportunity for diversified agriculture. Smallholder farmers especially with limited land but high available labour resources can be benefited from multiple cropping.

For intercrops fertilizer recommendations are made on the basis of the intercrop plant population in the field. Usually half or one-third of the recommended rates of fertilizers for a particular crop is recommended depending on the plant population. Examples of fertilizer recommendations for different mixed and intercropping systems are given in section 11.4 of this Guide.

6.2 Homestead gardening

Homestead gardening is done on a small scale in the backyard or front yard of a house. The basic purpose of homestead gardening is to grow fresh and safe food in a healthy environment for family consumption. Traditionally, homestead gardening in Bangladesh is the activity of rural households. Home gardening activities are centered on women; thus, it creates opportunity for women empowerment. The gardening activities are mainly seasonal, where about 70% of vegetables and fruits are produced in the winter, less than 10% of homestead gardens grow vegetables year-round. Helen Keller International initiated a nationwide homestead gardening program which aimed at encouraging poor households with very limited land to grow vegetables year-round. Home gardening is especially important in overcoming seasonal availability of foods and promoting household self-sufficiency. Home gardening can be a good source of family income and good source of minerals, especially micronutrients (e.g. Zn, Fe) and vitamins (e.g. A, C). Homestead gardens can play a good role to reduce malnutrition as well as poverty.

Table 6. Fertilizer management for vegetables and fruits in homestead gardens (per decimal or 40.5 m^2)

Vegetable	Fertilizer rate (g) and time of application (day)											
	CD (kg)	TSP	Gypsum	$ZnSO_4$	Boric acid	MOP			Urea			
						Basal	TD1*	TD2*	Basal	TD1*	TD-2*	TD-3*
Raddish	30	2250	400	30	50	500	200	200	600	450	450	-
Tomato	40	2000	400	30	50	400	300	300	-	800	700 (25)	700(40)
Brinjal	40	2500	400	30	50	600	300	300	-	500	600 (flowering)	600 (fruiting)
Cabbage	40	1500	400	30	50	600	-	400	-	500	500(25)	600(40)
Bottle gourd	60 (pit)	1000/ pit	200/ pit	25/ pit	20/ pit	200/ pit	125/ pit (40)	125/ pit (70)	-	100/ pit (25)	500 (25)	600(40)
Bitter gourd	40 (4/pit	1250 (125/ pit	200 (20/pit)	20 (pit2)	10 (pit1)	300 (30/pit)	12/ pit(30)	-	-	220 (15)	220 (30)	220 (55)

Indian spinach	20	600	200	-	-	240	-	-	-	30 (15)	250 (25)	250 (35)
Ash gourd & sweet gourd	60 (pit 10)	270/ pit	40/ pit	3/pit	-	30/ pit	45/ pit	45/ pit	-	50/ pit (15)	70/ pit (35)	70/ pit (50)
Red amaranth	40	600	200	-	-	240	-	-	120	120 (15)	-	-
Stem amaranth	60	1000	250	20	-	600	-	-	400	400	-	-
Sponge gourd	10/ Pit	400/ pit	200	20	-	40/ pit	30/ pit (25)	30/ pit (40)	-	50/ pit (15)	100/ pit (35)	100/ pit (55)

TD1*= First top dressing; TD2*=Second top dressing; TD3*=Third top dressing

6.3 Hydroponic culture

Hydroponics is a type of farming where crops grow directly in nutrient-rich water, not in soil. Roots absorb nutrients from the water and meet their growth requirements using this method.

It is an important practice since arable land is decreasing and it has special significance in the coastal areas. Advantages of hydroponic culture are: (i) Plants are healthier and mature faster, (ii) Weeds can be easily controlled, (iii). Susceptibility to pests and diseases is negligible, (iv). Water present in the system can be re-used, (v) Small production space can be optimized effectively. A well-designed hydroponic system, with a multi-level bedding structure, is characterized by less wastage of water and nutrients than soil-based farms. Both water and nutrients are fed directly to the root structure of the plants and recycled through the hydroponic system. Hydroponic is the best way for vegetable cultivation. Besides this, it allows vertical farming which helps fulfill the demand for nutritious food of smallholder farmers. Vegetables can be cultivated in this way throughout the year. The crops could be chosen tomato, lettuce, capsicum, peppers, strawberries, bitter gourd, cucumber etc. There are three types of soil less culture. In hydroponics, plants are suspended in water full-time or fed by an intermittent flow of water. Aeroponic plants are suspended in air and nutrients are sprayed onto their roots from time to time. Aquaponics is a unique combination of hydroponics and fish farming in an integrated system.

6.4 Rooftop gardening

A roof top garden is established on the roof of a building. Hydroponic systems and plantings in containers (filled with soil) are used extensively in rooftop gardens. In the hydroponic system the plants are grown without soil, using

mineral nutrient solutions. Terrestrial plants may be grown with their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as gravel. The nutrients in hydroponics can come from an array of different sources; these can include but are not limited to byproduct from fish waste, duck manure, or normal nutrients. Some shades are required for some delicate plants like orchids and green leaves. Water source and clear drainage system are a must. Regular irrigation i.e. daily watering is a must in the hot summer days. Shallow-rooted edibles like lettuce, radishes, tomatoes, peppers, straw barriers, herbs, okras, egg plants, beets, carrots and beans are easily produced in different sized containers. Fruit trees like mangoes, litchis, guavas, lemons etc can also be grown in pots, but need large containers. Rooftop gardening is becoming popular day by day with the introduction of the multi-storied building, as in Dhaka city. There are many benefits of rooftop gardening. Apart from food supply, roof plants are beneficial for control of carbon emission and supply of oxygen to the atmosphere and filtering out harmful carbon dioxide from the atmosphere.

As benefits, apart from crop produce, green roofs provide shade, remove heat from the air, and reduce temperatures of the roof surface and surrounding air.

Vegetable crops under rooftop gardening

6.5 Floating agriculture

Floating agriculture is an age old agricultural practice in the southern districts (Barishal, Goplaganj and Pirojpur) of Bangladesh, where the agricultural lands remain water-logged for a longer period. The United Nation (UN) organization recognizes it as a national heritage of Bangladesh. The scientists of Bangladesh Agricultural Research Institute (BARI) has taken an initiative since long time to improve the production practices under the floating agriculture system, mostly on vegetable and spice crops for improving yield. Their effort has brought a good success.in it.

Turmeric and some vegetable crops on floating bed

The floating bed should be prepared in the water-logged areas during monsoon. This is usually made of water hyacinth (*Eichhornia crassipes*), if water hyacinth is not available other materials such as dularilota, paddy straw, nalkhagra (a freshwater wetland plant), and any other available organic materials like azolla, coconut husk, bamboo, obsolete jute ropes etc. can be used. Well-rooted, mature and tall water hyacinth is better for making floating bed. Decomposition rate of this type of water hyacinth is slow and thus help increase the durability of bed. An ideal bed should be 9.15 meters in length, 1.40 meters in width and 1.20 meters in height (30 feet in length, 4.5 feet in width and 4.0 feet in height). Water hyacinth should be stacked in layers up to the desired height with roots at the edges, and stems and leaves at the inner side of the bed. Durability of bed is increased if water hyacinth is stacked on bamboo ladder-shaped structure, mounted with plastic net and the water hyacinth is stalked twice at an interval of 10-12 days. On top of the bed a 12-15 cm thick layer of topapana (*Salvinia cucullata*) can be given, which keep the crops not to come in contact with the water. The crops obtain nutrients from floating beds, so fertilizer requirement for crops becomes the minimum. The vegetables grow comparatively faster on floating beds than on normal beds. It is an eco-friendly agriculture system enhancing the environmental value of wetlands.

6.6 Sorjan farming

Fields with higher soil salinity and flooding deeper than 90 cm during monsoon are not suitable for growing HYV T. Aman rice, thus farmers grow traditional varieties of rice having low yields ranging from 1.5 to 2.0 t/ha. In replace, s*orjan method* could be practiced, as being followed in Patuakhali region. In this technique, the land is divided into several raised subplots. Here, pattern basis year-round vegetables and quick-growing fruits are grown on the beds and seasonal fish cultivation is done during monsoon at the canals or sinks. This water is also used for irrigation during dry season.

The BARI (OFRD) has developed a model which suggests a piece of land with 12 m long and 11 m wide. Alternate rows and ridges furrows are constructed. After preparation of the beds, the soil should be placed on the top, making the beds at least 1 m high. A trench in between two beds could be about 10.5m x 1.5 m x 1.25m. Thus 5 beds and simultaneously 5-6 trenches should be prepared. A canal should be constructed around the periphery of the 'Sorjan' which may protect the crops from the animal. Slopes of the beds should be leveled by the spade. The size of the beds may vary according to the size of the field and the level of monsoon flooding. The top of the high beds should be at least 60 cm above the flood level and should be 1.5 to 2.0 m wide.

Selection of crops depends on the size of the *Sorjan*, farmers' preferences and demand in the local market. Crops found most suitable and profitable in the region are listed below.

Vegetables	Eggplant, Chilli, Capsicum, Tomato, Spinach, Indian spinach, Cabbage, Cauliflower, Kholkhol, Amaranth, Lalshak (Red amaranth), Coriander, Okra, Carrot, Country bean, Yard long bean, Sweet gourd, Field pea, Kangkong
Fruits	Papaya, Lemons, Melons, Watermelon
On the rim & slopes of the high beds	Bottle gourd, Ash gourd, Bitter gourd, Snake gourd, Ribbed gourd, Cucumber, Pointed gourd
Low bed	Fish and/or Duck

A small amount of cow dung, compost or poultry litter should be applied to the soil before planting of the crops. Most of the crops are pit-based. Use of farm yard manure, compost and vermi-compost are encouraged while that of chemical fertilizers is discouraged.

6.7 Fertilizer management in different fragile ecosystems

Agroecologically there are some disadvantageous areas in this country which the Bangladesh Delta Plan 2100 recognizes as hotspots. In other words, these can be called as fragile ecosystems which include hills, coasts, haors, charlands, and barinds. The soils in these areas are not productive and the cropping intensity is low because of some constraints e.g. soil erosion, salinity, floods, drought and low soil fertility. So, attention is needed how to improve crop production in these ecosystems. Obviously, development of stress tolerant crop varieties accompanied with efficient soil and crop management are essential.

Recently BARC has published a book on fragile ecosystems which focuses biophysical characteristics (land, soil, climate), land use, cropping systems, agroforestry, livestock, fisheries, agricultural mechanization, marketing, agricultural constraints and strategic investment opportunities (*Source: Bokhtiar at al., 2023*).

Char ecosystem

Char land (9,16,894 ha) covers the land masses formed through accretion of sedimentation of huge amounts of sand (upper part of the country), silt (central part) and clay (lower part) over time carried by three of the mightiest rivers of the world, the Padma, the Meghna, the Brahmaputra-Jamuna and their numerous tributaries. The greatest spread of chars exists in the Jamalpur district, followed by the chars in Kurigram district. The Noakhali district possesses the greatest number of such coastal chars followed by Patuakhali and Bhola districts. Land instability is a great problem. Other problems include coarse textured soils, low water holding capacity, low nutrient capacity, river bank erosion and flooding for achieving satisfactory yield of a crop. The cropping intensity is low, averagely 145%. Major crops grown in the char lands are maize, groundnut, mustard, sesame, vegetables (brinjal, sweet gourd etc.).

Haor ecosystem

Haor (8,73,524 ha) is a wet land ecosystem in the north-eastern part of Bangladesh. The core haor area is spread over larger parts of Sunamganj, Habiganj, Moulvibazar and Sylhet districts. It also exists in Kishoreganj, Netrokona and Brahmanbaria districts. Haor is a basin like structure, which remains either stagnant in water or flash flooding condition during the months of June through November. Some large haors are Hakaluki haor, Tangua haor, Kawadighi haor, Hail Haor and Balai haor. The major problems related to crop production in these areas are flash flood, strong soil acidity, heavy soil texture, nutrient deficiency and difficult communication. The cropping intensity is low, 133% on an average. It is predominantly a single cropped (Boro rice) area; however, in many areas T. Aman rice, mustard and some vegetable crops are grown. Fertilizer recommendations for different crops/cropping patterns are stated in section 8 under the AEZs 20 and 21.

Barind ecosystem

Barind areas (27,76,330 ha) cover the most parts of the greater Dinajpur and Rangpur districts under Rangpur division, and Pabna, Rajshahi, Bogura, Joypurhat and Naogaon districts under Rajshahi division. It occupies three agroecoogical regions – AEZ 25 (Level Barind Tract), AEZ 26 (High Barind Tract) and AEZ 27 (North Eastern Barind Tract). It is also popularly known as *Varendra Bhumi* in Bangla. Barind is a comparatively high and undulating region with reddish and yellowish clay soils. Hard soil clay, drought, heat stress, declined groundwater level and low annual rainfall are the major constraints for crop production. Crop production is comparatively more constrained in AEZ 26 than in AEZ 25 and AEZ 27. Fertilizer recommendations for different crops and cropping patterns are given in section 8 under the AEZs 25, 26 & 27.

Coastal ecosystem

Coastal areas are spread over 19 southern districts - Jashore, Narail, Gopalganj, Shariatpur, Chandpur, Satkhira, Khulna, Bagerhat, Pirojpur, Jhalakati, Barguna, Barishal, Patuakhali, Bhola, Laxmipur, Noakhali, Feni, Chattogram and Cox's Bazar. The environmental challenges include tidal surge, cyclone, acid sulphate soils (located at Sundarbans and Chakaria), water-logging in polder areas, river erosion and unstable atolls. Mangrove forest under Satkhira district lies in the coastal region. The coastal and offshore areas include tidal, estuarine and meander floodplains. Both area and magnitude of soil salinity increase with time. As estimated by SRDI, the salinity area in 1973 was 0.83 mha, in 2000 was 1.02 mha and in 2009 it became 1.06 mha. Saline soils have a high content of soluble salts. The EC value of saturated extract is more than 4 dS/m at 25^0C, ESP value is less than 15 and the pH value is below 8.5. The agricultural production constraints include soil and water (irrigation) salinity, high flooding depth in monsoon season, late draining, heavy soil consistency, poor soil fertility status, high osmotic pressure (causing reduction in absorption of water and nutrients), poor soil structure and cyclonic storm surges. The salinity increases in dry months showing a peak in Marh-April and decreases in wet months with the minimum in July-August. Growing of salt tolerant crops and varieties, improving drainage system, green manuring and use of mulches could be good options for crop production in this soil. The cropping intensity is averagely 127%. Field crops viz. rice (Boro & T. Aman), vegetables (brinjal, cabbage, cauliflower, tomato), sunflower, sesame, water melon, mungbean, etc. are grown in the areas. Fertilizer recommendation for crops/cropping patterns is presented in section 8 under the AEZ 13.

Hill ecosystem

The Hill areas occupy 1,836,605 ha (12.7% of the country's total area) which exist in three divisions – Chattogram, Sylhet and Mymensingh. Hilly areas fall under the AEZ 29 (Northern and Eastern Hills). Chattogram Hill Tracts (CHT, 75% of total hills) is located in the southeastern part of the country covering three districts - Rangamati, Bandarban, and Khagrachari. The major constraints are sloppy lands, soil erosion (by heavy downpours in July-August), deforestation, inadequate irrigation facility, soil acidity, limited volume of soil for root anchorage, low soil organic matter and jhum cultivation. Cropping intensity (CI) is only 129% which is much lower than country's average CI (198%). Soil erosion causes due to sloppy land and jhum cultivation. Jhum cultivation (shifting cultivation after slash and burning) and deforestation are the predominant form of land degradation. Soil erosion can be reduced by some practices like terracing, contour planting and stubble mulching. Steep slopes should be better left under perennial plants and permanent cover. Field crops are grown in the foot of hills; the crops are mainly cowpea, vegetables (sweet gourd, bitter gourd & cucumber), sugarcane, and rice (T. Aus, T. Aman and Boro). The single cropped area 68.1% (country's average 26.1%), double cropped area 28.3% and triple cropped area 3.6%. Fertilizer recommendation for crops/cropping patterns is shown in section 8 under the AEZ 29.

7. Fertilizer Recommendation for Crops

7.1 Cereal Crops

RICE (*Oryza sativa* L.)

Boro rice

(Var: BRRI dhan29, BRRI dhan58, BRRI dhan89, BRRI dhan92, BRRI dhan96, Bangabandhu dhan100, BRRI dhan102, Binadhan-14, Binadhan-18, Binadhan-24, Binadhan-25**)**

Yield Goal: 7.5 ± 0.75 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF* (t/ha)
	N	P	K	S	Zn	
Optimum	0-58	0-6	0-40	0–6	–	2
Medium	59-116	7-12	41-80	7–12	0.0–1.3	
Low	117-174	13-18	81-120	13–18	1.4–2.6	
Very low	175-232	19-24	121-160	19–24	2.7–3.9	

OF=Organic fertilizers

Boro rice

(Var: BRRI dhan28, BRRI dhan50, BRRI dhan63, BRRI dhan67, BRRI dhan81, BRRI dhan84, BRRI dhan86, BRRI dhan88, Binadhan-8, Binadhan-10)

Yield Goal: 6.0 ± 0.6 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF* (t/ha)
	N	P	K	S	Zn	
Optimum	0-46	2	0-32	0-5	0	2
Medium	47-92	6-10	33-64	6-10	0-1.0	
Low	93-138	11-15	65-96	11-15	1.1-2.0	
Very low	138-184	16-20	97-128	16-20	2.1-3.0	

Method of fertilizer application:

a) In general, all of P, K, S and Zn fertilizers should be applied as basal during final land preparation. S and Zn can be topdressed if needed (depending on symptom).
b) For light textured soils, half of K should be applied as basal and the rest half should be applied with last N topdressing.
c) 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.
d) Under direct seeded culture fertilizer should be applied in two equal splits, the first one as basal and the second one at maximum tillering stage; and should be mixed thoroughly with the soil as soon as possible for better utilization.

e) About 30% urea-N would be saved when USG-N is used. If the dose of N is 150 kg/ha, 110 kg N/ha should be applied as UMG (2.7 g each) and the rest 40 kg N/ha to be top dressed as prilled urea at one week before panicle initiation.

Aus rice

(Var. BRRI dhan48, BRRI dhan82, BRRI dhan85, BRRI dhan98, BRRI dhan106, Binadhan-21**)**

Yield Goal: 5.0 ± 0.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0-24	0-4	0-22	0–3	–
Medium	25-48	5-8	23-44	4–6	0.0–0.7
Low	49-72	9-12	45-66	7–9	0.8–1.4
Very low	73-96	13-16	67-88	10–12	1.5–2.1

Aus rice

(Var. BRRI dhan27, BRRI dhan83, Binadhan-19**)**

Yield Goal: 4.0 ± 0.4 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–21	0-3	0-19	0–2.5	–
Medium	22–42	4-6	20-38	2.6–5.0	0.0-0.5
Low	43–63	7-9	39-57	5.1-7.5	0.6–1.0
Very low	64–84	10-12	58-75	7.8–10	1.1–1.5

T. Aman rice

(**Var:** BRRI dhan72, BRRI dhan73, BRRI dhan87, BRRI dhan93, BRRI dhan94, BRRI dhan95, BRRI dhan103, Binadhan-16, Binadhan-17, Binadhan-22, Binadhan-23)

Yield Goal: 6.0 ± 0.6 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–30	0-5	0-27	0-4	–
Medium	31–60	6-10	28-54	5-8	0-0.9
Low	61–90	11-15	55-81	9-12	1.0-1.8
Very low	91–120	16-20	82-108	13-16	1.9-2.7

T. Aman rice

(Var: BR22, BR23, BRRI dhan30, BRRI dhan33, BRRI dhan46, BRRI dhan49, BRRI dhan51, BRRI dhan52, BRRI dhan62, BRRI dhan70, BRRI dhan71, BRRI dhan75, BRRI dhan76, BRRI dhan77, BRRI dhan78, BRRI dhan79, Binadhan-7, Binadhan-11, Binadhan-12, Binadhan-15, Binadhan-16, Binadhan-17, Binadhan-20**)**

Yield Goal: 5.0 ± 0.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0-24	0-4	0-22	0–3	–
Medium	25-48	5-8	23-44	4–6	0.0–0.7
Low	49-72	9-12	45-66	7–9	0.8–1.4
Very low	73-96	13-16	67-88	10–12	1.5–2.1

T. Aman rice

(Var: BRRI dhan34, BRRI dhan90, Binadhan-12, Binadhan-13)

Yield Goal: 4.0± 0.4 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0-19	0-3	0-18	0-2.5	–
Medium	20-38	4-6	19-36	2.6-5.0	0.0–0.7
Low	39-57	7-9	37-54	5.1-7.5	0.8–1.4
Very low	58-76	10-12	55-72	7.6-10	1.5–2.1

Method of fertilizer application: Please follow the method as described in page 76.

T. Aman rice

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

Yield Goal: 3.0 ± 0.3 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–18	0-2.5	0-16	0–2.5	–
Medium	19–36	2.6-5.0	17-32	2.6–5.0	0.0-0.6
Low	37–54	5.1-7.5	33-48	5.1–7.5	0.7–1.2
Very low	55–72	7.6-10	49-64	7.6–10	1.3–1.8

B. Aman rice

(Variety: BRRI dhan91)
(Var. LIV under Broadcast Culture)

Yield Goal: 2.5 ± 0.25 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–12	0-2.5	0–10	0–2	–
Medium	13–24	2.6-5.0	11–20	3–4	0.0–0.5
Low	25–36	5.1-7.5	21–30	5–6	0.6–1.0
Very low	37–48	7.6-10	31–40	7–8	1.1–1.5

Fertilizer recommendation for seedbed

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

WHEAT (*Triticum aestivum*)

[Var: BARI Gom 25, BARI Gom 28, BARI Gom 30, BARI Gom 32, BARI Gom 33, BWMRI Gom 1, BWMRI Gom 2, BWMRI Gom 3, BWMRI Gom 4, BWMRI Gom 5.

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF* (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–40	0-10	0–30	0–5	–	–	–	2
Medium	41–80	11-20	31–60	6–10	0–4	0.0–1.3	0.0–1.0	
Low	81–120	21-30	61–90	11–15	4–8	1.4–2.6	1.1–2.0	
Very low	121–160	31-40	91–120	16–20	7–12	2.7–3.9	2.1–3.0	

Method of application (Irrigated culture):

a) Two-thirds of the N and all of P, K, S, Mg, Zn, B and organic manure (if used) should be applied as basal during final land preparation.

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

MAIZE (*Zea mays*)

(Var: BARI Hybrid Bhutta-9, BARI Hybrid Bhutta-13, BARI Hybrid Bhutta-14, BARI Hybrid Bhutta-15, BARI Hybrid Bhutta-16, BARI Hybrid Bhutta-17, BWMRI Hybrid Maize-1, BWMRI Hybrid Maize-2)

Yield Goal: 11.0 ±1.1 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF* (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–80	0–18	0–45	0–12	0–5	–	–	3
Medium	81–160	19–36	46–90	13–24	6–10	0.0–2.0	0.0–1.0	
Low	161–240	37–54	91–135	25–36	11–15	2.1–4.0	1.1–2.0	
Very low	241–320	55–72	136–180	37–48	16–20	4.1–6.0	2.1–3.0	

Method of application:

Rabi season:

a) One-third of nitrogen and all of P, K, S, Zn, B, and organic manure (if any) should be applied during sowing in 7–10 cm deep furrows (7–10 cm apart from the rows) and covered with the soil.

b) Half of the remaining N should be applied at 50-55 DAS and the rest half should be applied at tasselling stage (80-85 DAS) as side dressing immediately after irrigation.

Kharif season:

a) For Kharif season the dose may be reduced by 30%. All of P, K, S, Mg, Zn and B should be applied during sowing in 7–10 cm deep furrows (7–10 cm apart from the rows) and covered with the soil.

b) The remaining N should be applied in two equal splits as side dressing in rows at 8–10 leaf stage (20–25 DAS) and at tasseling stage (45–50 DAS) and mixed thoroughly with the soil.

BARLEY (*Hordeum vulgare*)

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

Yield Goal: 3.0 ± 0.3 t/ha

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

Method of application:

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

b) Remaining N should be applied as topdress followed by light irrigation at 55-60 DAS for barley and foxtail millet and 30-35 DAS for proso millet.

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

PROSO MILLET (*Panicum miliaceum*)

(**Var.** BARI Cheena-1)

Yield Goal: 2.5 ± 0.25 t/ha

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

Method of application: as mentioned in barley.

FOXTAIL MILLET (*Setaria italica*)

(Var. Titas, BARI Kaon-2 and BARI Kaon-3, BARI Kaon-4)

Yield Goal: 3.0 ± 0.3 t/ha

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

Method of application: Same as barley.

7.2 Fibre Crops

JUTE (*Corchorus capsularis*)

(Var. CVL 1, CVE 3, CC 45, BJRI Deshi Pat 5, BJRI Deshi Pat 6, BJRI Deshi Pat 7, BJRI Deshi Pat 8, BJRI Deshi Pat 9, BJRI Deshi Pat 10, BJRI Deshi Pat shak 1**,** Binadeshipat-2, Atompat-38)

Yield Goal : 3.5 ± 0.35 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0-30	0-4	0-22	0-6	–
Medium	31-60	5-8	23-44	7-12	0.0–1.5
Low	61-90	9-12	45-66	13-18	1.6–3.0
Very low	91-120	13-16	67-88	19-24	3.1–4.5

Method of application:

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

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

c) Application of 3 t/ha organic fertilizer is recommended; if applied, the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

JUTE (*Corchorus olitorius*)

(Var. O 4, O 9897, BJRI Tossa Pat 4, BJRI Tossa Pat 5, BJRI Tossa Pat 6, BJRI Tossa Pat 7, BJRI Tossa Pat 8, BJRI Tossa Pat 9)

Yield Goal: 4.4 ± 0.44t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0-35	0-6	0–25	0-6	–
Medium	36-70	7-12	26–50	7-12	0.0–2.0
Low	71-105	13-18	51–75	13-18	2.1–4.0
Very low	106-140	19-24	76–100	19-24	4.1–6.0

Method of application: Same as jute (*Corchorus capsularis*)

KENAF (*Hibiscus cannabinus*)

(Var. HC 2, BJRI Kenaf 2, BJRI Kenaf 3, BJRI Kenaf 4)

Yield Goal: 3.5 ± 0.35 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0–30	0–5	0-22	0-6	–
Medium	31–60	6–10	23-44	7-12	0.0–1.5
Low	61–90	11–15	45-66	13-18	1.6–3.0
Very low	91–120	16–20	67-88	19-24	3.1–4.5

Method of application: Same as jute (*Corchorus capsularis*)

MESTA (*Hibiscus sabdariffa*)

(**Var.** HS 24, BJRI Mesta 2, BJRI Mesta 3, BJRI Mesta 4)

Yield Goal : 3.5± 0.35 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)				
	N	P	K	S	Zn
Optimum	0-27	0-4	0–20	0-6	–
Medium	28-54	5-8	21–40	7-12	0.0–1.5
Low	55-81	9-12	41–60	13-18	1.6–3.0
Very low	82-108	13-16	61–80	19-24	3.1–4.5

Method of application: Same as jute (*Corchorus capsularis*)

LATE JUTE SEED PRODUCTION

JUTE (*Corchorus capsularis*)

(Var. CVL 1, BJRI Deshi Pat 5, BJRI Deshi Pat 6, BJRI Deshi Pat 7, BJRI Deshi Pat 8)

Yield Goal (Seed): 900-1000 kg/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF* (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-29	0-4	0–20	0-6	–	0	
Medium	30-58	5-8	21–40	7-12	0.0–1.5	0-1.0	3
Low	59-87	9-12	41–60	13-18	1.6–3.0	1.1-2	
Very low	88-116	13-16	61–80	19-24	3.1–4.5	2.1-3	

*OF: Organic Fertilizer

Method of application:

a) All of P, K, S, Zn and organic fertilizer (if any) should be applied, as basal during final land preparation.

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

c) Application of 3 t/ha OF is recommended; if applied, the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

JUTE (*Corchorus olitorius*)

(**Var.** O 9897, BJRI Tossa Pat 4, BJRI Tossa Pat 8, BJRI Tossa Pat 9)

Yield Goal (seed): 900-1000 kg/ha.

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-30	0–5	0–20	0–5	–	–	
Medium	31-60	6–10	21–40	6–10	0.0–1.5	0.0–1.0	3
Low	61-90	11–15	41–60	11–15	1.6–3.0	1.1–2.0	
Very low	91-120	16–20	61–80	16–20	3.1–4.5	2.1–3.0	

Method of application: Same as jute (*Corchorus capsularis*) for seed production

KENAF (*Hibiscus cannabinus*)

(Var. HC 2, BJRI Kenaf 2, BJRI Kenaf 3, BJRI Kenaf 4)

and

MESTA (*Hibiscus sabdariffa*)

(**Var.** HS 24, BJRI Mesta 2, BJRI Mesta 3, BJRI Mesta 4)

Yield Goal (Seed): 800-1000kg/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–30	0–5	0–20	0–5	–	–	
Medium	31–60	6–10	21–40	6–10	0.0–1.5	0.0–1.0	3
Low	61–90	11–15	41–60	11–15	1.6–3.0	1.1–2.0	
Very low	91–120	16–20	61–80	16–20	3.1–4.5	2.1–3.0	

Method of application: Same as jute (*Corchorus capsularis*) for seed production.

COTTON (*Gossypium harbaceum*)

(**Var.** CB-9, CB-10)

Yield Goal: 2.25± 0.23 t/ha

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

Method of application:

a) **Basal application:** All of FYM should be applied as basal during final land preparation. Of the recommended inorganic fertilizer nutrients, 10% N, 75% P, 15% K, 30% S and 10% 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) **Side dressing:** Fertilizers should be applied in four installments. Of the recommended inorganic fertilizer nutrients -

- 20% N, 15% K and 30% Zn should be applied as side dressing during 20-25 days after sowing (DAS).
- 25% N, 25% P, 30% K, 40% S, 40% Zn and 50% B should be applied as side dressing during 40-45 DAS.
- 30% N, 30% K, 30% S, 30% Zn and 40% B should be applied as side dressing during 60-65 DAS.
- 15% N and 10% K should be applied as side dressing during 75-80 DAS.
- After application the fertilizers should be mixed thoroughly with the soil.

COTTON (*Gossypium harbaceum*)

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

Yield Goal: 2.70± 0.27 t/ha

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

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

COTTON (*Gossypium harbaceum*)

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

Yield Goal: 3.6± 0.36 t/ha

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

*FYM: Farm Yard Manure

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

7.3 Pulse Crops

LENTIL (*Lens culinaris*)

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

Yield Goal: 1.8 ± 0.18 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–7	0-5	0-8	0-4	-	-	-
Medium	8–14	6-10	9-16	5-8	0-1.0	0-0.4	0-0.4
Low	15–21	11-15	17-24	9-12	1.1-2.0	0.5-0.8	0.5-0.8
Very low	22–28	16-20	25-32	13-16	2.1-3.0	0.9-1.2	0.9-1.2

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) should be used if available and in that case N fertilizer should not be used.

CHICKPEA (*Cicer arietinum*)

(Var. BARI Chola-5, BARI Chola-6, BARI Chola-7, BARI Chola-9, BARI Chola-10, BARI Chola-11, Binasola-6, Binasola-7, Binasola-8, Binasola-9, Binasola-10)

Yield Goal: 2.0 ± 0.2 t/ha

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

Method of application:

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

b) *Rhizobium* inoculum (at the rate of 50 g/kg seed or 1.5 kg/ha) should be used if available and in that case N fertilizer should not be used.

MUNGBEAN (*Vigna radiata*)

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

Yield Goal: 2.0 ± 0.2 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–6	0-5	0-8	0–4	–	-	-
Medium	7–12	6-10	9-16	5–8	0.0–1.0	0-0.4	0-0.4
Low	13–18	11-15	17-24	9–12	1.1–2.0	0.5-0.8	0.5-0.8
Very low	19–24	16-20	25-32	13–16	2.1–3.0	0.9-1.2	0.9-1.2

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) should 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, BARI Mash-4, 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) should be used if available and in that case N fertilizer should not be used.

GRASSPEA (*Lathyrus sativus*)

(Var. BARI Kheshari-1, BARI Kheshari-2, BARI Kheshari-3, BARI Kheshari-4, BARI Kheshari-5, BARI Kheshari-6, Binakheshari-1)

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 conditions.

Method of application:

For crop 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:

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

COWPEA (*Vigna unguiculata*)

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

Yield Goal: 1.4 ± 0.14 t/ha

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

Method of application:

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

b) Rhizobium inoculum (at the rate of 40 g/kg seed or 1.6 kg/ha) should be used if available and in that case N fertilizer should not be used.

7.4 Oil Seed Crops

MUSTARD

(*Brassica juncia, Brassica napus*)

(Var. BARI Sharisa-11, BARI Sharisa-13, BARI Sharisa-16, BARI Sharisa-17, BARI Sharisa-18 (Canola), BARI Sharisa-19, Binasharisa-3, Binasharisa-4 and Binasharisa-5, Binasharisa-7, Binasharisa-9 and Binasharisa-10**)**

Yield Goal: 2.0 ± 0.2 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-30	0-8	0-25	0-8	–	-	–	3
Medium	31-60	9-16	26-50	9-16	0–3	0-1.3	0.0–1.0	
Low	61-90	17-24	51-75	17-24	4–6	1.4-2.6	0.6–2.0	
Very low	91-120	25-32	76-100	25-32	7–9	2.7-3.9	1.1–3.0	

Method of application:

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

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

c) Organic fertilizer, if applied, the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

Mustard *(Brassica campestris)*

(Var. Tori-7, BARI Sharisa-14, BARI Sharisa-15, BARI Sharisa-20, Safal, Agrani, Binasharisa-6, Binasharisa-7, Binasharisa-8**)**

Yield Goal: 1.8 ± 0.18 t/ha t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–30	0-8	0–20	0–5	–	–	–	3
Medium	31–60	9-16	21–40	6–10	0.0–2.5	0.0–1.0	0.0–0.5	
Low	61–90	17-24	41–60	11–15	2.6–5.0	1.1–2.0	0.6–1.0	
Very low	91–120	25-32	61–80	16–20	5.1–7.5	2.1–3.0	1.1–1.5	

Method of application: Same as *Brassica juncia*

SESAME (*Sesamum indicum*)

(Var: BARI Til-4, BARI Til-5 BARI Til-6, Binatil-1, Binatil-2, Binatil-3, Binatil-4**)**

Yield Goal: 1.4± 0.14 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					
	N	P	K	S	Zn	B
Optimum	0–25	0-8	0-27	0-3	-	-
Medium	26–50	9-16	28-54	4-6	0-1.0	0-0.8
Low	51–75	17-24	55-81	7-9	1.1-2.0	0.9-1.6
Very low	76–100	25-32	82-108	10-24	2.1-3.0	1.7-2.4

Method of application:

a) Half of N and all of P, K, S, Zn and B should be applied as basal during final land preparation. Remaining half of N should be applied as top dress at 25–30 DAS.

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

GROUNDNUT (*Arachis hypogaea*)

(Var. Jhingabadam, Tridanabadam, BARI Chinabadam-7, BARI Chinabadam-8, BARI Chinabadam-9, BARI Chinabadam-10, BARI Chinabadam-11, BARI Chinabadam-12, Binachinabadam-4, Binachinabadam-5, Binachinabadam-6, Binachinabadam-7, Binachinabadam-8, Binachinabadam-9**)**

Yield Goal: 2.6 ± 0.26 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						
	N	P	K	S	Zn	B	Mo
Optimum	0–12	0-10	0-20	0-10	-	–	-
Medium	13–24	11-20	21-40	11-20	0-1.3	0.0–1.0	0-0.4
Low	25–36	21-30	41-60	21-30	1.4-2.6	0.6–2.0	0.5-0.8
Very low	37–48	31-40	61-80	31-40	2.7-3.9	1.1–3.0	0.9-1.2

Method of application:

a) Half of N and all of P, K, S, Zn, B and Mo should be applied as basal during final land preparation. Remaining N should be applied as top dress 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. BARI Soybean-6, BARI Soybean-7, Binasoybean-3, Binasoybean-4, Binasoybean-5)

Yield Goal: 2.0 ± 0.2 t/ha

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

Method of application:

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

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

c) Application of OF at the rate of 2 t/ha is recommended; if applied the dose of N, P, K and S should be reduced based on the rate of application of organic fertilizer (as per Appendix-6).

SUNFLOWER (*Helianthus annus*)

(Var. BARI Surjamukhi-2, BARI Surjamukhi-3**)**

Yield Goal: 2.5± 0.25 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–35	0-12	0-30	0-10	–	–	–	2
Medium	36–70	13-24	31-60	11-20	0.0–3.0	0.0–1.0	0.0–0.8	
Low	71–105	25-36	61-90	21-30	4.0–6.0	1.1–2.0	0.9–1.6	
Very low	106–140	37-48	91-120	31-40	7.0–9.0	2.1–3.0	1.7–2.4	

Method of application:

a) Half of N and all P, K, S, Mg, Zn, B and OF should be applied as basal during final land preparation. Remaining half of N should be applied as top dress in two equal splits at 20–25 DAS and 40–45 DAS (before flower initiation stage) and mixed thoroughly with the soil as soon as possible for better utilization.

b) Application of OF at the rate of 2 t/ha is recommended. In that case the dose of N, P, K and S should be reduced based on the rate of application of organic manure (as per Appendix-6).

SAFFLOWER (*Carthenus tintorious*)

(Var. BARI Saff–1**)**

Yield Goal: 1.5 ± 0.15 t/ha

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

Method of application:

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

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

LINSEED (*Linum usitatissimum*)

(Var. BARI Tishi-1 (Neela)**,** BARI Tishi-2)

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

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

NIGER (*Guizotia abyssincia*)

(**Var:** BARI Guji-1)

Yield Goal: 1.5 ± 0.15 t/ha

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

Method of application:

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

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

7.5 Root and Tuber Crops

POTATO (*Solanum tuberosum*)

(**Var.** BARI Alu-7 (Diamant), BARI Alu-8 (Cardinal), BARI BARI Alu-13 (Granola), BARI Alu-25, BARI Alu-28, BARI Alu-29, BARI Alu-36, BARI Alu-37, BARI Alu-40, BARI Alu-41, BARI Alu-44, BARI Alu-48, BARI Alu-51, BARI Alu-52, BARI Alu-54 (Musica), BARI Alu-56, BARI Alu-62, BARI Alu-72, BARI Alu-73, BARI Alu-77, BARI Alu-78, BARI Alu-79, BARI Alu-85, BARI Alu-86, BARI Alu-90, BARI Alu-91)

Yield Goal: 30.0± 3.0 t/ha

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

Method of application:

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

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

SWEET POTATO (*Ipomoea batatas*

(Var. BARI Misti Alu-8, BARI Misti Alu-10, BARI Misti Alu12, BARI Misti Alu-14, BARI Misti Alu-15 BARI Misti Alu-16, BARI Misti Alu-17)

Yield Goal: 40.0 ± 4.0 t/ha

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

Method of application:

a) All P, S, Mg, Zn and B and half of N and K should be applied as basal during final land preparation. Entire amount of organic fertilizer (OF) should also be applied during final land preparation.

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

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

AROIDS

MUKHI KACHU (*Colocasia esculenta*)

(Var. Bilasi, BARI Mukhikachu-2, BARI Mukhikachu-3**)**

Yield Goal: 30.0± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-30	0-11	0-30	0–5	–	–	3
Medium	31-60	12-22	31-60	6–10	0.0–1.0	0.0–0.7	
Low	61-90	23-33	61-90	11–15	1.1–2.0	0.8–1.4	
Very low	91-120	34-44	91-120	16–20	2.1–3.0	1.5–2.1	

Method of application: Same as Panikachu

PANI KACHU (*Colocasia esculenta*)

(Var. Var. BARI Panikachu-1 (Latiraj), BARI Panikachu-2, BARI Panikachu-3, BARI Panikachu-4, BARI Panikachu-5, BARI Panikachu-6 and BARI Panikachu-7, BARI Panikachu-8, BARI Panikachu-9**)**

Yield Goal: 30.0± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-40	0-10	0-45	0–5	–	–	3
Medium	41-80	11–20	61-90	6–10	0.0–1.0	0.0–0.7	
Low	81-120	21–30	121-135	11–15	1.1–2.0	0.8–1.4	
Very low	121-160	31–40	181-180	16–20	2.1–3.0	1.5–2.1	

Method of application:

a) Full dose of OF, P, S and half of K potassium should be applied as basal during final land preparation.

b) The remaining K should be applied at 60 days after planting.

c) The nitrogen should be applied in six splits, starting at 30 days after planting and then at 15-20 days intervals.

7.6 Vegetable Crops

CAULIFLOWER (*Brassica oleracea var. botrytis*)

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

Yield Goal: 60.0 ± 6.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-40	0-15	0-30	0-6	0-2.5	–	-	5
Medium	41-80	16-30	31-60	7-12	2.6-5.0	0–1.5	0-0.8	
Low	81-120	31-45	61-90	13-18	5.1-7.5	1.6–3.0	0.9-1.6	
Very low	121-160	46-60	91-120	19-24	7.6-10	3.1–4.5	1.7-2.4	

Method of application:

a) Half of OF, K and all of P, S, Zn and B should be applied as basal. Remaining half of OF should be applied in pit before planting of seedlings.

b) Full N and half of K should be applied in three equal splits at 10-15, 30 and 50 days after transplanting as ring method under moist soil condition and mixed thoroughly with the soil.

c) Instead of urea, Urea Supper Granules (USG) can be applied 8–10 cm deep into the soil and 8–10 cm apart from the plant and as ring method.

BROCCOLI (*Brassica oleracea var. italica*)

(Var. BARI Brokoli-1)

Yield Goal: 40.0 ± 4.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-30	0-12	0-25	0-5	0-2.5	–	–	5
Medium	31-60	13-24	26-50	6-10	2.6-5.0	0–1.5	0-0.8	
Low	61-80	25-36	51-75	11-15	5.1-7.5	1.6–3.0	0.9-1.6	
Very low	91-120	37-48	76-100	16-20	7.8-10	3.1–4.5	1.7-2.4	

Method of application: Same as cauliflower

CABBAGE (*Brassica oleracea var. capitata*)

(Var. K-K Cross, Atlas-70, BARI Badhacopy-2, Hybrids)

Yield Goal: 90.0 ± 9.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-50	0-15	0-20	0-5	0-2.5	–	-	5
Medium	61-100	16-30	21-40	6-10	2.6-5.0	0–1.5	0-0.8	
Low	101-150	31-45	41-60	11-15	5.1-7.5	1.6–3.0	0.9-1.6	
Very low	151-200	46-52	61-100	16-32	7.8-10	3.1–4.5	1.7-2.4	

Method of application: Same as cauliflower

CHINESE CABBAGE (*Brassica chinensis*)

(Var. BARI Chinakopi-1**)**

Yield Goal: 50.0 ± 5.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-38	0-11	0-15	0-4	0-1.9	-	-	5
Medium	39-76	12-22	16-30	5-8	2.0-3.8	0-1.4	0-0.8	
Low	77-114	23-33	31-45	9-12	3.9-5.7	1.5-2.8	0.9-1.6	
Very low	115-152	34-44	46-60	13-16	5.8-7.6	2.9-4.2	1.7-2.4	

Method of application:

a) Half of OF, K and all of P, S, Zn and B should be applied as basal. Remaining half of OF should be applied in pit before planting of seedlings.

b) Full N and half of K should be applied in three equal splits at 10-15, 30 and 50 days after transplanting as ring method under moist soil condition and mixed thoroughly with the soil.

CHINASAK (*Brassica chinensis*)

(Var. BARI Chinasak-1**)**

and

BATISAK (*Brassica parachinensis*)

(Var. BARI Batisak-1**)**

Yield Goal: 50.0 ± 5.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-38	0-11	0-15	0-4	0-1.9	-	-	5
Medium	39-76	12-22	16-30	5-8	2.0-3.8	0-1.4	0-0.8	
Low	77-114	23-33	31-45	9-12	3.9-5.7	1.5-2.8	0.9-1.6	
Very low	115-152	34-44	46-60	13-16	5.8-7.6	2.9-4.2	1.7-2.4	

Method of application:

a) Half of N, K and OF and all of P and S should be applied as basal during land preparation. Remaining half of OF should be applied in pit before planting of seedlings.

b) Remaining half for both N and K should be applied at 20-25 DAS under moist soil condition and mixed thoroughly with the soil.

KANGKONG (*Ipomoea aquatica*)

(Var. BARI Gima Kalmi-1**)**

Yield Goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-30	0-10	0-13	0-5	0-1.9	-	-	5
Medium	31-60	11-20	14-26	6-10	2.0-3.8	0-1.4	0-0.8	
Low	61-90	21-30	27-39	11-15	3.9-5.7	1.5-2.8	0.9-1.6	
Very low	91-120	31-40	40-52	16-20	5.8-7.6	2.9-4.2	1.7-2.4	

Method of application:

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

b) Remaining N should be applied as top dress after each harvest under moist soil condition and mixed thoroughly with the soil.

INDIAN SPINACH (*Basella alba*)

(Var. BARI Puisak-1, BARI Puisak-2**)**

Yield Goal: 30.0± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0-30	0-10	0-13	0-5	-	5
Medium	31-60	11-20	14-26	6-10	0-1.0	
Low	61-90	21-30	27-39	11-15	1.1-2.0	
Very low	91-120	31-40	40-52	16-20	2.1-3.0	

Method of application:

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

b) Remaining N and K should be applied in two equal splits at 14 and 28 days after planting under moist soil condition and mixed thoroughly with the soil.

SPINACH (*Spinacea oleracea*)

(Var. BARI Palongsak-1, BARI Palongsak-2**)**

Yield Goal: 30.0± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0-20	0-8	0-10	0-4	-	5
Medium	21-40	9-16	11-20	5-8	0-1.0	
Low	41-60	17-24	21-30	9-12	1.1-2.0	
Very low	61-80	25-32	31-40	13-16	2.1-3.0	

Method of application:

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

b) Nitrogen should be applied in two instalments at 21 and 42 DAS.

AMARANTHUS (*Amaranthus lividus*)

(Var. BARI Danta-1, 2, 3**)**

Yield Goal: 30.0± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0–20	0-7	0-12	0-4	-	5
Medium	21–40	8-14	13-24	5-8	0-1.0	
Low	41–60	15-21	25-36	9-12	1.1-2.0	
Very low	61–80	22-28	37-48	13-16	2.1-3.0	

Method of application:

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

b) Remaining N should be applied in two equal splits at 15 and 35 DAS under moist soil condition and mixed thoroughly with the soil.

Sabuj Data shak

(Var: BARI Sabuj Dantasak-1**)**

Yield Goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0–20	0-7	0-12	0-4	-	5
Medium	21–40	8-14	13-24	5-8	0-1.0	
Low	41–60	15-21	25-36	9-12	1.1-2.0	
Very low	61–80	22-28	37-48	13-16	2.1-3.0	

Method of application:

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

b) Remaining N should be applied as topdress at 10–15 DAS under moist soil condition.

RED AMARANTH (*Amaranthus gangeticus*)

(Var. BARI Lalshak-1**)**

Yield Goal: 30.0 ± 3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0–25	0-5	0-7	0-2	-	5
Medium	26–50	6-10	8-14	3-4	0-1.0	
Low	51–75	11-15	15-21	5-6	1.1-2.0	
Very low	76–100	16-20	11-28	7-8	2.1-3.0	

Method of application:

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

b) Remaining N should be applied as topdress at 10–15 DAS under moist soil condition.

TOMATO (*Solanum lycopersicum*)
(Winter)

(Var. BARI Tomato-11, BARI Tomato-14, BARI Tomato-15, BARI Tomato-16, BARI Tomato-17, BARI Tomato-18, BARI Tomato-19, BARI Tomato-20, BARI Tomato-21; Binatomato-5, Binatomato-6, Binatomato-7, Binatomato-8, Binatomato-9, Binatomato-10, Binatomato-11, Binatomato-12**)**

Yield Goal: 75.0 ± 7.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–40	0-15	0-25	0-7	0-4	-	-	5
Medium	41–80	16-30	26-50	8-14	5-8	0-1.6	0-1.0	
Low	81–120	31-45	51-75	15-21	9-12	1.7-3.2	1.1-2.0	
Very low	121–160	46-60	76-100	22-28	13-16	3.3-4.8	2.1-3.0	

Method of application:

a) Half of OF and all of P, S, Zn and B should be applied as basal during final land preparation. Remaining OF should be applied in pits before planting of seedlings.

b) N and K should be applied in two equal splits at 15 and 35 DAT as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

TOMATO (*Solanum lycopersicum*) (Summer)

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

Yield Goal: 45.0 ± 4.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-30	0-11	0-25	0-7	-	-	4
Medium	31-60	12-22	26-50	8-14	0-1.5	0-1.0	
Low	61-90	23-33	51-75	15-21	2.3-3.0	1.1-2.0	
Very low	91-120	34-44	76-100	22-28	4.5-4.5	2.1-3.0	

Method of application:

a) Half of OF and all of P, S, Zn and B should be applied as basal during final land preparation. Remaining OF should be applied in pits before planting of seedlings.

b) N and K should be applied in three equal splits at 20, 40 and 60 DAT as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

BRINJAL (*Solanum melongena*)

(Var. BARI Begun-4, BARI Begun-5, BARI Begun-6, BARI Begun-8, BARI Begun-9, BARI Begun-10, BARI Begun-11, BARI Begun-12; BARI Hybrid Begun-2, BARI Hybrid Begun-3, BARI Hybrid Begun-4, BARI Hybrid Begun-6; BARI Bt Begun-1, BARI Bt Begun-2, BARI Bt Begun-3, BARI Bt Begun-4**)**

Yield Goal: 50.0 ±5.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–45	0-15	0-40	0-5	0-4	-	-	7
Medium	46–90	21-30	41-80	6-10	5-8	0-1.5	0-1.0	
Low	91–135	41-45	81-120	11-15	9-12	1.6-3.0	1.1-2.0	
Very low	136–180	61-60	121-160	16-20	13-16	3.1-4.5	2.1-3.0	

Method of application:

a) Half of OF and all of P, S, Zn and B should be applied as basal during final land preparation. Remaining OF should be applied in pits before planting of seedlings.

b) N and K should be applied in three equal splits at 20, 40 and 60 DAT as ring method under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

c) Instead of urea, Urea Supper Granule (USG) might be applied 7–8 cm deep into the soil and 8–10 cm apart from the plant and as ring method.

OKRA (*Abelmoschus esculentus*)

(Var. BARI Dherosh-2**)**

Yield Goal: 25.0 ± 2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						FYM* (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–30	0–10	0–23	0–5	–	–	5
Medium	31–60	11–20	24–46	6–10	0.0–1.0	0.0–0.7	
Low	61–90	21–30	47–69	11–15	1.1–2.0	0.8–1.4	
Very low	91–120	31–40	70–92	16–20	2.1–3.0	1.5–2.1	

Method of application:

a) All of OF and all of P, S, Zn and B; and one-fourth of N should be applied as basal during final land preparation.

b) Remaining three-fourth N should be applied at 20, 40 and 60 DAS under moist soil condition and mixed thoroughly with the soil.

RADISH (*Raphnus sativus*)

(Var. BARI Mula-1, BARI Mula-2, BARI Mula-3, BARI Mula-4**)**

Yield Goal: 60.0 ± 6.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0-37	0–15	0-30	0–6	–	5
Medium	38-74	16–30	31-60	7–12	0–1.5	
Low	75-111	31–45	61-90	13–18	1.6–3.0	
Very low	112-148	46–60	91-120	19–24	3.1–4.5	

Method of application:

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

b) Remaining N and K should be side dressed in two equal splits at 21 and 35 DAS under moist soil condition and mixed thoroughly with the soil.

CARROT (*Daucus carota*)

(All cultivars)

Yield Goal: 25 ± 2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0–33	0–10	0–30	0–5	–	3
Medium	34–66	11–20	31–60	6–10	0–1.0	
Low	67–99	21–30	61–90	11–15	1.1–2.0	
Very low	100–132	31–40	91–120	16–20	2.1–3.0	

Method of application:

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

b) Remaining N should be applied in two equal splits at the3rd and 5th weeks of sowing under moist soil condition and mixed thoroughly with the soil.

COUNTRY BEAN (*Dolichos lablab*)

(Var. BARI Sheem-1, BARI Sheem-2, BARI Sheem-4, BARI Sheem-5, BARI Sheem-6, BARI Sheem-7, BARI Sheem-8, BARI Sheem-9, BARI Sheem-10**,** BARI Jack Sheem-1, IPSA Shim-2**)**

Yield Goal: 25.0 ±2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–15	0–12	0-23	0-4	0-2.5	-	-	5
Medium	16–30	13–24	24-46	5-8	2.6-5.0	0-1.5	0-1.0	
Low	31–45	25–36	47-69	9-12	5.1-7.5	2.2-3.0	1.1-2.0	
Very low	46–60	37–48	70-92	13-16	7.6-10	4.3-4.5	2.1-3.0	

Method of application:

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

b) Remaining half of N should be applied during 25–30 DAT under moist soil condition and mixed thoroughly with the soil.

YARDLONG BEAN (*Vigna unguiculata*)

(**Var**. BARI Barboti-1, BARI Barboti-2, Kagor Natoki)

Yield Goal: 15.0 ±1.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-12	0-7	0-14	0-5	–	–	5
Medium	13-24	8-14	15-28	6-10	0.0–1	0.0–0.7	
Low	25-36	15-21	29-42	11-15	0.7–2	0.7–1.4	
Very low	37-48	22-28	43-56	16-20	1.3- 3.0	1.3–2.1	

Method of application:

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

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

c) *Rhizobium* inoculum (at the rate of 50 g/kg seed) should be used if available and in that case N fertilizer should not be used.

FRENCH BEAN (*Phaseolus vulgaris*)

(Var. BARI Jharsheem-1, BARI Jharsheem-2, BARI Jharsheem-3**)**

Yield Goal: 15.0 ± 1.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-19	0-10	0-20	0-4	–	–	3
Medium	20-38	11-20	21-40	5-8	0.0–1.0	0.0–0.7	
Low	39-57	21-30	41-60	9-12	1.1–2.0	0.8–1.4	
Very low	58-76	31-40	61-80	13-16	2.1–3.0	1.5–2.1	

Method of application:

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

b) Remaining N should be side dressed at 20 and 35 DAS under moist soil condition and mixed thoroughly with the soil.

GARDEN PEA (*Pisum sativum*)

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

Yield Goal: 15.0 ±1.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-10	0-6	0-13	0-4	–	–	5
Medium	11-20	7-12	14-26	5-8	0.0–1	0.0–0.7	
Low	21-30	13-18	27-39	9-12	0.7–2	0.7–1.4	
Very low	31-40	19-24	40-52	13-16	1.3- 3.0	1.3–2.1	

Method of application:

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

b) Remaining N should be side dressed at 20 and 35 DAS under moist soil condition and mixed thoroughly with the soil.

SWEET GOURD (*Cucurbita moschata*)

(Var. BARI Mistikumra -1, BARI Mistikumra -2, BARI Mistikumra -3; BARI Hybrid Mistikumra-1, BARI Hybrid Mistikumra-2, BARI Hybrid Mistikumra-3**)**

Yield Goal: 45.0 ±4.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-28	0-14	0-28	0-7	0-2.4	-	-	5
Medium	29-56	15-28	31-56	8-14	2.5-4.8	0-1.9	0-1.0	
Low	56-84	29-42	61-84	15-21	4.9-7.2	2.0-3.8	1.1-2.0	
Very low	85-92	43-56	91-112	22-28	7.3-9.6	3.9-5.7	2.1-3.0	

Method of application:

a) All of OF, P, K, S, Zn and B should be applied in pits 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 DAT under moist soil condition and mixed thoroughly with the soil.

BOTTLE GOURD (*Lagenaria siceraria*)

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

and

ASH GOURD (*Benincasa hispida*)

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

Yield Goal: 60.0 ± 6.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-33	0-13	0-20	0-7	0-3	-	-	5
Medium	34-66	14-26	21-40	8-14	4-6	0-1.5	0-1.0	
Low	67-99	27-39	41-60	15-21	7-9	2.3-3.0	1.1-2.0	
Very low	100-132	40-52	61-80	22-28	10-12	4.5-4.5	2.1-3.0	

Method of application:

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

b) Nitrogen should be applied around the plant as side dressing at 15, 35, 55 and 75 DAT under moist soil condition and mixed thoroughly with the soil.

TEASLE GOURD (*Momordica cochinchinensis*)

(KAKROL) (All cultivars)

Yield Goal: 25.0 ±2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–20	0-9	0-13	0-5	0-2.5	-	-	5
Medium	21–40	12-18	14-26	6-10	2.6-5.0	1.1-1.5	0-1.0	
Low	41–60	23-27	27-39	11-15	5.1-7.5	1.6-2.0	1.1-3.0	
Very low	61–80	34-36	40-52	16-20	7.6-10	2.1-4.5	2.1-3.0	

Method of application:

a) All of OF, P, K, S, Mg, Zn and B should be applied in pits 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 DAT under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

BITTER GOURD (*Momordica charantia*)

(Var. BARI Karolla-1, BARI Karolla-2, BARI Karolla-3, BARI Karolla-4; BARI Hybrid Karolla-1, BARI Hybrid Karolla-2, BARI Hybrid Karolla-3**)**

Yield Goal: 25 ± 2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-25	0-14	0-30	0-5	0-2.5	-	-	5
Medium	26-50	15-28	31-60	6-10	2.6-5.0	0-1.5	0-1.0	
Low	51-75	29-42	61-90	11-15	5.1-7.5	2.3-3.0	1.1-2.0	
Very low	76-100	43-56	91-120	16-20	7.6-10	4.5-4.5	2.1-3.0	

Method of application:

a) All of OF, P, K, S, Mg, Zn and B should be applied in pits 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 DAT under moist soil condition and mixed thoroughly with the soil.

POINTED GOURD (*Trichosanthes dioica*)

(Var. BARI Potol-1, BARI Potol-2; BARI Hybrid Potol-1**)**

Yield Goal: 25.0 ±2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–30	0-9	0-13	0-5	0-2.5	-	-	5
Medium	31–60	10-18	14-26	6-10	2.6-5.0	0-1.5	0-0.8	
Low	61–90	19-27	27-39	11-15	5.1-7.5	1.6-3.0	0.9-1.6	
Very low	91–120	28-36	40-52	16-20	7.6-10	3.1-4.5	1.7-2.4	

Method of application:

a) All of OF, P, K, S, Mg, Zn and B should be applied in pits 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 DAT planting and mixed thoroughly with the soil.

SNAKE GOURD (*Trichosanthes anguina*)

(**Var:** BARI Chicinga-1 and others),

RIDGE GOURD (*Luffa acutangula*)

(**Var:** BARI Jhinga-1, BARI Jhinga-2 and others)

and

SPONGE GOURD (*Luffa cylindrica*)

(**Var:** BARI Dhundul-1, BARI Dhundul-2, BARI Hybrid Dhundul-1 and others)

Yield Goal: 35.0 ±3.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0–25	0–12	0–20	0-7	0-2.4	-	-	5
Medium	26–50	13–24	21–40	7-14	2.5-4.8	0-2.2	0-1.0	
Low	51–75	25–36	41–60	13-21	4.9-7.2	2.3-4.4	1.1-2.0	
Very low	76–100	37–48	61–80	19-28	7.3-9.6	4.5-4.8	2.1-3.0	

Method of application:

a) All of OF, P, K, S, Mg, Zn and B should be applied in pits 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 DAT under moist soil condition and mixed thoroughly with the soil.

CUCUMBER (*Cucumis sativus*)

(**Var:** All cultivars)

Yield Goal: 25 ± 2.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–25	0-9	0-15	0-5	-	-	5
Medium	26–50	10-18	16-30	6-10	0-2.2	0-1.0	
Low	51–75	19-27	31-45	11-15	2.3-4.4	1.1-2.0	
Very low	76–100	28-36	46-60	16-20	4.5-4.8	2.1-3.0	

Method of application:

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

b) Remaining N and K should be applied during 20, 35 and 50 DAT around the plant as side dressing under moist soil condition and mixed thoroughly with the soil.

SQUASH

(Var. OP)

Yield Goal: 30.0 ±3.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-25	0-9	0-20	0-5	–	–	5
Medium	26-50	10-18	21-40	6-10	0.0–1.0	0.0–0.7	
Low	51-75	19-27	41-60	11-15	1.1–2.0	0.8–1.4	
Very low	76-100	28-36	61-80	16-20	2.1–3.0	1.5–2.1	

Method of application:

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

b) N should be applied around the plant as side dressing at 15, 35, 55 and 75 DAT under moist soil condition and mixed thoroughly with the soil.

7.7 Spice Crops

ONION (*Allium cepa*)

(Var. BARI Peyaz-1, BARI Peyaz-4 and BARI Peyaz-5, BARI Peyaz-6, BARI Peyaz-7**)**

Yield Goal: 20.0 ± 2.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N		K	S	Zn	B	
Optimum	0-30	0-10	0-25	0–10	-	–	5
Medium	31-60	11-20	26-50	11–20	0-1.3	0.0–0.7	
Low	61-90	21-30	51-75	21–30	1.6-2.6	0.8–1.4	
Very low	91-120	31-40	76-100	31–40	2.7-3.9	1.5–2.1	

Method of application:

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

a) Remaining N and K should be applied in 2 equal splits at 25 and 50 DAP for bulb production; and in 3 equal splits at 25, 50 and 75 days after planting for seed production.

SUMMER ONION (*Allium cepa*)

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

Yield Goal: 12.0 ± 1.2 t/ha

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

Method of application:

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

b) Remaining N and K should be applied in 2 equal splits at 25 and 50 DAP for bulb production; and in 3 equal splits at 25, 50 and 75 days after planting for seed production.

GARLIC (*Allium sativum*)

(Var. BARI Rashun-1, BARI Rashun-2, BARI Rashun-3, BARI Rashun-4, BAU Rashun-2 BAU Rashun-2**)**

Yield Goal: 15.0 ± 1.5 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-30	0-10	0-25	0–10	-	-	5
Medium	31-60	11-20	26-50	11–20	0-1.3	0-0.7	
Low	61-90	21-30	51-75	21–30	1.4-2.6	0.8-1.4	
Very low	91-120	31-40	76-100	31–40	2.6-3.9	1.5-2.1	

Method of application:

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

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

GARLIC (*Allium sativum*)

(Var. BARI Rashun-1**)**

(under zero tillage)

Yield Goal: 13.0 ± 1.3 t/ha

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

Method of application:

a) Under zero tillage, garlic is cultivated widely in Chalan Beel areas of Natore, Sirajganj and Pabna districts after harvesting of deep water aman rice. Before cultivation of garlic, rice straw should be removed from the land. Then all of OF, P, K, S and Zn; and one-third of N should be applied as broadcast on muddy soils. After application of fertilizers garlic should be planted by dibbling shallowly (1/3rd of the clove into the soil) and the land should be covered again with the rice straw.

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

c) After 2-3 hours of N topdressing light irrigation should be provided. Care should be taken so that there is no water logging after irrigation to avoid damage of the crop.

GINGER (*Zingiber officinale*)

(Var. BARI Ada-1, BARI Ada-2, BARI Ada-3**)**

Yield Goal: 30.0 ± 3.0 t/ha

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

Method of application:

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

b) Remaining N 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, BARI Halud-3, BARI Halud-4, BARI Halud-5)

ield Goal: 30.0 ± 3.0 t/ha

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

Method of application:

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

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

CHILLI (*Capsicum annuum*)

(Var. BARI Morich-1, BARI Morich-2, BARI Morich-4, BARI Morich-5, BARI Morich-6, Bogra Bogra local, Jamalpur local**)**

Yield Goal: 2.5± 0.25 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-25	0-12	0-30	0-4	-	–	3
Medium	26-50	13-24	31-60	5-8	0-1.0	0.0–0.7	
Low	51-75	25-36	61-90	9-12	1.1-2.0	0.8–1.4	
Very low	76-100	37-48	91-120	11-16	2.1-3.0	1.5–2.1	

Method of application:

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

b) Remaining N should be applied in three equal splits at 25, 50 and 70 DAP under moist soil condition and mixed thoroughly with the soil.

SWEET PEPPER (Capsicum) (*Capsicum annuum L.*)

(**Var:** BARI Misty Morich-1)

Yield Goal: 20.0 ± 2.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–35	0-12	0-33	0-6	-	-	5
Medium	36–70	13-24	34-66	7-12	0-1.0	0-0.7	
Low	71–105	25-36	67-99	13-18	1.1-2.0	0.8-1.4	
Very low	106–140	37-48	100-132	19-24	2.1-3.0	1.5-2.1	

Method of application:

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

d) Remaining N should be applied in three equal splits at 25, 50 and 70 DAP under moist soil condition and mixed thoroughly with the soil.

CORIANDER (*Coriandrum sativum*)

(Var. BARI Dhonia-1, BARI Dhonia-2**)**

Yield Goal: 1.5 ± 0.15 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-20	0-7	0-18	0-5	–	–	3
Medium	21-40	8-14	19-36	6-10	0.0–1.3	0.0–1.0	
Low	41-60	15-21	37-54	11-15	1.4–2.6	1.1–2.0	
Very low	61-80	22-28	55-72	16-20	2.7–3.9	2.1–3.0	

Method of application:

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

b) Remaining N should be applied as top dress at 30 DAS under moist soil condition and mixed thoroughly with the soil.

BLACK CUMIN (*Nigella sativa*)

(Var. BARI Kalozira-1**)**

Yield Goal: 1.0 ± 0.10 t/ha

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

Method of application:

a) All of OF, P, K, S, Zn and B 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, BARI Methi-2, BARI Methi-3**)**

Yield Goal: 2.0 ± 0.2 t/ha

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

Method of application:

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

BLACK PEPPER (*Piper nigrum*)

(Var. BARI Golmorich-1, Jainta Gulmorich**)**

Yield Goal: 4–5 kg/plant/year

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

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

Method of application:

a) Before planting, recommended OF, P and K should be applied into the pits 10–15 days before planting of seedling and mixed thoroughly with the soil followed by irrigation.

b) For growing plant N, P and K should be applied in two equal splits during April–May and September–October under moist soil condition and mixed thoroughly with the soil followed by irrigation.

7.8 Fruit Crops

MANGO (*Mangifera indica*)

(Var. BARI Aam-3, BARI Aam-4, BARI Aam-8, BARI Aam-9, BARI Aam-10, BARI Aam-11, BARI Aam-12, BARI Aam-13, BARI Aam-14, BARI Aam-15, BARI Aam-16, BARI Aam-17, BARI Aam-18**)**

Yield Goal: 350± 35 kg/tree (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (in Pit)	-	100	100	50	10	10	10
0–1	100	30	50	20	5	5	10
2–4	210	50	90	30	5	5	15
5–7	390	80	120	50	5	5	20
8–10	500	100	150	70	8	8	25
11–15	550	150	200	80	8	8	30
16–20	800	200	230	100	10	10	35
>20	1000	300	300	130	10	12	40

Method of application:

1) Before 15-20 days of sapling plantation, full amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.
2) After plantation, fertilizers and manure should be applied in two equal splits. One half should be applied just after harvesting of fruits (June-July) and another half should be applied in 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.

MANGO (*Mangifera indica*)

(Var. BAU Aam-1, BAU Aam-2, BAU Aam-3, BAU Aam-4, BAU Aam-5, BAU, Aam-6, BAU Aam-11, BAU Aam-14, BAU Aam-15)

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (in Pit)	-	200	-	111	-	41	15
0–1	130	100	120	-	7	-	5
2–3	261	200	200	33	9	-	6
4–5	370	300	240	67	17	18	7
6–7	609	500	360	133	17	18	8
8–10	848	700	480	200	26	29	9
11–15	1087	900	600	267	26	29	10
16-20	1326	1150	720	356	35	41	11
>20	1565	1400	800	444	44	53	12

Method of application: Same as BARI varieties

JACKFRUIT (*Artocarpus heterophyllus*)

(**Var:** BARI Kanthal-1, BARI Kanthal-2, BARI Kanthal-3, BARI Kanthal-4, BARI Kanthal-5, BARI Kanthal-6, BAU Kanthal-1)

Yield goal: 1000 ±100 kg/tree/year (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (in Pit)	-	100	125	35	-	-	25
0–1	150	75	150	20	2	-	-
2–4	250	100	250	30	4	-	15
5–7	350	150	350	35	4	2	20
8–10	450	200	450	45	6	4	25
11–15	600	280	550	60	7	5	30
16–20	750	300	650	90	8	8	35
>20	800	400	750	100	10	10	40

Method of application: Same as mango.

BANANA (*Musa paradisiaca*)

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

Yield Goal: 50.0± 5.0 t/ha

Method of application	Nutrient Recommendation (g/plant)						OF (kg/pit)
	N	P	K	S	Zn	B	
Before planting (pit)	0	100	0	50	3	3	15
1st TD*	50	0	70	0	0	0	0
2nd TD	50	0	70	0	0	0	0
3rd TD	50	0	70	0	0	0	0
4th TD	100	0	130	0	0	0	0
Total	250	100	340	50	3	3	15

***TD:** Top dressing

Method of application:

a) Before 15-20 days of sapling plantation, whole amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil in the pit followed by irrigation.

b) The N and K should be applied in four equal splits starting after two months of sucker planting. The second and third TD should be done at two month-intervals and the last TD should be applied after emergence of inflorescence.

PAPAYA (*Carica papaya*)

(Var. BARI papaya-1 **(**Shahi Pepe))

Yield Goal: 50.0 ± 5.0 t/ha

Method of application	Nutrient Recommendation (g/plant)						OF (kg/pit)
	N	P	K	S	Zn	B	
Before planting (pit)	0	120	0	60	3	5	15
1st TD	35	0	35	0	0	0	0
2nd TD	35	0	35	0	0	0	0
3rd TD	40	0	40	0	0	0	0
4th TD	60	0	60	0	0	0	0
5th TD	60	0	60	0	0	0	0
6th TD	50	0	50	0	0	0	0
Total	280	120	280	60	3	5	15

Method of application:

a) Before 15-20 days of sapling plantation, the full amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) The 1st top dressing (TD) of N and K should be done around the plant after 30 days of sapling transplantation and mixed thoroughly with the soil followed by irrigation.

c) The remaining N and K should be applied at 30 day- intervals as the 2nd, 3rd, 4th, 5th and 6th TD until two months before final harvest.

GUAVA (*Psidium guajava*)

(**Var:** Kazi payara, BARI Payara-2, BARI Payara-3, BARI Payara-4; BAU Payara-7, BAU Payara-8, BAU Payara-9)

Yield Goal: 75 ± 5 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	60	125	10	5	2	15
0-1	50	70	100	15	5	2	10
2-4	160	80	250	20	8	5	10
5-7	250	120	300	25	8	8	15
8-10	300	150	350	35	10	10	20
>10	400	200	450	40	10	10	25

Method of application

1) Before 15-20 days of sapling plantation, entire amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

2) After plantation, fertilizers and manure should be applied in two equal splits. One half should be applied just after harvesting of fruits (June-July) and another half should be applied in 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.

COCONUT (*Cocos nucifera*)

(**Var:** BARI Narikel-1, BARI Narikel-2)

Yield Goal: **80 ±5 nut/tree/year (above 20 years old tree)**

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	60	200	45	20	5	25
0-1	100	30	200	20	10	2	10
2-4	150	50	250	30	15	3	15
5-7	220	80	350	50	20	3	20
8-10	425	100	600	55	20	5	20
11-15	550	160	950	60	25	10	25
16-20	650	160	1200	70	30	10	25
>20	800	250	1500	80	30	15	30

Method of application

a) Before 15-20 days of sapling plantation, full amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during April to May and second installment should be applied during September to October. For orchards, fertilizers should be broadcast and mixed thoroughly with the soil by shallow plowing with a power tiller, followed by irrigation. For individual tree, fertilizer should be applied by drilling with a peg to a depth of 15-20 cm around the tree up to 2-3 m, leaving 1.0 m from the tree base, and mixed thoroughly with the soil followed by irrigation.

PINEAPPLE (*Ananas sativus*)

(Var. Giant kew, Honey queen, Ghorasal**)**

Yield Goal: 30.0 ± 3.0 t/ha

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

Method of application:

a) All of OF, P, S and 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 1-month intervals starting from 4–5 months after planting and mixed thoroughly with the soil followed by irrigation.

LITCHI (*Litchi chinensis*)

(**Var:** BARI Litchu-2, BARI Litchu-3, BARI Litchu-4, BAU Litchu-3, BAU Litchu-4)

Yield Goal: 150 ± 15 kg/tree/year (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	100	200	20	15	4	25
0-1	160	80	150	25	20	5	10
2-4	200	100	280	40	25	5	15
5-7	250	150	400	50	30	5	20
8-10	400	250	500	60	35	8	25
11-15	600	300	650	60	40	10	30
16-20	750	350	800	70	45	12	35
>20	1000	400	900	80	50	15	40

Method of application:

1) Before 15-20 days of sapling plantation, entire amount of OF, P, K, S, Zn and B should be applied and mixed thoroughly with the soil into the pits, followed by irrigation.
2) In the 1st year, OF and N should be applied at a time around the tree in September.
3) After plantation, fertilizers and manure should be applied in two equal splits. One half should be applied just after harvesting of fruits (June-July) and another half should be applied in September-October. Fertilizer should be applied around the tree up to canopy spread.

CITRUS

PUMMELO (*Citrus grandis*)

(**Var:** BARI Batabilebu-3, BARI Batabilebu-4, BARI Batabilebu-5, BARI Batabilebu-6)

Yield Goal: 120± 12 kg/tree/year (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	60	50	45	-	-	15
0-1	100	40	90	20	5	2	10
2-4	150	50	160	25	5	2	15
5-7	250	75	250	30	20	5	20
8-10	300	100	275	40	20	6	25
11-15	350	120	350	50	25	8	30
>15	450	150	400	60	25	10	35

Method of application

1) Before 15-20 days of sapling plantation, full amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.
2) After plantation fertilizers and manure should be applied in three equal splits. First installment should be applied during February, and the second and third installments during May and October, respectively. Fertilizers should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.
3) For the highly acidic soils, dolomite should be applied at the rate of 250g/tree in every3-4 years.

MANDARIN (*Citrus reticulanta)*

(**Var:** BARI Komola-2, BARI Komola-3)

Yield Goal: 50±5 kg/tree/year (above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	60	50	-	-	-	15
0-1	100	30	80	20	5	2	10
2-4	150	50	120	25	8	2	15
5-7	200	75	180	30	10	3	20
8-10	250	100	250	40	12	4	25
11-15	350	150	300	50	15	6	30
>15	500	200	400	60	15	8	35

Method of application

1) Before 15-20 days of sapling plantation, entire amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.
2) After plantation fertilizers and manure should be applied in three equal splits. First installment should be applied during February, and the second and third installments should be applied during May and September, respectively. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.
3) For the highly acidic soils, dolomite should be applied at the rate of 250g/tree at every 3-4 years interval.

SWEET ORANGE (*Citrus sinensis*)

(Var. BARI Malta-1, BARI Malta-2, BAU Malta-1**)**

Yield Goal: 60 ± 6.0 kg/tree/year (Above 15 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	60	50	-	-	-	20
0-1	125	40	75	20	5	2	10
2-4	200	50	90	25	8	2	15
5-7	250	75	140	40	10	5	20
8-10	320	100	175	50	12	5	30
11-15	350	150	225	50	15	8	35
>15	480	200	300	60	15	8	40

Method of application: Same as mandarin

LEMON (*Citrus limon)*

(Var. BARI Lebu-4, BARI Lebu-5, BARI Lebu-6**)**

Yield Goal: 20.0 ± 2.0 kg/tree/year (above 5 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before Planting (Pit)	-	50	50	-	-	-	15
0-1	125	75	75	20	5	2	10
2-4	150	90	200	30	5	2	15
5-7	250	120	250	50	8	5	20
8-10	300	160	280	80	10	6	25
>10	350	200	320	80	10	8	30

Method of application: Same as mandarin

SATKARA (*Citrus macroptera*)

(Var. BARI Satkara-1**)**

Yield Goal: 35.0 ± 3.5 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)				OF (kg/tree/year)
	N	P	K	S	
Before planting (Pit)	-	50	-	-	-
0-1	100	25	75	20	5
2-4	150	35	170	25	5
5-7	200	80	250	30	8
8-10	280	100	280	30	10
>10	300	150	325	40	10

Method of application:

1) Before 15-20 days of sapling plantation, full amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.
2) After plantation, fertilizers and manure should be applied in three equal splits. First installment should be applied during February, and the second and third installments should be applied during May and October, respectively. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.
3) For the highly acidic soils, dolomite should be applied at the rate of 250g/tree at every3-4 years interval.

BER (*Zizyphus mauritiana*)

(Var. BARI Kul-1, BARI Kul-2, BARI Kul-3, BARI Kul-4, BARI Kul-5**)**

Yield Goal: 50±5 t/ha/year (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					OF (kg/tree/year)
	N	P	K	S	B	
Before planting (pit)	-	60	125	10	-	-
0-1	140	50	125	15	0	2
2-4	320	100	300	20	5	2.5
5-7	400	160	400	25	5	3
8-10	500	200	550	30	5	4
11-15	550	250	600	40	10	4
16-20	620	280	650	40	10	5
>20	750	350	750	50	10	5

Method of application

1) Before 15-20 days of sapling plantation, whole amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.
2) After plantation fertilizers and manure should be applied in three equal splits. First installment should be applied during March, and the second and third installments should be applied during May and September, respectively. 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.

GOLDEN APPLE (*Spondias pinnata*)

(Var: BARI Amra-1, BAU Amra-1, BARI Amra-2)

Yield Goal: 30± 3.0 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					OF (kg/tree/year)
	N	P	K	S	B	
Before planting (pit)	-	50	30	-	-	-
0-1	50	40	50	15	5	2
2-4	100	50	80	25	5	2
5-7	125	80	120	30	8	4
8-10	150	100	150	35	10	5
>10	180	125	180	50	10	5

Method of application:

a) Before 15-20 days of sapling plantation all amount recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation fertilizers and manure should be applied in four equal splits at 2-3 months' interval during March-April, May-June, September and October. Fertilizer should be applied around the tree up to 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**)**

Yield Goal: 50± 5.0 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)					OF (kg/tree/year)
	N	P	K	S	B	
Before planting (pit)	-	75	30	-	-	-
0-1	75	50	100	20	5	2
2-4	120	75	125	30	5	2
5-7	180	100	180	40	8	4
8-10	200	120	200	50	10	5
11-15	250	140	250	60	10	8
>15	300	150	300	75	12	10

Method of application:

a) Before 15-20 days of sapling plantation, entire amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation, the fertilizers and manure should be applied in four equal splits at 2-3 months' intervals during March-April, May-June, September and October. Fertilizer should be applied around the tree up to 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-2, BARI Sofeda-3, BAU Shofeda-1, BAU Shofeda-2, BAU Shofeda-3, BAU Shofeda-4)

Yield Goal: 150 ± 15 kg/tree/year (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	60	45	20	-	-	15
0-1	60	30	75	20	5	2	10
2-4	75	80	200	30	5	2	15
5-7	200	100	250	40	8	4	20
8-10	320	150	350	60	10	5	20
11-15	450	175	450	80	10	8	25
>15	500	200	500	90	12	10	25

Method of application:

a) Before 15-20 days of sapling plantation, full amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation, fertilizers and manure should be applied in four equal splits at 2-3 months of intervals during March-April, May-June, September and October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

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

CARAMBOLA (*Averrhoa carambola*)

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

Yield Goal: 250± 25 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	60	-	-	-	-	15
0-1	100	50	100	15	0	2	10
2-4	200	75	150	20	5	5	15
5-7	250	100	200	35	5	5	20
8-10	350	120	250	40	8	8	20
>10	450	130	275	50	10	8	25

Method of application:

a) Before 15-20 days of sapling plantation, full amount of manure and P should be applied and mixed thoroughly with the soil into the pit, followed by irrigation.

b) After plantation, fertilizers and manure should be applied in two equal splits. First installment should be applied during April-May, and the second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 1.00-1.50 m from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

JAMUN (*Syzygium cumini*)

(BARI Jam-1**)**

Yield Goal: 170 ± 17 kg/tree (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	75	30	50	15	5	2	10
2-4	150	50	120	30	5	2	15
5-7	250	75	200	40	8	4	20
8-10	350	120	275	50	10	5	20
11-15	400	150	350	60	10	8	25
16-20	450	180	400	70	12	10	25
>20	500	200	450	80	12	10	25

Method of application:

a) Before 15-20 days of sapling plantation, total amount of manure and P should be applied and mixed thoroughly with the soil in the pit, followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during April-May, and the second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 1.00-1.50 m from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

BURMESE GRAPE (*Baccaurea ramiflora*)

(Var: BARI Lotkon-1, BAU Lotkon-1**)**

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	50	50	-	-	-	15
0-1	50	20	50	20	5	2	10
2-4	150	60	150	35	5	2	15
5-7	225	80	180	45	8	4	20
8-10	350	100	250	65	10	6	25
11-15	400	120	300	75	12	8	30
>15	450	140	350	100	12	10	35

Method of application:

a) Before 15-20 days of sapling plantation, whole amount of manure, P and K should be applied and mixed thoroughly with the soil into the pits, followed by irrigation.

b) After plantation fertilizers and manure should be applied in three equal splits. First installment should be applied after fruit harvest. The second and third installments should be applied during October and March, respectively. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

AONLA (*Emblica officinalis*)

(Var. BARI Amloki-1, BARI Amloki-2, BAU Amloki-1**)**

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	100	30	75	18	5	2	15
2-4	220	50	150	35	5	2	15
5-7	300	100	250	45	8	4	20
8-10	400	150	350	50	10	5	25
11-15	500	200	400	55	11	8	25
>15	675	250	500	60	12	10	30

Method of application:

a) Before 15-20 days of sapling plantation, full amount of manure and P should be applied and mixed thoroughly with the soil into the pits, followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during June-July and second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

WAX APPLE (*Syzygium samrangense*)

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

Yield Goal: 120 ± 12 kg/tree (above10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	35	-	-	-	-	10
0-1	92	40	75	18	4.2	2.6	15
2-4	175	100	150	27	4.2	2.6	15
5-7	230	130	175	36	8.4	4.3	20
8-10	276	150	225	45	10.5	5.1	25
>10	336	200	250	59	10.5	6.8	30

Method of application:

a) Before 15-20 days of sapling plantation, full amount of manure and P should be applied separately and mixed thoroughly with the soil in the pit, followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during May-June and the second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

BAEL (*Aegle marmelos*)

(BARI Bel-1, BARI Bel-2)

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	100	30	75	20	5	2	15
2-4	200	100	150	30	5	2	15
5-7	250	120	200	40	8	4	20
8-10	300	150	250	50	10	5	25
>10	350	200	300	60	10	8	30

Method of application:

a) Before 15-20 days of sapling plantation, entire amount of manure and P should be applied separately and mixed thoroughly with the soil in the pit, followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during May-June and the second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

WOOD APPLE (*Feronia limonia*)

(Var. BARI Kodbel-1, BARI Kodbel-2, BAU Kodbel-1**)**

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	100	40	75	15	5	2	10
2-4	200	50	150	35	5	2	15
5-7	250	70	200	50	8	4	20
8-10	300	80	250	70	10	5	20
11-15	350	100	275	75	10	8	25
>15	400	150	300	80	12	10	30

Method of application:

a) Before 15-20 days of sapling plantation, whole amount recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation fertilizers and manure should be applied in three equal splits during February, May and October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

BULLOCK'S HEART (*Anona squamosa*) (Ata phal)

(BARI Ata-1)

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	100	40	75	15	5	2	10
2-4	200	50	150	35	5	2	15
5-7	250	70	200	50	8	4	20
8-10	300	80	250	70	10	5	20
11-15	350	100	275	75	10	8	25
>15	400	150	300	80	12	10	30

Method of application:

a) Before 15-20 days of sapling plantation, entire amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation fertilizers and manure should be applied in three equal splits during February, May and October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

CUSTARD APPLE (*Annona squamosa*) Sharifa)

(All cultivars**)**

Yield Goal: 50 ± 5 kg/tree (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	75	30	75	10	5	2	10
2-4	150	50	120	20	5	2	15
5-7	200	60	150	30	8	4	20
8-10	250	70	175	40	10	5	20
>10	300	80	200	50	10	8	25

Method of application:

a) Before 15-20 days of sapling plantation, full amount recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil in the pit followed by irrigation.

b) After plantation fertilizers and manure should be applied in three equal splits during February, May and October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. In hill slope conditions, drilling method should be followed.

VELVET APPLE (*Diospyros discolor*)

(Var. BARI Bilatigab-1, BAU Bilatigab-1, BAU Seedless Bilatigab-2**)**

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	75	40	75	10	5	2	10
2-4	150	60	150	20	5	2	15
5-7	250	80	250	40	8	4	20
8-10	350	90	350	50	10	5	20
11-15	450	100	450	55	10	8	25
>15	550	110	550	60	12	10	25

Method of application:

a) Before 15-20 days of sapling plantation, whole amount of manure and P should be applied separately and mixed thoroughly with the soil into the pits, followed by irrigation.

b) After plantation, fertilizers and manure should be applied in three equal splits during February, May and October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. In hill slope conditions, drilling method should be followed.

TAMARIND (*Tamarindus indicus*)

(Var. BARI Tentul-1**)**

Yield Goal: 100 ± 10 kg/tree/Year (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	75	50	75	15	5	2	10
2-4	150	80	200	20	5	2	15
5-7	250	100	300	30	8	4	20
8-10	350	150	400	40	10	5	20
11-15	450	200	500	50	10	8	25
16-20	500	225	550	55	12	10	25
>20	550	250	600	60	12	10	30

Method of application:

a) Before 15-20 days of sapling plantation, total amount of manure and P should be applied separately and mixed thoroughly with the soil into the pits, followed by irrigation.

b) After plantation fertilizers and manure should be applied in three equal splits. First installment should be applied during May-June, and the second and third installments should be applied during September-October and February-March, respectively. Fertilizer should be applied around the tree up to canopy spread leaving 1.00-1.50 m from the tree base and mixed thoroughly with the soil followed by irrigation. In hill slope conditions, drilling method should be followed.

TAMARIND (*Tamarindus indicus*)

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

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

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

Method of application: Same as above

INDIAN DILLENIA (*Dillenia indica*) (Chalta)

(All cultivars**)**

Yield Goal: 150 ± 15 kg/tree (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	75	30	50	15	5	2	10
2-4	150	50	100	35	5	2	15
5-7	200	75	150	50	8	4	20
8-10	250	90	200	50	10	5	20
11-15	300	100	225	60	10	8	25
>15	350	110	250	70	12	10	25

Method of application:

a) Before 15-20 days of sapling plantation, full amount of manure and P should be applied separately and mixed thoroughly with the soil into the pits, followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during April-May, the second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 1.00-1.50 m from the tree base and mixed thoroughly with the soil followed by irrigation. In hill slope conditions, drilling method should be followed.

DRAGON FRUIT (*Hylocereus undatus*)

(Var. BARI Dragonphol-1, BAU Dragon-1, BAU Dragon-2, BAU Dragon-3, BAU Dragon-4**)**

Yield Goal: 70 ± 7 kg/plant/year (above 10 years)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	0	30	20	15	0	0	20
0-1	75	50	150	15	0	0	10
2-4	150	75	200	25	5	2	15
5-7	175	100	250	30	5	5	20
8-10	200	125	300	40	8	5	20
>10	250	150	350	50	10	8	25

Method of application:

a) Before 15-20 days of sapling plantation, total amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during April-May, the second installment should be applied during September-October. Fertilizer should be applied around the plant base and mixed thoroughly with the soil followed by irrigation.

STRAWBERRY (*Fragaria ananassa*)

(Var. BARI Strawberry-1, BARI Strawberry-2, BARI Strawberry-3, BAU Strawberry-1**)**

Yield Goal: 10± 1.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–45	0–18	0–42	0–9	–	–	5
Medium	46–90	19–36	43–84	10–18	0.0–1.5	0.0–0.7	
Low	91–135	37–54	85–126	19–27	1.6–3.0	0.8–1.4	
Very low	136–180	55–72	127–168	28–36	3.1–4.5	1.5–2.1	

Method of application:

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

b) Nitrogen and half of K should be applied in 4–5 installments at 15–20 day intervals starting from 15 DAP.

LONGAN (*Nephelium longana*)

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

Yield Goal: 50 ± 5 kg/tree/year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	0	30	20	0	0	0	10
0-1	150	50	100	15	0	2	10
2-4	200	75	150	20	5	5	15
5-7	250	100	200	35	5	5	20
8-10	350	150	300	40	8	8	20
>10	400	200	350	50	10	8	25

Method of application:

a) Before 15-20 days of sapling plantation, total amount of recommended organic and chemical fertilizers should be applied and mixed thoroughly with the soil into the pits followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during April-May, the second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

CASHEWNUT (*Anacardium occidentale*)

(Var. BAU Kajubadam-1**)**

Yield Goal: 20 ± 2 kg/tree/Year (above 10 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/tree/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	-	-	-	-	-	10
0-1	75	30	70	-	-	2	10
2-4	90	40	85	15	5	5	15
5-7	105	50	100	20	5	5	20
8-10	125	60	120	25	8	8	20
>10	145	70	140	30	10	8	25

Method of application:

a) Before 15-20 days of sapling plantation, all amounts of manure should be applied and mixed thoroughly with the soil in the pit, followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. First installment should be applied during April-May, second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 50-100 cm from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

STAR GOOSE BERRY (*Phylanthus acidus*)

(Var. BAU Orbiroi-1**)**

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

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

Method of application:

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

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

Fig (*Ficus carica*)

(Var. BAU Dumur-1**)**

Yield Goal: 5 ± 0.5 kg/plant/Year (above 8 years old tree)

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

Method of application:

a) Before planting, recommended OF should be applied into the pits 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.

INDIAN OLIVE (*Elaeocarpus floribundus*)

(Var. BARI Jalpai-1, BAU Jalpai-1**)**

Yield Goal: 150 ± 15 kg/tree/Year (above 20 years old tree)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/plant/year)
	N	P	K	S	Zn	B	
Before planting (pit)	-	30	-	-	-	-	10
0-1	75	30	50	10	5	2	10
2-4	100	50	90	20	5	2	15
5-7	150	75	120	30	8	3	20
8-10	200	80	150	40	10	3	20
11-15	250	85	200	50	10	4	25
>15	300	90	220	60	12	4	25

Method of application:

a) Before 15-20 days of sapling plantation, total amount of manure and P should be applied separately and mixed thoroughly with the soil into the pit, followed by irrigation.

b) After plantation fertilizers and manure should be applied in two equal splits. The first installment should be applied during April-May, the second installment should be applied during September-October. Fertilizer should be applied around the tree up to canopy spread leaving 1.00-1.50 m from the tree base and mixed thoroughly with the soil followed by irrigation. Under hill slope conditions, drilling method should be followed.

WATERMELON (*Citrullus colocynthis*)

(Var. BARI Tormuj-1, BARI Tormuj-2)

Yield Goal: 50.0 ± 5.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)							OF (t/ha)
	N	P	K	S	Mg	Zn	B	
Optimum	0-39	0–12	0-40	0–5	0-3	-	-	7
Medium	40-78	13–24	41-80	6–10	4-6	0-1.6	0-1.0	
Low	79-117	25–36	81-120	11–15	7-9	2.3-3.2	1.1-2.0	
Very low	118-156	37–48	121-160	16–20	10-12	4.5-4.8	2.1-3.0	

Method of application:

a) One-third of the OF should be applied during final land preparation.

b) Rest two-thirds of the OF and all of P, S, Mg, Zn, B and one-third of K should be applied as basal into the pits.

c) One-fifth of N and one-third of K should be applied after 20 and 40 days of transplanting. After that, the rest of N could be applied in equal two installments at 20-day intervals.

NETTED MELON

(Variety: OP, Hybrid)

Yield Goal: 20.0 ±2.0 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-20	0-11	0-30	0–5	-	–	5
Medium	21-40	12-22	31-60	6–10	0-1.6	0.0–1.0	
Low	41-60	23-33	61-90	11–15	2.3-3.2	1.1–2.0	
Very low	61-80	34-44	91-120	16–20	4.5-4.8	2.1–3.0	

Method of application: Same as watermelon.

7.9 Hydroponic Culture

Fertilizer Recommendation (Amount: g/1000 L)*										
$Ca(NO_3)_2.4H_2O$	HNO_3	KOH	$MgSO_4.7H_2O$	KH_2PO_4	H_3BO_3	$ZnSO_4.7H_2O$	$MnSO_4.5H_2O$	$CuSO_4.5H_2O$	$(NH_4)_6Mo_7O_{24}.4H_2O$	Fe-EDTA
1000	272 ml	275	510	270	1.80	0.44	6.10	0.40	0.38	80

*BARI Hydroponic Solution-1; Electrical conductivity (EC) of Full strength of BARI Hydroponic Solution = 2.3~2.5 dS/m. The solution can be used in the following crops:

Crop	Variety	Yield	Application method
Tomato (*Solanum lycopersicum*)	BARI Tomato – 14	28.0 ± 2.0 kg/m^2	At seedling stage, low concentration of BARI Hydroponic Solution – 1 (1.5 dS/m EC) should be applied until transplanting. After transplanting till anthesis, hydroponic nutrient solution concentration should be maintained at 1.5 dS/m, while after anthesis and fruit development stage it should be increased to 2.3-2.5 dS/m and during fruit ripening stage EC should be maintained around 2.0 dS/m.
Sweet pepper (*Capsicum annuum L.*)	BARI Mistimorich – 1, and – 2	50.0 ± 5.0 t/ha	At seedling stage, low concentration of BARI Hydroponic Solution – 1 (1.5 dS/m EC) should be applied until transplanting. After transplanting till anthesis, hydroponic nutrient solution concentration should be maintained at 1.5 dS/m, while after anthesis and fruit development stage till harvest it should be increased to 2.0 dS/m
Lettuce (*Lactuca sativa*)	BARI Lettuce – 1	15.0 ± 1.0 kg/m^2	At seedling stage, low concentration of BARI Hydroponic Solution – 1 (1.5 dS/m EC) should be applied until transplanting. After transplanting till

Crop	Variety	Yield	Application method
			anthesis, hydroponic nutrient solution concentration should be maintained at 1.5-2.0 dS/m throughout the growing period until harvest.
Strawberry (*Fragaria × ananassa Duch.*)	BARI Strawberry – 1, – 2, and – 3	15.0 ± 1.0 kg/m^2	After transplanting till harvest, hydroponic nutrient solution concentration should be maintained at 1.0-1.2 dS/m.

7.10 Rooftop Gardening

MANGO (*Mangifera indica*)

(Var. BARI Aam-3, BARI Aam-4, BARI Aam-11**)**

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/plant/year)
	N	P	K	S	Zn	B	
Before planting (pot)	0	30	0	0	0		0
1-2	56	25	35	10	4	3	10
3-4	70	32	40	15	6	5	10
5-6	85	40	45	20	8	5	10
7-8	95	45	50	25	10	8	10
>9	120	60	75	35	12	10	10

Method of application:

- Before 15-20 days of sapling plantation, full amount of manure and P should be applied and mixed thoroughly with the soil into the pot, followed by irrigation.
- Pot size: 18-20″ x 18 -20″
- Media: After plantation, fertilizers should be applied in four equal splits. The first, second, third and fourth installments should be applied during September, December, March and June, respectively. Manure should be applied in two splits during September and March. However, refilling of the media should be done if necessary.

DRAGON FRUIT

(Var. BARI Dragonphol-1, BAU Dragon-1, BAU Dragon-2, BAU Dragon-3, BAU Dragon-4**)**

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/plant/year)
	N	P	K	S	Zn	B	
0–1	46	14	36	7	3.5	0.87	25
2–3	55	18	48	9.5	5	1.40	06
4–6	64	20	54	12	7	1.75	09
>6	69	24	60	12	7	1.75	12

Method of application:

- Before planting (1st year) 20 kg organic manure and 1/6th of other inorganic fertilizers should be applied to the potting media (70-100 kg soil/half drum).
- Afterward, the rest of the fertilizers will be applied in 5 splits at two months interval. From 2nd year, all the fertilizers are suggested to be applied in six splits at two months interval.
- Fertilizers should be applied in the periphery of the pot followed by light irrigation.

LEMON

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/plant/year)
	N	P	K	S	Zn	B	
0–1	18	6	18	2.5	1.0	0.87	25
2–3	23	8	24	3.0	2.0	0.87	06
4–6	28	9	24	3.5	3.0	1.39	09
>6	28	9	24	3.5	4.0	1.75	12

Method of application:

- Before planting (1st year) 20 kg organic manure and 1/6th of other inorganic fertilizers should be applied to the potting media (70-100 kg soil/half drum).
- Afterward, the rest of the fertilizers need to be applied in 5 splits in 2 month intervals. From the 2nd year, all the fertilizers are suggested to be applied in six splits at 2 month intervals.
- Fertilizers should be applied in the periphery of the pot followed by light irrigation.

GUAVA

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

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/plant/year)
	N	P	K	S	Zn	B	
0–1	19	6	18	2.35	1.65	7.00	25
2–3	23	7	21	2.80	2.64	9.00	06
4–6	28	8	24	3.50	3.30	10.50	09
>6	30	9	27	3.50	4.00	11.50	12

Method of application:

- Before planting (1st year) 20 kg organic manure and 1/6th of other inorganic fertilizers should be applied to the potting media (70-100 kg soil/half drum).
- Afterward, the rest of the fertilizers need to be applied in 5 splits in 2- month intervals. From the 2nd year, all the fertilizers are suggested to be applied in six splits at 2-month intervals.
- Fertilizers should be applied in the periphery of the pot followed by light irrigation.

GOLDEN APPLE

(BARI Amra-1, BAU Amra-1)

Age of tree (Year)	Nutrient Recommendation (g/tree/year)						OF (kg/plant/year)
	N	P	K	S	Zn	B	
0–1	14	8	18	3.53	1.65	0.87	25
2–3	19	10	24	4.70	2.64	1.39	06
4–6	23	12	30	4.70	2.64	139	09
>6	28	14	36	6.00	3.30	1.39	09

Method of application:

- Before planting (1st year) 20 kg organic manure and 1/6th of other inorganic fertilizers should be applied to the potting media (70-100 kg soil/half drum).
- Afterwords, the rest of the fertilizers need to be applied in 5 splits in 2- month intervals. From the 2nd year, all the fertilizers are suggested to be applied in six splits at 2- month intervals.
- Fertilizers should be applied in the periphery of the pot followed by light irrigation.

7.11 Floating Agriculture

Fertilizer management

The floating beds should be prepared as described in the text part of this Guide. The crops grown in the floating beds should be fertilized at the rates given in the table below. All of the fertilizers should be applied in liquid forms in six equal instalments for bottle gourd, turmeric and chilli and in five equal instalments for the other crops as mentioned in the table. The fertilizers should be applied at 15 days' intervals in turmeric and at 10 days' intervals in other crops since 15 days after seedling transplanting. Fertilizers should be dissolved in 10 litres of water and be applied in the bed around the plants. Zinc fertilizer should be applied as foliar spray. After heavy rainfall the rate of fertilizers should slightly be increased. Urea should not be applied as over dose which enhances decomposition of the bed and reduces its durability. There is no need of fertilizer application for raising seedlings on the floating bed because it may make the seedlings weaker and increase their mortality.

Fertilizer recommendation for vegetables and spices in floating bed

Vegetable/spice crops	Recommendation (g/10 sqm floating bed)					
	N	P	K	S	Zn	B
A. Vegetable crops						
1. Cucumber	26	13	9	5.0	0.42	0.77
2. Bottle gourd	24	27	15	5.9	0.42	0.77
3. Pumpkin	24	27	15	5.9	0.42	0.77
4. Watermelon	32	19	14	4.3	0.42	0.77
5. Bitter gourd	21	16	16	5.4	-	0.77
6. Yard long bean	20	16	16	5.0	0.42	0.77
7. Okra	42	16	12	4.3	0.42	0.77
8. Summer tomato	56	34	19	4.3	0.42	0.77
B. Spice crop						
9. Turmeric	44	18	53	8.5	-	1.12
10. Chilli	22	43	24	4.3	0.42	0.77

7.12 Plantation Crops

SUGARCANE (*Saccharum officinarum*)

(Var. BSRI Akh 41, BSRI Akh 42, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46, BSRI Akh 47, BSRI Akh 48**)**

Yield Goal: 100 ± 10 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF* (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-54	0-18	0-53	0-6	-	-	3
Medium	55-108	19-36	54-106	7-12	0-1.6	0-1.0	
Low	109-162	37-54	107-159	13-18	1.7-3.2	1.1-2.0	
Very low	163-220	55-72	160-212	19-24	3.3-4.8	2.1-3.0	

Method of application:

a) For heavy textured soils, half of N and K and all of P, S, Mg and Zn should be applied in trench and mixed thoroughly with the soil before planting of sugarcane. Remaining N and K should be applied as top dress at tillering stage (120–150 days after planting).

b) For light textured soils, one-third of N and K, and all of P, S, Mg and Zn should be applied in trench and mixed thoroughly with the soil before planting of sugarcane. Remaining N and K should be applied in two equal splits as top dress at tillering stage (90–120 DAP) and after completion of tillering (150-180 DAP).

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

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

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

SUGAR BEET (*Beta vulgaris*)

(All varieties**)**

Yield Goal: 80 ±8 t/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF
	N	P	K	S	Mg	Zn	
Optimum	0–32	0-16	0–40	0-6	0-3	–	5
Medium	33–64	17-32	41–80	7-12	4-6	0–2	
Low	65–96	33-48	81–120	13-18	7-9	3–4	
Very low	97–148	49-56	121–160	19-24	10-12	5–6	

Methods of application:

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

b) Remaining N and K should be side dressed in two equal splits at 30 and 60 days after sowing under moist soil condition and mixed thoroughly with the soil as soon as possible for better utilization.

PALMYRA PALM (*Borassus flabellifer*) (Tal)

(All cultivars**)**

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

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

Method of application:

a) Before planting, recommended OF should be applied into the pits as basal at 15-20 days before planting of sapling and mixed thoroughly with the soil followed by irrigation.

b) For growing trees, the recommended fertilizers should be applied in two equal splits during April-May and September-October. Fertilizer should be applied around the tree and mixed thoroughly with the soil followed by irrigation.

TEA (*Camellia sinensis*)

(All varieties)

Young Tea

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

Method of application:

Fertilizers should be applied in three split doses

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

Mature tea*

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

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

Method of application:

a) All of P and Zn; and half of N and K should be applied during April–May with onset of shower. Remaining half of N and K should be applied within July to first week of August.

b) Urea is generally used in tea cultivation as a source of nitrogen; and TSP/Rock phosphate/DAP and MOP might be used as the sources of P and K, respectively.

c) Zinc should also be applied as foliar spray four times a year- twice during mid-April to Mid-June and twice during mid-September to mid-October.

d) If soil pH is below 5.0, dolomite [$(CaMg(CO_3)_2$] application at 1-2 t/ha 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 could be 90 kg/ha for the first three years; and from the fourth year onwards N rate could be 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:

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

b) Rate of N could be 90 kg/ha for the first three years; and from the fourth year onwards N rate could be 100 kg/ha

BETEL LEAF (*Piper betle*)

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

Yield Goal: 35± 3.5 lac leaf/ha/year

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

Method of application:

a) One-third of oilcake and all of P, K and S should be applied as basal during final land preparation.

b) After 30–40 days of planting, remaining oilcake should be applied at 15–20 days of intervals 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.

BETELNUT (*Areca catechu*)

(All cultivars**)**

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

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

Method of application:

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

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

RUBBER (*Hevea brasiliensis*)

(Clone: TJIR-1, RRIM-600, PBIG, PB-217, PB-235, 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 into the pits 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 years 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).

7.13 Flowers

MARIGOLD (*Tagetes erecta* L.)

(Var. BARI Gada-1, French marigold**)**

Yield Goal : 10.0 ± 1.0 ton flowers/ha

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

Method of application:

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

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

MARIGOLD (*Tagetes erecta* L.)

(African marigold)

Yield Goal: 15± 1.5 ton flowers/ha

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

Method of application:

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

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

MARIGOLD (*Tagetes erecta* L.)

(BARI Gadha – 1)

(Hydroponic culture)

Yield Goal: 15.0 ± 2.0 flowers/plant

Fertilizer Recommendation (Amount: g/1000 L)*									
$Ca(NO_3)_2$. 4 H_2O	KNO_3	$MgSO_4$. 7 H_2O	KH_2PO_4	H_3BO_3	$ZnSO_4$. 7 H_2O	$MnSO_4$. 5 H_2O	$CuSO_4$. 5 H_2O	$(NH_4)_6Mo_7O_{24}$. 4 H_2O	Fe-EDTA
1000	580	510	270	1.80	0.44	6.10	0.40	0.38	80

*BARI Hydroponic Solution-1 (Asaduzzaman et al., 2021); EC of Full strength of BARI Hydroponic Solution = 2.3~2.5 dS/m.

Method of application:

At seedling stage, low concentration of BARI Hydroponic Solution – 1 (1.5 dS/m EC) should be applied until transplanting. After transplanting hydroponic nutrient solution concentration should be maintained at 1.5 dS/m till harvest.

ROSE (*Rosa centiflora*)

(Class: Hybrid tea)

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)					OF (t/ha)
	N	P	K	S	Zn	
Optimum	0–35	0–25	0–35	0-5	-	5
Medium	36–70	26–50	36–70	6-10	0-2.0	
Low	71–105	51–75	71–105	11-15	2.1-4.0	
Very low	106–140	76–100	106–140	16-20	4.1-6.0	

Method of application:

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

b) Nitrogen should be applied in three equal splits as topdress at 30, 60 and 90 DAP.

TUBEROSE (*Polianthes tuberosa*)

(Var. Double**)**

Yield Goal: 115,000–125,000 sticks/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–75	0–23	0–44	0–5	–	-	5
Medium	76–150	24–46	45–88	6–10	0.0–2.0	0-1.0	
Low	151–225	47–69	89–132	15–15	2.1–4.0	1.1-2.0	
Very low	226–300	70–92	133–176	16–20	4.1–6.0	2.1-3.0	

Method of application:

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

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

GLADIOLUS (*Gladiolus spp.*)

(Var. BARI Gladiolus-3, BARI Gladiolus-4, BARI Gladiolus-5**)**

Yield Goal: 175,000–200,000 flower sticks/ha

Soil analysis interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–60	0–22	0–45	0–8	–	–	5
Medium	61–120	23–44	46–90	9–16	0.0–2.0	0.0–0.7	
Low	121–180	45–66	91–135	17–24	2.1–4.0	0.8–1.4	
Very low	181–240	67–88	136–180	25–32	4.1–6.0	1.5–2.1	

Method of application:

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

d) Nitrogen should be applied in three equal splits as topdress at 30, 45 and 60 DAP.

ZINNIA (*Zinnia elegans*)

(All varieties)

Yield Goal : 200,000 – 300,000 flower sticks/ha

Soil analysis interpretation	Nutrient Recommendation (kg/ha)					OF (kg/tree/year)
	N	P	K	S	Zn	
Optimum	0–25	0–8	0–15	0–5	–	5
Medium	26–50	9–16	16–30	6–10	0.0–2.0	
Low	51–75	17–24	11–45	11–15	2.1–4.0	
Very low	76–100	25–32	46–180	16–20	4.1–6.0	

Method of application:

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

b) Nitrogen should be applied in three equal installments at 25, 45, 65 DAP.

GERBERA (*Gerbera jamesonii*)

(Var. BARI Gerbera-1, BARI Gerbera-2**)**

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)						OF (t/ha)	Coco-dust (kg/ha)
	N	P	K	S	Zn	B		
Optimum	0-50	0-25	0-40	0–8	-	-	5	1000
Medium	51-100	26-50	41-80	9–16	0-2.0	0-1.0		
Low	101-150	51-75	81-120	17–24	2.1-4.0	1.1-2.0		
Very low	151-200	76-100	121-160	25–32	4.1-6.0	2.1-3.0		

Method of application:

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

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

CHRYSANTHEMUM (*Chrysanthemum coronarium*)

(Var. BARI Chandramallika-1, BARI Chandramallika-2, BARI Chandramallika-3, BARI Chandramallika-4, Large flowered varieties**)**

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–50	0–25	0–40	0–5	-	-	3
Medium	51–100	26–50	41–80	6–10	0-2.0	0-1.0	
Low	101–150	51–75	81–120	11–15	2.1-4.0	1.1-2.0	
Very low	151–200	76–100	121–160	16–20	4.1-6.0	2.1-3.0	

Method of application:

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

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

CHRYSANTHEMUM (*Chrysanthemum coronarium*)

(Var. BARI Chandramallika-1, BARI Chandramallika-2, BARI Chandramallika-3, BARI Chandramallika-4, Small flowered varieties**)**

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)						OF (t/ha)	Bonemeal (kg/ha)
	N	P	K	S	Zn	B		
Optimum	0–45	0–22	0–40	0–5	-	-	2	15
Medium	46–90	23–44	41–80	6–10	0-2.0	0-1.0		
Low	91–135	45–66	81–120	11–15	2.1-4.0	1.1-2.0		
Very low	136–180	67–88	121–160	16–20	4.1-6.0	2.1-3.0		

Method of application:

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

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

ORCHID (*Phaius tankervilleae*)

(Var. BARI Orchid-1**)**

Yield Goal : 18,000–20,000 flowers/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0–22	0–10	0–20	0–5	-	-	5
Medium	23–44	11–20	21–40	6–10	0-2.0	0-1.0	
Low	45–66	21–30	41–60	11–15	2.1-4.0	1.1-2.0	
Very low	67–88	31–40	61–80	16–20	4.1-6.0	2.1-3.0	

Method of application:

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

b) Nitrogen should be applied as topdress in three equal splits at 30, 60 and 90DAT and mixed thoroughly with the soil.

GYPSOPHILA (*Gypsophila paniculata*)

(Var. BARI Gysophila-1**)**

Yield Goal: Seed-1200 kg/ha, Cut flower bunch yield- 190000 nos. bunch/ha

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha)						OF (t/ha)
	N	P	K	S	Zn	B	
Optimum	0-29	0-16	0-24	0-8	–	–	5
Medium	30-58	17-32	25-48	9-16	0.0–1.3	0.0–0.7	
Low	59-87	33-48	49-72	17-24	1.4–2.6	0.8–1.4	
Very low	88-116	49-64	73-96	25-32	2.7–3.9	1.5–2.1	

Method of application:

a) The full dose of cowdung, one-third of N, full of P, half of K, and full of S should be applied during final land preparation.

b) Remaining two-third of N and half of K should be applied in two equal splits, the first split at 20 days after sowing (DAS) and the second split at 35 DAS.

7.14 Fodder Crops

NAPIER GRASS (*Pennisetum purpureum*)

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

Yield Goal (Green biomass): 300 ± 30 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–45	0–6	0–10	0–3	-
Medium	46–90	7–12	11–20	4–6	0-1.3
Low	91–135	13–18	21–30	7–9	1.4-2.6
Very low	136–180	19–24	31–40	10–12	2.7-3.9

Method of application:

a) All of P, K, S and Zn and 25% of N should be applied as basal during final land preparation.

b) 25% of N should be top dressed after 25 days of sowing/planting.

c) The remaining 50% of N should be top dressed in equal splits after each cut at 30 – 40 days' intervals.

PARA GRASS (*Brachiaria mutica*)

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–30	0–5	0–8	0–2	-
Medium	31–60	6–10	9–16	3–4	0-1.0
Low	61–90	11–15	17–24	5–6	1.1-2.0
Very low	91–120	16–20	25–32	7–8	2.1-3.0

Method of application:

a) All of P, K, S and Zn and 25% of N should be applied as basal during final land preparation.

b) 25% of N should be top dressed after 25 days of sowing/planting.

c) The remaining 50% of N should be top dressed in equal splits after each cut at 30 – 40 days' intervals.

GERMAN GRASS (*Echinocloa crusgalli*)

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–33	0–4	0–6	0–2	-
Medium	34–66	5–8	7–12	3–4	0-1.0
Low	67–99	9–12	13–18	5–6	1.1-2.0
Very low	100–132	13–16	19–24	7–8	2.1-3.0

Method of application:

a) All of P, K, S and Zn and 25% of N should be applied as basal during final land preparation.

b) 25% of N should be top dressed after 25 days of sowing/planting.

c) The remaining 50% of N should be top dressed in equal splits after each cut at 30 – 40 days' intervals.

DHAL GRASS (*Hymenachne amplexicaulis*)

Yield Goal (Green biomass): 100 ± 10 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–25	0–4	0–6	0–1.5	-
Medium	26–50	5–8	7–12	1.6–3.0	0-1.0
Low	51–75	9–12	13–18	3.1–4.5	1.1-2.0
Very low	76–100	13–16	19–24	4.6–6.0	2.1-3.0

Method of application:

a) All of P, K, S and Zn and 25% of N should be applied as basal during final land preparation.

b) 25% of N should be top dressed after 25 days of sowing/planting.

c) The remaining 50% of N should be top dressed in equal splits after each cut at 30 – 40 days' intervals.

GUINEA GRASS (*Panicum maximum*)

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

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–33	0–4	0–6	0–1.5	-
Medium	34–66	5–8	7–12	1.6–3.0	0-1.0
Low	67–99	9–12	13–18	3.1–4.5	1.1-2.0
Very low	100–132	13–16	19–24	4.6–6.0	2.1-3.0

Method of application:

d) All of P, K, S and Zn and 25% of N should be applied as basal during final land preparation.

e) 25% of N should be top dressed after 25 days of sowing/planting.

f) The remaining 50% of N should be top dressed in equal splits after each cut at 30 – 40 days' intervals.

JUMBO

(**Var.** Hybrid sorghum)

Yield Goal: 150 ± 15 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–37	0–5	0–7	0–2	-
Medium	38–74	6–10	8–14	3–4	0-1.0
Low	75–111	11–15	15–21	5–6	1.1-2.0
Very low	112–148	16–20	22–28	7–8	2.1-3.0

Method of application:

a) All of P, K, S and Zn and 25% of N should be applied as basal during final land preparation.

b) 25% of N should be top dressed after 25 days of sowing/planting.

c) The remaining 50% of N should be top dressed in equal splits after each cut at 30 – 40 days' intervals.

ROZI (*Brachiaria ruzuziensis*)

Yield Goal: 120 ± 12t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–30	0–4	0–6	0–1.5	-
Medium	31–60	5–8	7–12	1.6–3.0	0-1.0
Low	61–90	9–12	13–18	3.1–4.5	1.1-2.0
Very low	91–120	13–16	19–24	4.6–6.0	2.1-3.0

Method of application:

a) All of P, K, S and Zn and 25% of N should be applied as basal during final land preparation.

b) 25% of N should be top dressed after 25 days of sowing/planting.

c) The remaining 50% of N should be top dressed in equal splits after each cut at 30 – 40 days' intervals.

MAIZE (*Zea mays* L.)

Yield Goal: 80 ± 8 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–30	0–4	0–5	0–1.5	-
Medium	31–60	5–8	6–10	1.6–3.0	0-1.0
Low	61–90	9–12	11–15	3.1–4.5	1.1-2.0
Very low	91–120	13–16	16–20	4.6–6.0	2.1-3.0

Method of application:

a) All of P, K, S and Zn and 50% of N should be applied as basal during final land preparation.

b) Remaining 50% of N should be top dressed after 30 days of sowing/planting.

OAT (*Avena sativa*)

Yield Goal: 50 ± 5 t/ha/year

Soil Analysis Interpretation	Nutrient Recommendation (kg/ha/year)				
	N	P	K	S	Zn
Optimum	0–15	0–3	0–4	0–1.5	-
Medium	16–30	4–6	5–8	1.6–3.0	0-1.0
Low	31–45	7–9	9–12	3.1–4.5	1.1-2.0
Very low	46–60	10–12	13–16	4.6–6.0	2.1-3.0

Method of application:

a) All of P, K, S and Zn and 50% of N should be applied as basal during final land preparation.

b) Remaining 50% of N should be top dressed after 30 days of sowing/planting.

8. 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; 398154 ha
Medium highland	34	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	12	120	18	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	6.0 ± 0.6	90	6	65	7	0	1	0	0
Rabi	Maize	11.0 ±1.1	240	36	135	36	15	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	6.0 ± 0.6	90	6	53	7	0	2	0	0
Rabi	Potato	30.0 ± 3.0	135	20	135	15	10	3	1.5	3
Kharif-1	Maize	7.0 ± 0.70	168	15	61	15	10	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	53	7	0	1	0	0
Rabi	Mustard	1.8± 0.18	90	16	60	15	5	2	1	3
	Boro	6.0 ± 0.6	138	6	77	9	0	2	0	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	6.0 ± 0.6	90	6	65	7	0	1	0	0
Rabi	Wheat	4.0 ± 0.4	120	20	90	15	8	3	2	2
Kharif-1	T. Aus	5.0 ± 0.5	72	5	53	5	0	0	0	0
Kharif-2	T. Aman	6.0 ± 0.6	90	6	65	7	0	1	0	0
Rabi	Wheat	4.0 ± 0.4	120	20	90	15	8	3	2	2
Kharif-1	Jute O)	4.0 ± 0.4	105	7	60	11	0	0	0	0
Kharif-2	T. Aman	6.0 ± 0.6	90	6	65	7	0	1	0	0
Rabi	Potato	30.0± 3.0	135	20	135	15	10	3	1.5	3
	Boro	6.0 ± 0.6	138	6	62	9	0	2	0	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	6.0 ± 0.6	90	6	53	7	0	1	0	0
Rabi	Wheat	4.0 ± 0.4	120	20	90	15	8	3	2	2
Kharif-1	Maize	7.0 ± 0.70	168	15	76	15	10	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	65	7	0	1	0	0
Rabi	Chilli	2.5± 0.25	75	24	90	12	0	2	1	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. aman	6.0 ± 0.6	90	6	65	7	0	1	0	0

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Groundnut	2.5 ± 0.25	36	20	60	30	0	3	1	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. aman	6.0 ± 0.6	90	6	65	7	0	1	0	0
Rabi	Wheat	4.0 ± 0.4	120	20	90	15	8	3	2	2
Kharif-1	Mungbean	2.0 ± 0.2	18	6	19	7	0	0	0	0
Kharif-2	T. Aman	6.0 ± 0.6	90	6	65	7	0	1	0	0
Rabi	Potato	30± 3.0	135	20	135	15	10	3	1.5	3
Kharif-1	T. aus	5.0 ± 0.5	72	5	43	5	0	0	0	0
Kharif-2	T. aman	6.0 ± 0.6	90	6	53	7	0	1	0	0
Year round	Sugarcane + Lentil	100 ± 10 1.8±0.18	180	44	180	30	0	5	3	3
Rabi	Radish	60 ± 6.0	111	30	90	18	0	2	1	5
	Cabbage	90 ± 9.0	150	30	60	15	8	2	1.5	5
	Cauliflower	60 ± 6.0	120	30	80	18	8	2	1.5	5
	Tmato	75 ± 7.5	90	22	75	21	0	2	2	5
	Brinjal	50 ±5.0	135	30	120	15	12	2	2	7
Kharif-1	Okra	25 ± 2.5	90	13	46	9	0	2	0	5
	Ind. Spinach	30± 3.0	90	13	26	9	0	2	0	5
	Bottle gourd	60 ±6.0	100	16	39	12	10	2	0	5
	Amaranthus	30± 3.0	60	10	23	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	20	78	9	12	2	1	7
	Ash gourd	60 ±6.0	100	16	39	12	10	2	1	5
	Bitter gourd	25 ± 2.5	75	18	59	9	8	2	1	5
	Pointed	25 ± 2.5	90	12	26	9	8	2	1	5
	Cucumber	25 ± 2.5	75	12	29	9	0	2	1	5

AEZ 2: ACTIVE TISTA FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Medium highland	72	The region occupies narrow belts, within and adjoining the channels, rivers in Nilphamari, Rangpur, Lalmonirhat, Kurigram and Gaibandha districts; 83644 ha.

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	15	4	2	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	10	3	1.5	3
	Boro	6.0 ± 0.6	138	9	42	9	0	1.5	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	5	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	1.5	0	
Kharif-1	T. Aus	4.0 ± 0.4	63	5	30	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	10	3	1.5	3
Kharif-1	Maize	7.0 ± 0.7	168	23	41	15	10	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	3	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	8	3	2	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	10	3	1.5	3
Rabi	T. aus	5.0 ± 0.5	72	7	29	5	0	1.5	0	
Kharif-2	T. aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	15	3	2	3
Kharif-1	Jute	4.0 ± 0.4	105	11	33	11	0	2	0	
Kharif-2	T. aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Radish	60 ± 6.0	111	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	8	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	60	18	8	2	1.5	5
	Tomato	45 ± 4.5	90	33	50	21	0	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	12	2	2	7

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	60.0 ±6.0	100	25	26	12	10	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	12	2	1	7
	Bottle gourd	60.0 ±6.0	100	25	26	12	10	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	8	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	8	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	5

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 Bogura and part of Jaipurhat, Naogaon and Rajshahi districts; 946803 ha.
Medium highland	51	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	12	80	18	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	20	90	15	10	3	1.5	3
	Boro	6.0 ± 0.6	138	6	42	9	0	1.5	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	35	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	16	40	15	2.5	2	1	3
	Boro	6.0 ± 0.6	138	6	51	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	43	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	12	80	18	0	3	0	2
Kharif-1	T. Aus	5.0 + 0.5	72	5	35	5	0	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	43	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	36	90	36	10	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	35	6	0	2	0	
Rabi	Potato	30.0± 3.0	135	20	90	15	10	3	1.5	3
Kharif-1	Maize	7.0 ± 0.70	168	15	41	15	7	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	35	7	0	1	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Wheat	4.0 ± 0.4	120	20	60	15	4	2.5	2	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	7	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	20	90	15	10	3	1.5	3
Rabi	T. Aus	5.0 + 0.5	72	5	29	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	35	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	36	90	36	10	4	2	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	7	33	9	0	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	35	6	0	1	0	
Rabi	Potato	30.0± 3.0	135	20	90	15	10	3	1.5	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	7	33	11	0	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	35	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	36	90	36	10	4	2	3
Kharif-1	T. Aus	5.0 + 0.5	72	5	29	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	6	35	6	0	1	0	
Rabi	Onion	20.0 ± 2.0	90	20	50	30	0	2.5	1.5	5
Kharif-1	Okra	25.0 ± 2.5	90	13	36	8	0	1	0	
Kharif-2	T. aman	6.0 ± 0.6	90	6	35	6	0	1	0	
Rabi	Garlic	15.0 ± 1.5	90	20	50	30	0	2.5	1.5	5
Kharif-1	T. aus	5.0 + 0.5	72	5	35	5	0	1.5	0	
Kharif-2	T. aman	6.0 ± 0.6	90	6	43	6	0	1	0	
Rabi	Garlic	15.0 ± 1.5	90	20	50	30	0	2.5	1.5	5
Kharif-1	Jute (O)	4.0 ± 0.4	105	7	40	9	0	1.5	0	
Kharif-2	T. aman	6.0 ± 0.6	90	6	43	6	0	1	0	
Year round	Sugarcane +Lentil	100 ± 10 1.8 ± 0.18	183	46	122	30	0	5	2.5	3
Year round	Ginger	30.0 ± 3.0	135	30	80	15	0	3	1.5	3
Year round	Turmeric	30.0 ± 3.0	105	20	80	15	0	3	1.5	2
Rabi	Radish	60.0 ± 6.0	111	30	60	18	0	2	1	5
	Cabbage	90.0 ± 9.0	150	30	40	15	5	2	1.5	5
	Cauliflower	60.0 ± 6.0	120	30	60	18	5	2	1.5	5
	Tomato	45.0 ± 4.5	90	22	50	21	0	2	2	5
	Brinjal	50.0 ±5.0	135	30	80	15	8	2	2	7
Kharif-1	Okra	25.0 ± 2.5	90	13	30	9	0	2	0	5
	Ind. spinach	30.0± 3.0	90	13	17	9	0	2	0	5
	Ash gourd	60.0 ±6.0	100	17	26	12	6	2	0	5
	Amaranthus	30.0± 3.0	60	9	16	7	0	2	0	5
Kharif-2	Brinjal	50.0 ±5.0	135	20	52	9	8	2	1	7
	Bottle gourd	60.0 ±6.0	100	17	26	12	6	2	1	5
	Bitter gourd	25 ± 2.5	75	18	39	9	5	2	1	5
	Pointed	25 ± 2.5	90	12	17	9	5	2	1	5
	Cucumber	25 ± 2.5	75	12	20	9	0	2	1	5

AEZ 4: KARATOYA-BANGALI FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
High land	23	Eastern half of Bogura, most of Sirajganj and small areas of Pabna districts; 257158 ha
Medium highland	44	
Medium lowland	14	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	1.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	3	1.5	3
	Boro	6.0 ± 0.6	138	9	42	9	0	1	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Chilli	2.5± 0.25	75	24	60	8	0	2	1.5	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	10	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	10	2.5	3	1	3
	Boro	6.0 ± 0.6	138	9	51	6	0	1	0	
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	
Rabi	Groundnut	2.5 ± 0.25	36	30	40	20	0	2.5	1	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Maize	11.0 ±1.1	240	36	90	24	10	4	2	3
Kharif-1	Dhaincha	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	1.5	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	-
Rabi	Grasspea	1.5 ± 0.15	15	15	12	6	0	0	0	-
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	
Rabi	Blackgram	1.5 ± 0.15	18	15	12	6	0	2	1.5	-
Kharif-1	Sesame	1.5± 0.15	75	14	43	4	0	0	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Kharif-2	Fallow	0	0	0	0	0	0	0	0	-
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	4	1.5	2	2
Kharif-1	Sesame	1.4± 0.14	75	14	43	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	24	10	4	2	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	7	33	7	0	2	0	
Kharif-2	Fallow	0	0	0	0	0	0	0	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	1.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Radish	60 ± 6.0	111	30	60	12	0	2	1	5
	Cabbage	90 ± 9.0	150	30	40	10	5	2	1.5	5
	Cauliflower	60 ± 6.0	120	30	60	12	5	2	1.5	5
	Tomato	45 ± 4.5	90	33	50	14	0	2	2	5
	Brinjal	50 ±5.0	135	30	80	10	8	2	2	7
Kharif-1	Okra	25 ± 2.5	90	13	30	6	0	2	0	5
	Ind. spinach	30± 3.0	90	13	17	6	0	2	0	5
	Ash gourd	60.0 ± 6.0	99	17	26	8	6	2	0	5
	Amaranthus	30.0± 3.0	60	9	16	5	0	2	0	5
Kharif-2	Brinjal	50.0 ±5.0	135	20	52	6	8	2	1	7
	Bottle gourd	60.0 ± 6.0	99	17	26	8	6	2	1	5
	Bitter gourd	25 ± 2.5	75	18	39	6	5	2	1	5
	Pointed	25 ± 2.5	90	12	17	6	5	2	1	5
	Cucumber	25 ± 2.5	75	12	20	6	0	2	1	5

AEZ 5: LOWER ATRAI BASIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Medium lowland	21	Most of this region lies in Naogaon and Natore districts, small areas extend into Rajshahi, Bogra and Sirajganj districts; 85105 ha.
Lowland	65	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	1.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	1.5	0	2
Kharif-1 Kharif-2	B. Aman	2.50 ± 0.25	36	5	16	4	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	1.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	6	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	0	3	1	3
	Boro	6.0 ± 0.6	138	9	51	6	0	2	0	
Kharif-1 Kharif-2	B. Aman	2.50 ± 0.25	36	5	16	4	0	0	0	
Rabi	Boro	6.0 ± 0.60	138	15	64	15	0	2	0	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Onion	20.0 ± 2.0	9	20	50	20	0	2.5	1.5	3
Kharif-1	Jute- C	3.5 ± 0.35	90	7	35	7	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Wheat	4.0 ± 0.4	120	30	60	10	0	2.5	2	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	10	0	3	0	3
Kharif-1	Maize	7.0 ± 0.7	168	15	41	10	0	2	1.5	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	

AEZ 6: LOWER PUNARBHABA 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; 12896 ha.
Lowland	60	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	1.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Mastard	1.8 ± 0.18	90	24	40	10	0	3	1	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	6	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	6	0	1	0	
Rabi	Mastard	1.8 ± 0.18	90	24	40	10	0	3	1	2
	Boro	6.0 ± 0.6	138	9	51	6	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	6	0	2	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	10	0	2	0	2
Kharif-1	Maize	7.0 ± 0.7	240	32	72	14	5	2	1	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	8	0	1	0	
Rabi	Mastard	1.8 ± 0.18	90	24	40	10	0	3	1	3
	Boro	6.0 ± 0.6	138	9	51	6	0	1	0	
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	6	0	1	0	
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; 319001 ha
Medium lowland	20	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	2.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	2	0	
Rabi	Wheat	4.0 ± 0.4	120	30	90	15	0	2.5	0	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	60	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	1	0	
Rabi	Mastard	1.8 ± 0.18	90	24	60	15	5	3	1	3
	Boro	6.0 ± 0.6	138	9	77	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	135	36	10	4	2	3
Kharif-1	Jute- C	3.5 ± 0.35	90	7	43	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	6.0 ± 0.6	138	15	96	15	0	3	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	6	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	135	36	10	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	53	7	0	2	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	2.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	53	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	2	0	
Rabi	Groundnut	2.5 ± 0.25	36	30	60	30	0	2.5	2	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Blackgram	1.5 ± 0.15	18	15	18	9	0	0	0	
	Boro	7.5 ± 0.75	174	11	96	14	0	2.5	0	
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	6	0	1	0	
Rabi	Onion	20.0 ± 2.0	90	30	75	30	0	2.5	1.5	2
Kharif-1	Jute- C	3.5 ± 0.35	90	7	53	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	S. potato	40.0 ± 4.0	120	36	120	15	5	3	1.5	3
Kharif-1	Jute- C	3.5 ± 0.35	90	7	43	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Mustard	2.0 ± 0.2	90	24	75	24	3	2	1	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	60	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	1	0	
Year round	Sugarcane +Lentil	100 ± 10 1.8 ± 0.18	183	69	183	30	0	5	2.5	3
Rabi	Radish	60 ± 6.0	110	45	90	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	60	15	5	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	80	18	5	2	1.5	5
	Tomato	45 ± 4.5	120	45	75	21	8	2	2	5
	Brinjal	50 ±5.0	135	45	120	15	8	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	46	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	25	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	39	12	6	2	0	5
	Amaranthus	30± 3.0	60	13	23	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	78	9	8	2	1	7
	Botte gourd	50 ±5.0	100	26	39	12	6	2	1	5
	Bitter gourd	25 ± 2.5	75	27	59	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	26	9	5	2	1	5
	Cucumber	25 ± 2.5	75	18	29	9	0	2	1	5

AEZ 8: YOUNG BAHMAPUTRA 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; 592394 ha.
Medium highland	42	
Medium lowland	19	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	Fallow	0	0	0	0	0	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Boro	6.0 ± 0.6	138	15	64	15	0	2.5	0	2
Kharif-1	Jute	4.0 ± 0.4	105	11	40	7	0	2		
Kharif-2	T. Aman	5.0 ± 0.5	72	9	43	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	3	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	Fallow	0	0	0	0	0	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	3	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	2	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	T. Aus	4.0 ± 0.4	63	5	30	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	10	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	5	0	2	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	3	1.5	3
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	13	6	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	3	1.5	3
	Boro	6.0 ± 0.6	138	9	42	9	0	2	0	
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	13	4	0	1	0	
Year round	Sugarcane + Lentil	100 ± 10 1.8 ± 0.18	183	69	122	30	0	5	2.5	3
Rabi	Radish	60 ± 6.0	110	45	60	12	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	10	2.5	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	60	12	2.5	2	1.5	5
	Tomato	45 ± 4.5	120	45	50	14	4	2	2	5
	Brinjal	50 ±5.0	135	45	80	10	4	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	6	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	6	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	8	3	2	0	5
	Amaranthus	30± 3.0	60	14	16	5	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	6	4	2	1	7
	Botte gourd	50 ±5.0	100	26	26	8	3	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	6	2.5	2	1	5
	Pointed gourd	25 ± 2.5	90	18	17	6	2.5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	6	0	2	1	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; 723037 ha.
Medium highland	35	
Medium lowland	20	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	2.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	64	7	0	2	0	
Rabi	Mustard	1.8 ± 0.18	90	24	60	15	2.5	3	1	3
	Boro	6.0 ± 0.6	138	9	77	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	64	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	3	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	53	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	64	7	0	1	0	
Rabi	Boro	6.0 ± 0.6	138	15	96	15	0	2	0	2
Kharif-1	Jute	4.0 ± 0.4	105	11	60	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	64	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	60	15	2.5	3	1	3
	Boro	6.0 ± 0.6	138	9	77	9	0	2	0	
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	6	24	4	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	90	15	4	2.5	2	2
Kharif-1	Jute	4.0 ± 0.4	105	11	60	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	52	7	0	2	0	
Rabi	Maize	11.0 ±1.1	240	54	135	36	10	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	52	7	0	2	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	3	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	4	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	90	15	4	2.5	2	2
Kharif-1	Jute	4.0 ± 0.4	105	11	60	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Maize	11.0 ±1.1	240	54	135	36	10	3	2.0	3
Kharif-1	Jute	4.0 ± 0.4	105	11	49	11	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	52	7	0	2	0	
Rabi	Chilli	2.5± 0.25	75	36	90	12	0	2	1.5	3
Kharif-1	Jute	4.0 ± 0.4	105	11	60	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Onion	20.0 ± 2.0	90	30	75	30	0	2.5	1.5	5
Kharif-1	Jute	4.0 ± 0.4	105	11	60	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Year round	Sugarcane +Lentil	100 ±10.0 1.8 ± 0.18	183	69	183	30	0	3.5	2.5	3
Rabi	Radish	60 ± 6.0	110	45	90	18	0	3	1	5
	Cabbage	90 ± 9.0	150	45	60	15	5	1.5	1.5	5
	Cauliflower	60 ± 6.0	120	45	80	18	5	1.5	1.5	5
	Tomato	45 ± 4.5	120	45	75	21	8	1.6	2	5
	Brinjal	50 ±5.0	135	45	120	15	8	1.5	2	7
Kharif-1	Okra	25 ± 2.5	90	20	46	9	0	1	0	5
	Ind. spinach	30± 3.0	90	20	26	9	0	1	0	5
	Ash gourd	50 ±5.0	100	26	39	12	6	1.5	0	5
	Amaranthus	30± 3.0	60	14	23	7	0	1	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	78	9	8	1	1	7
	Botte gourd	50 ±5.0	100	26	39	12	6	1	1	5
	Bitter gourd	25 ± 2.5	75	27	59	9	5	1	1	5
	Pointed	25 ± 2.5	90	18	26	9	5	1	1	5
	Cucumber	25 ± 2.5	75	18	29	9	0	1	1	5

AEZ 10: ACTIVE GANGES FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	12	The region extends along the Ganges and lower Meghna river Channels from the Indian border through Chapai Nawabganj and Rajshahi districts to the mouth of Meghna Estuary in Laxmipur and Barisal districts; 333447 ha.
Medium highland	33	
Medium lowland	18	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Mustard	2.0 ± 0.2	90	24	50	24	0	2.5	1	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1.5	0	
Kharif-2	Blackgram	1.5 ± 0.15	18	9	10	5	0	0	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	0	2.5	1.5	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	3	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Lentil*	1.8 ± 0.18	21	15	16	12	0	2	1	
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	4	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Mustard	1.8 ± 0.18	90	24	50	15	0	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	0	3.0	1.5	3
Kharif-1	Maize	7.0 ± 0.7	168	30	41	15	3.5	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Round the year	Sugarcane + Lentil	100 ±10.0 1.8 ± 0.18	183	69	122	30	0	5	3	3
Rabi	Onion	20.0 ± 2.0	90	30	50	30	0	2.5	1.5	5
Kharif-1 Kharif-2	Jute (O)	4.0 ± 0.4	105	11	40	11	0	3	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Maize	11.0 ±1.1	240	54	90	36	5	4	2	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	29	5	0	1.5	0	
Kharif-2	Blackgram	1.5 ± 0.15	18	9	8	5	0	0	0	
Rabi	Mustard	1.8 ± 0.18	90	24	50	15	0	3	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	6	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1 Kharif-2	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Lentil	1.8 ± 0.18	21	15	16	12	0	2	1	
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1.5	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Maize	11.0 ±1.1	240	54	90	36	5	3	2	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	33	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	0	2.5	2.0	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Garlic	20 ± 2.0	90	30	50	30	0	2.5	1.5	5
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Radish	60 ± 6.0	110	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	2.6	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	60	18	2.5	2	1.5	5
	Tomato	45 ± 4.5	120	45	50	21	4	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	4	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	3	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	4	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	3	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	2.5	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	2.5	2	1	5
	Cucumber	25 ± 2.5	75	18	29	9	0	2	1	5

AEZ 11: HIGH GANGES RIVER FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	43	Chapainawabganj, Rajshahi, southern Pabna, Kushtia, Meherpur, Chuadanga, Jhenidah, Magura, Jessore, Satkhira and Khulna districts together with minor areas in Naogaon and Narail districts; 1320549 ha.
Medium highland	32	
Medium lowland	12	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	175	18	80	18	0	2.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	175	18	80	18	0	2.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	0	0	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2.5	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Boro	6.0 ± 0.6	138	15	64	15	0	3	0	2
Kharif-1	Jute (O)	4.5 ± 0.45	105	11	40	7	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	0	3	2	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Onion	20.0 ± 2.0	90	30	50	30	0	2.5	1.5	5
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	7	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Lentil*	1.8 ± 0.18	21	15	16	12	0	2.5	1	
	Jute (O)	4.5 ± 0.45	105	11	40	7	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	0	4	2	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	33	7	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	0	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Lentil*	1.8 ± 0.18	21	15	16	8	0	2.0	1	
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	0	2	2	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	0	2	2	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	0	0	
Kharif-2	Blackgram	1.5 ± 0.15	18	9	10	5	0	1	0	
Rabi	Onion	20.0 ± 2.0	90	30	50	30	0	2.5	1.5	3
Kharif-1	Jute (O)	4.5 ± 0.45	105	11	40	7	0	0	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Year round	Sugarcane + Lentil	100 ±10.0 1.8 ± 0.18	183	69	122	26	0	3	2.5	3
Rabi	Radish	60 ± 6.0	110	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	0	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	60	18	0	2	1.5	5
	Tomato	45 ± 4.5	120	45	50	21	0	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	0	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	0	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	0	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	0	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	0	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	0	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	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; 796751 ha.
Medium highland	29	
Medium lowland	31	
Lowland	14	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.6	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.8	0	
Rabi	Onion	20.0 ± 2.0	90	30	50	30	0	2.6	2	5
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.4	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	0	2.6	2	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.4	0	
Rabi	Lentil	1.8 ± 0.18	21	15	16	12	0	2	1	0
Kharif-1	Jute (O)	4.5 ± 0.45	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.4	0	
Rabi	Boro	7.5 ± 0.75	174	15	64	15	0	2.6	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	
Rabi	Mustard	2.0 ± 0.2	90	24	50	24	0	2.6	1	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.4	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	0	2.0	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2.0	0	
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	
Rabi	Grasspea	1.5 ± 0.15	15	15	12	9	0	0	0	0
Kharif-1	Jute (O)	4.0 ± 0.4	105	14	40	11	0	4	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.4	0	
Rabi	Onion	20.0 ± 2.0	90	30	50	30	0	2.6	1.5	5
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	
Rabi	Lentil*	1.8 ± 0.18	21	15	24	12	0	2	1	0
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	4	0	1	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Mustard	2.0 ± 0.2	90	24	50	24	0	2.6	1	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Garlic	15.0 ± 1.5	90	30	50	30	0	2.6	1.5	5
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	1.4	0	
Rabi	Coriander	1.5 ± 0.15	60	21	36	15	0	2.6	1	0
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	1.4	0	
Rabi	Groundnut*	2.5 ± 0.25	36	30	40	30	0	2.6	2	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Year round	Sugarcane	100 ± 10	162	54	106	18	0	3	2.5	3
Rabi	Radish	60 ± 6.0	110	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	0	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	60	18	0	2	1.5	5
	Tomato	45 ± 4.5	120	45	50	21	0	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	0	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	0	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	0	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	0	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	0	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	0	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	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; 1706573ha.

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Fallow	-	-	-	-	-	-	-	-	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	15	54	0	0	2	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	0	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	
Rabi	Mungbean	2.0 ± 0.2	18	15	16	0	0	2	0	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	
Rabi	Mungbean	**2.0 ± 0.2**	18	15	16	0	0	2	0	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	
Rabi	Grasspea	1.5 ± 0.15	15	15	12	0	0	0	0	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	
Rabi	Fallow	-	-	-	-	-	-	-	-	
Kharif-1	T. Aus	5.0 ± 0.5	72	12	44	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	
Rabi	Watermelon	50.0 ± 5.0	117	36	80	0	0	3	0	7
Kharif-1	T. Aus	5.0 ± 0.5	72	7	29	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	0	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	0	0	1	0	3
	Boro	6.0 ± 0.6	138	9	51	0	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	0	0	3	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	1	0	
Rabi	Chilli	2.5± 0.25	75	36	60	0	0	2	0	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Sweet gourd	45.0 ±4.5	84	42	56	0	0	4	0	5
Kharif-1	T. Aus	5.0 ± 0.5	72	7	29	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	0	0	1	0	
Rabi	Sunflower	2.5± 0.25	105	36	60	0	0	2	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	0	0	2	0	
Rabi	Maize	11.0 ±1.1	240	54	90	0	0	4	0	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	29	0	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	0	0	1	0	
Rabi	Radish	60 ± 6.0	110	45	60	0	0	2	0	5
	Cabbage	90 ± 9.0	150	45	40	0	0	2	0	5
	Cauliflower	60 ± 6.0	120	45	60	0	0	2	0	5
	Tomato	45 ± 4.5	120	45	50	0	0	2	0	5
	Brinjal	50 ±5.0	135	45	80	0	0	2	0	7
Kharif-1	Okra	25 ± 2.5	90	20	30	0	0	2	0	5
	Ind. Spinach	30± 3.0	90	20	17	0	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	0	0	2	0	5
	Amaranthus	30± 3.0	60	14	16	0	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	0	0	2	0	7
	Botte gourd	50 ±5.0	100	26	26	0	0	2	0	5
	Bitter gourd	25 ± 2.5	75	27	39	0	0	2	0	5
	Pointed	25 ± 2.5	90	18	17	0	0	2	0	5
	Cucumber	25 ± 2.5	75	18	20	0	0	2	0	5

AEZ 14: GOPALGANJ-KHULNA BILS

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Medium highland	13	The region occupies a number of separate basin areas in Madaripur, Gopalganj, Narail, Jessore, Bagerhat and Khulna districts; 224700 ha.
Medium lowland	41	
Lowland	28	
Very lowland	11	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	116	18	40	12	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	9	22	5	0	1	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	116	18	40	12	0	2	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	24	5	8	2	0	1		
Rabi	Wheat	4.5 ± 0.45	80	30	30	10	0	1.5	2	2
Kharif-1	Jute- C	3.5 ± 0.35	60	7	18	7	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Mustard	1.8 ± 0.18	60	24	20	10	0	2	1	3
	Boro	6.0 ± 0.6	92	9	26	6	0	1	0	
Kharif-1 Kharif-2	Fallow	-	-	-	-	-	-	-	-	-
Rabi	Fallow	-	-	-	-	-	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	15	27	8	0	1	0	
Rabi	Mustard	1.8 ± 0.18	60	24	20	10	0	2	1	3
Kharif-1	Jute (O)	4.0 ± 0.4	70	11	20	7	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	60	9	22	5	0	1	0	
Rabi	Grasspea	1.5 ± 0.15	10	15	6	6	0	0	0	
Kharif-1	Jute- C	3.5 ± 0.35	60	7	18	7	0	2	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Mustard	1.8 ± 0.18	60	24	20	10	0	2	1	3
	Boro	6.0 ± 0.6	92	9	26	6	0	1	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	9	22	5	0	1	0	
Rabi	Grasspea	1.5 ± 0.15	10	15	6	6	0	0	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	9	22	8	0	1	0	
Rabi	Mustard	2.0 ± 0.2	60	24	25	16	0	2	1	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	9	22	5	0	1	0	
Year round	Sugarcane	100 ± 10	108	54	53	12	0	3	2.5	3

AEZ 15: ARIAL BIL

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Medium lowland	13	Munshiganj and Dhaka districts; 14436 ha.
Lowland	73	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	117	12	80	6	0	0	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Mustard	1.8 ± 0.18	60	16	40	5	0	0	0	3
	Boro	6.0 ± 0.6	92	6	51	3	0	0	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Potato	30.0± 3.0	90	20	90	5	0	0	0	3
	Boro	6.0 ± 0.6	92	6	42	3	0	0	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	6	35	3	0	0	0	
Rabi	Potato	30.0± 3.0	90	20	90	5	0	0	0	3
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	24	3	13	2	0	0	0	
Rabi	Grasspea	1.5 ± 0.15	10	10	12	3	0	0	0	
Kharif-1	Jute-C	3.5 ± 0.35	60	5	35	4	0	0	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Mustard	1.8 ± 0.18	60	16	40	5	0	0	0	3
Kharif-1	Jute-C	3.5 ± 0.35	60	5	35	4	0	0	0	
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, Cumilla, Chandpur, Narshingdi, Munshiganj and Narayanganj districts; 155464 ha.
Lowland	25	
Very lowland	11	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	1.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	1.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	1.5	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	4	0	1	0	
Rabi	Mustard	2.0 ± 0.2	90	24	75	24	0	1.5	1	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	4	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	18	0	1.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	53	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	60	15	0	1	1	3
	Boro	6.0 ± 0.6	138	9	77	9	0	1		
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Potato	30.0± 3.0	135	30	135	15	0	2	1.5	3
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	20	4	0	1	0	
Rabi	Chilli	2.5± 0.25	75	36	90	12	0	1	1	3
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	4	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	135	15	0	2	1	3
	Boro	6.0 ± 0.6	138	9	62	9	0	2	1	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Radish	60 ± 6.0	110	45	90	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	60	15	2.5	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	80	18	2.5	2	1.5	5
	Tomato	45 ± 4.5	120	45	75	21	4	2	2	5
	Brinjal	50 ±5.0	135	45	120	15	4	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	46	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	25	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	39	12	3	2	0	5
	Amaranthus	30± 3.0	60	14	23	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	78	9	4	2	1	7
	Botte gourd	50 ±5.0	100	26	39	12	3	2	1	5
	Bitter gourd	25 ± 2.5	75	27	59	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	25	9	2.5	2	1	5
	Cucumber	25 ± 2.5	75	18	29	9	0	2	1	5

AEZ 17: LOWER MEGHNA RIVER FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	14	Chandpur, Laxmipur and Noakhali districts; 90934 ha)
Medium highland	28	
Medium lowland	31	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Soybean	2.0 ± 0.2	18	24	40	14	0	2	1	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	6	43	5	0	2	0	
Rabi	Groundnut	2.5 ± 0.25	24	20	40	20	0	1	2	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	6	43	5	0	2	0	
Rabi	Mungbean	2.0 ± 0.2	12	10	16	8	0	1	1	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	6	43	5	0	2	0	
Rabi	Boro	7.5 ± 0.75	116	12	80	12	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	60	6	43	5	0	2	0	
Rabi	Soybean	2.0 ± 0.2	18	24	40	14	0	2	1	0
Kharif-1	T. Aus	5.0 ± 0.5	48	5	35	4	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	60	6	43	5	0	1	0	
Rabi	Boro	7.5 ± 0.75	116	12	80	12	0	3	0	2
Kharif-1	T. Aus	5.0 ± 0.5	48	5	35	4	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	60	6	43	5	0	1	0	
Rabi	Boro	6.0 ± 0.6	92	10	64	10	0	2	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	24	3	16	2	0	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; 926885 ha
Medium lowland	7	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Grasspea	1.5 ± 0.15	15	15	12	9	0	0	0	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Mungbean	2.0 ± 0.2	18	15	16	12	0	2	1	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	0
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Soybean	2.0 ± 0.2	27	36	40	21	0	2	1	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Groundnut	2.5 ± 0.25	36	30	40	30	0	3	2	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Soybean	2.0 ± 0.2	27	36	40	21	0	2	1	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Mungbean	2.0 ± 0.2	18	15	16	12	0	2	1	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	3	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Chilli	2.5± 0.25	75	36	60	12	0	2	1	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	0	3	2	2
Kharif-1	D. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	0	4	1.5	3
Kharif-1	D. Aus	5.0 ± 0.5	72	7	29	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Watermelon	50.0 ± 5.0	117	36	80	15	0	3	1	7
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	2	0	

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; 774026 ha.
Medium lowland	33	
Lowland	21	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	120	12	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	174	18	120	12	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	12	0	3	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	53	4	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Boro	6.0 ± 0.6	138	15	96	10	0	3	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	2.5	0	0	0	
Rabi	Potato	30.0± 3.0	135	30	135	10	0	2	1.5	3
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	20	2.5	0	0	0	
Rabi	Potato	30.0± 3.0	135	30	135	10	0	2	1.5	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	49	7	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Mustard	2.0 ± 0.2	90	24	75	16	0	2	1	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	60	7	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Coriander	1.5 ± 0.15	60	21	54	10	0	1.5	1	
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	60	7	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Mustard	2.0 ± 0.2	90	24	75	16	0	2	1	2
	Boro	6.0 ± 0.6	138	9	77	5	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Potato	30.0± 3.0	135	30	135	10	0	2	1.5	3
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	4	0	0	0	
Rabi	S. Potato	40.0 ± 4.0	120	36	120	10	0	1.5	1	3
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	49	7	0	0	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Mustard	2.0 ± 0.2	90	24	75	16	0	1.5	1	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	60	7	0	0	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Grasspea	1.5 ± 0.15	15	15	18	6	0	0	0	0
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	24	4	0	1	0	
Rabi	Radish	60 ± 6.0	110	45	90	12	0	2	1	5
	Cabbage	90 ± 9.0	150	45	60	10	0	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	80	12	0	2	1.5	5
	Tomato	45 ± 4.5	120	45	75	14	0	2	2	5
	Brinjal	50 ±5.0	135	45	120	10	0	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	45	6	0	2	0	5
	Ind. spinach	30± 3.0	90	20	25	6	0	2	0	5
	Ash gourd	50 ±5.0	100	26	39	8	0	2	0	5
	Amaranthus	30± 3.0	60	14	23	5	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	78	6	0	2	1	7
	Botte gourd	50 ±5.0	100	26	39	8	0	2	1	5
	Bitter gourd	25 ± 2.5	75	27	59	6	0	2	1	5
	Pointed	25 ± 2.5	90	18	25	6	0	2	1	5
	Cucumber	25 ± 2.5	75	18	29	6	0	2	1	5

AEZ 20: EASTERN SURMA-KUSHYARA FLOODPLAIN

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Medium highland	25	Sylhet, Moulvibazar, Sunamganj and Habiganj districts; 462159 ha.
Medium lowland	20	
Lowland	36	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1	0	
Rabi	Fallow	-	-	-	-	-	-	-	-	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	44	6	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	2	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	4	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1	0	
Rabi	Mustard	2.0 ± 0.2	90	24	50	16	0	2	1.5	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1	0	
Rabi	Radish	60 ± 6.0	110	45	90	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	10	0	2	1.5	5
	Cauliflower	60 ± 6.0	120	45	60	12	0	2	1.5	5
	Tomato	45 ± 4.5	120	45	50	14	0	2	2	5
	Brinjal	50 ±5.0	135	45	80	10	0	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	6	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	6	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	8	0	2	0	5
	Amaranthus	30± 3.0	60	14	16	5	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	6	0	2	1	7
	Botte gourd	50 ±5.0	100	26	26	8	0	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	6	0	2	1	5
	Pointed	25 ± 2.5	90	18	17	6	0	2	1	5
	Cucumber	25 ± 2.5	75	18	20	6	0	2	1	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; 457345 ha
Lowland	43	
Very lowland	23	

Cropping pattern		Yield goal	Nutrient Recommendation (kg/ha)							OF
Season	Crop	(t/ha)	N	P	K	S	Mg	Zn	B	(t/ha)
Rabi	Boro	7.5 ± 0.75	74	18	80	6	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Boro	7.5 ± 0.75	74	18	80	6	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	3	0	1	0	
Rabi	Boro	7.5 ± 0.75	74	18	80	6	0	2	0	2
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	2	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	5	0	2	1	3
	Boro	6.0 ± 0.6	138	9	51	3	0	1	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Maize	11.0 ±1.1	240	54	90	12	5	2	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Coriander	1.5 ± 0.15	60	21	36	5	0	2	1	0
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	2	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	5	0	2	1	3
Kharif-1 Kharif-2	B. Aman	2.5 ± 0.25	36	5	16	2	0	1	0	
Rabi	Fallow	-	-	-	-	-	-	-	-	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	44	3	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	3	0	1	0	
Rabi	Potato	30.0± 3	135	30	90	5	0	2	1	3
	Okra	25 ± 2.5	90	20	30	5		2	0	5
Kharif-1	Ind. spinach	30± 3.0	90	20	17	5	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	7	0	2	0	5
	Amaranthus	30± 3.0	60	14	16	4	0	2	0	5
	Brinjal	50 ±5.0	135	29	52	3	0	2	1	7
	Botte gourd	50 ±5.0	100	26	26	4	0	2	1	5
Kharif-2	Bitter gourd	25 ± 2.5	75	27	39	3	2.5	2	1	5
	Pointed	25 ± 2.5	90	18	17	3	2.5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	3	0	2	1	5

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; 403758 ha
Medium highland	31	
Medium lowland	16	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	120	12	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	12	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Fallow	-	-	-	-	-	-	-	-	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	66	6	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	120	12	0	2	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	53	4	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	60	10	0	2	1	3
	Boro	6.0 ± 0.6	138	9	77	6	0	1	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	65	5	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	60	10	0	2	1	3
	Boro	6.0 ± 0.6	138	9	77	6	0	1	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Rabi	Potato	30.0± 3.0	135	30	135	6	0	2	1	3
	Okra	25.0 ± 2.5	90	20	46	6	0	1	1	5
Kharif-1	Ind. spinach	30.0± 3.0	90	20	26	6	0	1	0	5
	Amaranthus	30.0± 3.0	60	14	23	5	0	1	0	5
Kharif-2	T. Aman	6.0 ± 0.6	90	9	53	5	0	1	0	0
	Radish	60 ± 6.0	111	45	90	12	0	2	1	5
	Cabbage	90 ± 9.0	150	45	60	10	2.5	2	1.5	5
Rabi	Cauliflower	60 ± 6.0	120	45	80	12	2.5	2	1.5	5
	Tomato	45 ± 4.5	120	45	75	14	4	2	2	5
	Brinjal	50 ±5.0	135	45	120	10	4	2	2	7

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Kharif-1	Okra	25 ± 2.5	90	20	46	6	0	2	0	5
	Ind. spinach	30± 3.0	90	20	26	6	0	2	0	5
	Ash gourd	50 ±5.0	100	26	39	8	3	2	0	5
	Amaranthus	30± 3.0	60	14	23	5	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	78	6	4	2	1	7
	Botte gourd	50 ±5.0	100	26	39	8	3	2	1	5
	Bitter gourd	25 ± 2.5	75	27	59	6	2.5	2	1	5
	Pointed	25 ± 2.5	90	18	25	6	2.5	2	1	5
	Cucumber	25 ± 2.5	75	18	29	6	0	2	1	5

AEZ 23: CHITTAGONG COASTAL PLAINS

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	17	Feni, Chittagong and Cox's Bazar districts; 372007 ha
Medium highland	43	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	3	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1.5	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	12	0	3	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	4	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1.5	0	
Rabi	Cowpea	1.5 ± 0.15	15	15	12	6	0	0	0	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	2	0	
Rabi	Cowpea	1.5 ± 0.15	15	15	12	6	0	0	0	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	4	0	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1.5	0	
Rabi	Potato	30.0± 3.0	135	30	90	10	0	4	1.5	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	5	0	1.5	0	
Rabi	Mungbean*	2.0 ± 0.2	18	15	16	8	0	2	1	0
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	4	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	2	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Chilli	2.5± 0.25	75	36	60	8	0	2	1	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1.5	0	
Rabi	Grasspea	1.5 ± 0.15	15	15	12	6	0	0	0	0
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	2	0	
Rabi	Fallow	-	-	-	-	-	-	-	-	-
Kharif-1	T. Aus	5.0 ± 0.5	72	7	44	4	0	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	2	0	
Rabi	Watermelon	50.0 ± 5.0	117	36	80	10	3	3	1	7
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	5	0	2	0	
Rabi	Cabbage	90.0 ± 9.0	150	45	40	10	2.5	3	1	5
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	5	0	2	0	
Year round	Sugarcane	100 ± 10	162	54	106	12	0	3	2.5	3
Rabi	Radish	60 ± 6.0	111	45	60	12	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	10	2.5	2	1	5
	Cauliflower	60 ± 6.0	120	45	60	12	2.5	2	1	5
	Tomato	45 ± 4.5	120	45	50	14	4	2	1	5
	Brinjal	50 ±5.0	135	45	80	10	4	2	1	7
Kharif-1	Okra	25 ± 2.5	90	20	30	6	0	2	0	5
	Ind. Spinach	30± 3.0	90	20	17	6	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	8	3	2	0	5
	Amaranthus	30± 3.0	60	14	16	5	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	6	4	2	1	7
	Botte gourd	50 ±5.0	100	26	26	8	3	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	6	2.5	2	1	5
	Pointed	25 ± 2.5	90	18	17	6	2.5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	6	0	2	1	5

AEZ 24: ST. MARTIN'S CORAL ISLAND

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	33	St. Martin's Island; 804 ha
Medium highland	63	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Fallow	-	-	-	-	-	-	-	-	-
Kharif-1	Fallow	-	-	-	-	-	-	-	-	-
Kharif-2	T. Aman	6.0 ± 0.6	90	9	54	8	0	2	0	
Rabi	Watermelon	50.0 ± 5.0	117	36	80	10	0	3	1	7
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	5	0	2	0	
Rabi	Onion	20.0 ± 2.0	90	30	50	20	0	2.5	1.5	5
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1.5	0	
Rabi	Radish	60 ± 6.0	111	45	60	12	0	3	1	5
	Cabbage	90 ± 9.0	150	45	40	10	0	3	1	5
	Cauliflower	60 ± 6.0	120	45	60	12	0	3	1	5
	Tomato	45 ± 4.5	120	45	50	14	0	3	1	5
	Brinjal	50 ±5.0	135	45	80	10	0	3	1	7
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	5	0	1.5	0	

AEZ 25: LEVEL BARIND TRACT

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	30	Dinajpur, Gaibandha, Joypurhat, Bogura, Naogaon, Sirajganj, Rajshahi and Natore districts; 504851 ha.
Medium highland	55	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	2	1.5	3
	Boro	6.0 ± 0.6	138	9	42	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	10	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	4	2	2	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	2	2	3
Kharif-1	Maize	7.0 ± 0.7	168	30	41	15	7	3	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	2	1.5	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	29	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	4	2	2	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Boro	6.0 ± 0.6	138	15	64	15	0	1	0	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	4	2	2	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Lentil*	1.8 ± 0.18	21	15	16	12	0	1	1	
Kharif-1	Jute (O)	4.0 ± 0.4	105	14	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	10	4	2	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	29	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Year round	Sugarcane	100 ± 10	162	54	106	18	0	3	2.5	3
Rabi	Radish	60 ± 6.0	111	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	5	2	1.6	5
	Cauliflower	60 ± 6.0	120	45	60	18	5	2	1.6	5
	Tomato	45 ± 4.5	120	45	50	21	8	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	8	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. Spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	6	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	8	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	6	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	5

AEZ 26: HIGH BARIND TRACT

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	93	Rajshahi, Chapai Nawabganj and Naogaon districts; 159964 ha.

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Fallow	-	-	-	-	-	-	-	-	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	54	12	0	2	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	4	2.5	2	2
Kharif-1	Fallow	0	0	0	0	0	0	0	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.5	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.5	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Mustard	2.0 ± 0.2	90	24	50	24	0	3	1	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.5	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	0	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	4	2.5	2	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Fallow	-	-	-	-	-	-	-	-	
Kharif-1	T. Aus	5.0 ± 0.5	72	7	44	9	0	1.5	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1.5	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Lentil	1.8 ± 0.18	21	15	16	12	0	2	1	
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Mustard	2.0 ± 0.2	90	24	50	24	0	2	1	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Chickpea	2.0 ± 0.2	27	18	16	12	0	2	1	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Year round	Sugarcane	100 ± 10	162	54	106	18	0	3	2	3
Rabi	Radish	60 ± 6.0	111	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	5	2	1.6	5
	Cauliflower	60 ± 6.0	120	45	60	18	5	2	1.6	5
	Tomato	45 ± 4.5	120	45	50	21	8	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	8	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	6	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	8	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	6	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	5

AEZ 27: NORTH EASTERN BARIND TRACT

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	36	Dinajpur, Rangpur, Gaibandha, Jaipurhat and Bogura districts; 107926 ha.
Medium highland	56	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	3	1.5	3
	Boro	6.0 ± 0.6	138	9	42	9	0	1	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	2	1	3
	Boro	6.0 ± 0.6	138	9	51	9	0	2	0	
Kharif-1	T. Aus	4.0 ± 0.4	63	5	30	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	3	1.5	3
Kharif-1	Maize	7.0 ± 0.7	168	30	41	15	7	2	1.4	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Maize	11.0 ±1.1	240	54	90	36	10	4	2	3
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	3	1.5	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	29	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	2	0	
Rabi	Wheat	4.0 ± 0.4	120	30	60	15	4	2	2	2
Kharif-1	Jute (O)	4.0 ± 0.4	105	11	40	11	0	2	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Radish	60 ± 6.0	111	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	5	2	1.6	5
	Cauliflower	60 ± 6.0	120	45	60	18	5	2	1.6	5
	Tomato	45 ± 4.5	120	45	50	21	8	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	8	2	2	7

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. Spinach	30± 3.0	90	20	17	9	0	2	0	5
	Botte gourd	50 ±5.0	100	26	26	13	6	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	8	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	6	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	5

AEZ 28: MADHUPUR TRACT

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	56	Dhaka, Gazipur, Narshingdi. Narayanganj, Tangail, Dhaka and Kishoreganj districts; 424359 ha.
Medium highland	18	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Potato	30.0± 3.0	135	30	90	15	5	2	1.5	3
	Boro	6.0 ± 0.6	138	9	42	9	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	35	7	0	1	0	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Groundnut	2.5 ± 0.25	36	30	40	30	0	2	2	
Kharif-1	Sesame	1.5± 0.15	75	15	43	5	0	1	0	
Kharif-2	Fallow	-	-	-	-	-	-	-	-	
Year round	Pineapple	30.0 ± 3.0	180	75	120	21	0	2	1	3
Year round	Turmeric	30.0 ± 3.0	105	30	80	15	0	2	1	3
Rabi	Radish	60 ± 6.0	111	45	60	18	0	2	1	5

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
	Cabbage	90 ± 9.0	150	45	40	15	5	2	1.6	5
	Cauliflower	60 ± 6.0	120	45	60	18	5	2	1.6	5
	Tomato	45 ± 4.5	120	45	50	21	8	2	2	5
	Brinjal	50 ±5.0	135	45	80	15	8	2	2	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. Spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	6	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	8	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	6	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	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; 1817172 ha.

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2.5	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Fallow	-	-	-	-	-	-	-	-	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	54	12	0	2	0	
Rabi	Boro	7.5±0.75	174	18	80	18	0	2.5	0	2
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Rabi	Cowpea	1.5±0.15	15	15	12	9	0	0	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Chilli	2.5±0.25	75	36	60	12	0	2	1	3
Kharif-1	T. Aus	5.0 ± 0.5	72	7	35	5	0	1	0	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	2	0	
Year round	Turmeric	30 ± 3.0	105	30	80	15	0	3	1	3
Year round	Ginger	30 ± 3.0	135	45	80	15	0	3	1	3
Year round	Sugarcane	100 ± 10	162	54	106	18	0	3	1	3
Rabi	Radish	60 ± 6.0	111	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	5	2	1	5
	Cauliflower	60 ± 6.0	120	45	60	18	5	2	1	5
	Tomato	45 ± 4.5	120	45	50	21	8	2	1	5
	Brinjal	50 ±5.0	135	45	80	15	8	2	1	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	6	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	8	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	6	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	5

AEZ 30: AKHAURA TERRACE

MAJOR LAND TYPE	PERCENT	LOCATION AND EXTENT
Highland	55	Brahmanbaria and minor area in Habiganj districts; 11324 ha.
Medium highland	11	
Medium lowland	10	
Lowland	15	

Cropping pattern		Yield goal (t/ha)	Nutrient Recommendation (kg/ha)							OF (t/ha)
Season	Crop		N	P	K	S	Mg	Zn	B	
Rabi	Boro	7.5 ± 0.75	174	18	80	18	0	2	0	2
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Rabi	Mustard	1.8 ± 0.18	90	24	40	15	2.5	2	1	3
	Boro	6.0 ± 0.6	138	9	51	7	0	2	0	
Kharif-1	Fallow	-	-	-	-	-	-	-	-	
Kharif-2	T. Aman	6.0 ± 0.6	90	9	43	7	0	1	0	
Year round	Turmeric	30 ± 3.0	105	30	80	15	0	1.5	1	3
Year round	Ginger	30 ± 3.0	135	45	80	15	0	1.5	1	3
Year round	Sugarcane	100 ± 10	162	54	106	18	0	1.6	1	3
Rabi	Radish	60 ± 6.0	111	45	60	18	0	2	1	5
	Cabbage	90 ± 9.0	150	45	40	15	5	2	1	5
	Cauliflower	60 ± 6.0	120	45	60	18	5	2	1	5
	Tomato	45 ± 4.5	120	45	50	21	8	2	1	5
	Brinjal	50 ±5.0	135	45	80	15	8	2	1	7
Kharif-1	Okra	25 ± 2.5	90	20	30	9	0	2	0	5
	Ind. spinach	30± 3.0	90	20	17	9	0	2	0	5
	Ash gourd	50 ±5.0	100	26	26	13	6	2	0	5
	Amaranthus	30± 3.0	60	14	16	7	0	2	0	5
Kharif-2	Brinjal	50 ±5.0	135	29	52	9	8	2	1	7
	Botte gourd	50 ±5.0	100	26	26	13	6	2	1	5
	Bitter gourd	25 ± 2.5	75	27	39	9	5	2	1	5
	Pointed	25 ± 2.5	90	18	17	9	5	2	1	5
	Cucumber	25 ± 2.5	75	18	20	9	0	2	1	5

9. Fertilizer Recommendation for Multiple Cropping Systems

POINTED GOURD + RED AMARANTH + GINGER INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
Highland & Medium highland AEZ: 8, 9, 11	*Rabi* + *Kharif*	Pointed gourd	35	250	160	200	40		2	1	5
		+									
		Red amaranth	3	60	20	30	5		-	-	-
		+									
		Ginger	20	150	60	130	20		-	-	-

Sowing time : Pointed gourd: Mid October to mid-November
Red amaranth: Mid October to mid-November
Ginger : Mid-March to end of March

Spacing : Pointed gourd: Pit- pit: 1m × 1m
Red amaranth: Broadcast
Ginger : 30 cm × 25 cm spacing (2 rows of ginger between 2 rows of pointed gourd)

Fertilizer application method:

Pointed gourd: 1/4th N and all P, K, S and cowdung should be applied in pit at 5-7 DAT. Rest N should be applied in 3 equal splits at 40, 80 and 120 DAP.

Red amaranth: All N, P, K, S should be applied as basal during sowing of seed.

Ginger : Half of N, K and all of P, S should be applied as basal during planting. Rest amount of N and K should be applied at 60-80 DAP.

HYBRID MAIZE + INDIAN SPINACH INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
High & Medium highland AEZ: 8, 9, 11, 25	*Kharif*	Hybrid maize	6	260	180	115	70		3	1	3
		+									
		Indian spinach	18	25	-	-	-		-	-	-

Sowing time: Last week of February to Last week of March
Spacing : Maize paired row (37.5cm/150cm/37.5cm ×20cm) + 3 line Indian spinach.
Maize single row (75cn × 20cm + 1line Indian spinach.

Fertilizer application method:

a) One third of N and all of cow dung P, K, S, Zn and B should be applied as basal during final land preparation.

b) Rest 2/3rd N should be applied in two equal splits as side dressing between maize rows at 20-25 DAS and 40-45 DAS. At the same time N should also be applied in two equal splits in Indian spinach (20-25 DAS and 40-45 DAS) as side dressing.

SWEETGOURD + CABBAGE INTERCROPPING

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

Sowing time : November (Sweet gourd transplant 15 DAT of cabbage)

Spacing : Sweet gourd: 2m × 2m
Cabbage: 80cm× 50cm (3 row cabbage in between 2 rows of sweet gourd)

Fertilizer application method:

a) In sweet gourd, all of cowdung, P, K, S, Zn should be applied in pit at 5-7 DBT (days before transplanting) and mixed with the soil. N should be applied around the plant as the side dressing at 30 and 50 DAT.

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

c) N and K should be applied in two equal splits at 15, 30, 45 DAT as ring method.

BRINJAL + CORIANDER INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
High & Medium highland AEZ: 8, 9, 11	*Rabi*	Brinjal + Coriander	15 0.60	190	40	140	20	-	2	1	5

Sowing time : Mid October to November

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

Fertilizer application method:

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

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

HYBRID MAIZE + SOYBEAN INTERCROPPING

Land and soil chara-cteristics	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	263	70	160	45	10	7	2.5	-

*Mg for AEZ 3 only

Sowing time : December 1st week to 2nd week of December
Sowing method : Four rows of Soybean (30 cm x 10cm) in between maize paired rows (30 cm - 120 cm/ 25 cm) or 2 rows of Soybean in between maize normal row (75 cm x 25 cm)
Fertilizer application method: 1/3rd N top dressed at 35 & rest 1/3 at 65 DAS in maize rows only + 1/3rd N & other fertilizer as basal

HYBRID MAIZE + CARROT INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							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	295	73	170	48	10	6	2	3-5

*Mg for AEZ 3 only

Sowing time : Mid November to 1st week of December
Sowing method : 4 rows of carrot 25 cm apart in between maize paired rows (30 cm - 120 cm/ 25 cm)
Fertilizer Application method: 1/3rd N & other fertilizers as basal and remaining 2/3rd N as top dressed at 30 and 65 DAS. The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

ONION + HYBRID MAIZE INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							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	128	51	68	23	-	2	1	-

Sowing time : Mid December
Sowing method : One row of maize (140 cm) in between onion rows (30 cm apart)
Fertilizer application method: All basal except 50% N top dressed 3 & 5 weeks after transplantation

HYBRID MAIZE + SPINACH/ LALSHAK/ GIMAKALMI INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							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	260	65	90	30	-	4	1	3-5

*Mg for AEZ 3 only

Sowing time : Mid November to Last week of November
Sowing method : Maize 75cm x 25cm, two rows of lalshak/spinach/gimakalmi at a spacing of 25 cm
Fertilizer application method: 1/3rd N and all fertilizers as basal. Rest N at 30 and 60 DAS as band placement in maize rows. The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

CHICKPEA + LINSEED MIXEDCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							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	33	17	24	8	-	1.0	1.0	-

Sowing time : Mid October to mid-November
Sowing method : One row of linseed in between two rows of chickpea (30cm x 10cm)
Fertilizer application method: All fertilizer as basal

CHICKPEA + MUSTARD MIXEDCROPPING

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	59	23	42	9	1	1	1	-

Sowing time : Mid October to last week of November
Sowing method : Two rows of chickpea alternate with two rows of mustard at 30cm apart
Fertilizer application : All fertilizers as basal

WHEAT + CHICKPEA MIXEDCROPPING

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	90	22	68	9	3	1	1	-

Sowing time : Mid November to last week of November
Sowing method : Two rows of wheat (20cm apart) alternate with one row of chickpea
Fertilizer application : All fertilizer as basal

JUTE (SEED) + RADISH INTERCROPPING

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	155	40	50	15	0	5	2	155

Sowing time : Mid-September

Spacing (jute) : 30cm x 10cm

Fertilizer application method: 45 kg N at 20 DAE, 45 kg N at 35 DAE

9.13 GROUNDNUT + SESAME INTERCROPPING

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	
Highland & Medium highland AEZ: 12, 18, 19	Rabi	Groundnut + Sesame	1.50 + 0.50	60	35	45	25	-	1.0	1.0	-

Sowing time : Middle of February to end of March (Kharif-I), Middle of August to September (Kharif-II)

Sowing method : Three rows of groundnut (25cm x 10cm) in between paired rows of sesame (30cm in continuous)

Fertilizer application method: All fertilizer as basal except 9 kg/ha of N as top dress in sesame row 25 DAS.

POTATO + VEGETABLES (LALSHAK/SPINACH) INTERCROPPING

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 lowland AEZ: 1, 3, 15, 25	Rabi	Potato (100%) + Vegetables (Lalshak	25.0-30.0 + 2.0-3.0	180	25	95	5	0	2	1	2-6

*Mg for AEZ 3 only

Sowing time : 1st week of November - 3rd week of November

Sowing method : Potato 60cm x 30cm, two rows of lalshak/spinach (30cm apart) in between paired cotton rows

Fertilizer application method: 1/3rd N and other fertilizers as basal, 1/3rd N 25 at DAS & rest N at 45-55 DAS in potato rows. The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

POTATO + LALSHAK + SWEETGOURD INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg*	Zn	B	
Rainfed highland AEZ: 3, 8d, 15, 25, 28	Rabi	Potato + Lalshak + Sweet gourd	25.0 + 2.0 + 2.50	190	30	100	5	-	2	1	2-6

*Mg for AEZ 3 only

Sowing time : Mid December

Spacing : Potato 60cm x 25cm

Sowing method : Red amaranth: Broadcast, Sweet gourd in pit

Fertilizer application method: 2/3rd N & other fertilizer as basal and rest 1/3rd N at 30 DAP in potato rows. The dose of N, P & K may be reduced based on quantity of CD to be applied and as per Appendix-6

BANANA + DHAINCHA INTERCROPPING

Land and soil characteristics	Cropping pattern		Yield Goal (t/ha)	Nutrient Recommendation* (kg/ha)							CD (t/ha)
	Season	Crops		N	P	K	S	Mg	Zn	B	
Medium highland AEZ: 3, 7, 11, 9, 28	Rabi	Banana + Indian spinach	20-25 20-25 (Green)	230 105	40 15	300 30	36 5	- -	1.2 -	0.34 -	12

*Note: Fertilizer for banana should be considered as g/plant; and for Indian spinach as kg/ha

Spacing : Banana pit size: 0.6m x 0.6m x 0.4m

Fertilizer application: Banana: Two weeks before planting/pit: cowdung 5 kg, TSP 25 g, MOP 25 g
Three months after planting/pit: Urea 25 g, MOP 25 g as topdress

Indian spinach: Half of N all of other fertilizers should be applied as basal before final land preparation. The rest urea should be topdress at 25 DAP

SUGARCANE + ONION INTERCROPPING

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	
Highland & Medium highland AEZ: 1a, 11a, 25a	Rabi	T. Sugarcane (100%) + Onion (50%)	100 + 10.0	180 50	60 20	90 30	30 10	- -	- 2	- 1	- -

Spacing : Sugarcane: 100cm x 45cm, Onion: 30cm x 10cm

Sowing method : Five rows of onion (bulb) planted in between two rows of sugarcane

Fertilizer application : For Sugarcane: 50 kg N 20 DAT, 65 N 45 K kg at 4-6 tiller stage, 65 N 45 K at earthing up and other fertilizers should be applied as basal before final land preparation.

For Onion, all fertilizers as basal.

SUGARCANE (PAIRED ROW) + POTATO + LALSHAK INTERCROPPING

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	180	40	90	30	20	-	-	-
		+ Potato	10	70	10	45	8	3	1	1	-
		+ Lalshak	6	40	7	15	2	-	-	-	-

Sowing time : Sugarcane: Mid October to mid-November

Potato: Mid October to mid-November

Red amaranth: February to March

Spacing : Sugarcane: 60 cm-140 cm x 45 cm.

Fertilizer application: Sugarcane: 50 kg N 20 DAT, 65 N 45 K kg at 4-6 tiller stage, 65 N 45 K at earthing up and other fertilizers should be applied as basal in sugarcane rows.

Potato: Half of N and K and all of other fertilizers should be applied as basal and N and K during earthing up at 30-35 DAP.

Red amaranth : All fertilizes as basal

Appendix-1

Fertilizer use in Bangladesh during 1980-81 to 2022-23 (Metric ton)

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	-	1,515,200
1988-89	1,135,062	415,993	-	-	94,172	60,745	2,800	93	173	1,709,038
1989-90	1,369,237	479,767	718	-	1 18,663	67,808	5,180	1,785	18	1,924,513
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	-	2,812,542
1999-00	2,151,233	259,263	237,201	109,171	239,464	189,398	1,170	26,003	-	3,212,903
2000-01	2,121,096	399,428	138,589	90,077	123,788	102,260	3,006	13,020	-	2,991,264
2001-02	2,247,422	401,464	127,126	127,033	233,249	115,578	238	20,083	12,876	3,285,069
2002-03	2,247,000	375,130	132,527	122,010	270,620	150,520	500	10,000	26,000	3,334,307
2003-04	2,324,080	361,000	148,000	90,000	240,000	140,000	7,000	9,000	45,000	3,364,080
2004-05	2,523,395	420,029	170,931	140,718	260,385	135,704	8,000	5,592	90,000	3,754,754
2005-06	2,451,370	436,470	130,390	145,000	290,670	104,950	7,500	6,320	110,000	3,682,670
2006-07	2,515,000	340,000	122,000	115,000	230,000	72,000	26,000	6,000	125,000	3,551,000
2007-08	2,762,783	381,970	57,949	89,000	274,000	82,731	6,500	3,147	100,000	3,758,080
2008-09	2,533,000	161,000	-	18,000	82,000	100,000	30,000	5,400	50,000	2,979,400
2009-10	2,406,000	420,000	-	136,000	263,000	120,000	38,000	8,500	65,000	3,456,500
2011-12	22,96,000	641,000	-	403,000	603,000	135,000	42,000	8,800	82,000	1,914,800
2012-13	22,47,000	654,000	-	434,000	571,000	185,000	48,000	-	45,000	1,937,000
2013-14	24,62,000	685,000	-	543,000	576,000	128,000	42,000	-	16,000	1,990,000

Year	Urea	TSP	SSP	DAP	MOP	Gypsum	Zinc	AS	Others	Total
2014-15	26,39,000	722,000	-	597,000	640,000	122,000	39,000	-	16,000	2,136,000
2015-16	22,91,000	730,000	-	658,000	727,000	286,281	62,785	-	-	2,464,066
2016-17	23,65,000	740,000	-	609,000	781,000	250,000	57,000	10,000	-	1,707,000
2017-18	24,27,000	706,000	-	690,000	789,000	250,000	100,000	10,000	30,000	2,575,000
2018-19	25,95,000	781,000	-	763,000	724,000	300,000	100,000	10,000	40,000	2,718,000
2019-20	25,10,000	690,000	-	962,000	716,000	400,000	133,000	10,000	41,000	2,952,000
2020-21	24,63,000	523,000	-	14,24,000	798,000	450,000	141,000	4,000	48,000	3,388,000
2021-22	26,33,000	6,90,000	-	16,30,000	8,30,000	5,50,000	1,41,000	5,000	2,21,000	67,00,000
2022-23	26,07,000	7,04,000	-	15,12,000	8,43,000	5,67,000	1,33,000	4,000	1,83,000	65,53,000

Source: Monthly report FDI-11 and ATDP/IFDC and MOA, MMI/DAE

Appendix–2

Nutrient compositions (%) 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	$ZnSO_4.H_2O$	-	-	-	17.5	36	-	-	-	-	-
Zinc sulphate, Heptahydrate	$ZnSO_4.7H_2O$	-	-	-	10.5	21	-	-	-	-	-
Zinc oxide	ZnO	-	-	-	-	78	-	-	-	-	-
Boric acid	H_3BO_3	-	-	-	-	-	-	-	-	17	-
Solubor	$Na_2B_80_{13}.4H_20$	-	-	-	-	-	-	-	-	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–3

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

Sl. No.	Toxic metal	Chemical fertilizer[1] (ppm)	Organic fertilizer[2] (ppm)
1.	Arsenic (As)	50	20
2.	Cadmium (Cd)	10	5
3.	Lead (Pb)	100	30
4.	Mercury (Hg)	5	0.1
5.	Chromium (Cr)	500	50
6.	Nickel (Ni)	50	30
7.	Zinc (Zn)	NA*	0.1(%)
8.	Copper (Cu)	NA	0.05 (%)

**NA=Not applicable*
[1]Fertilizer (Management) Regulation, 2007; Published in Bangladesh Gazette on 30 May 2007; &
[২] কৃষি মন্ত্রণালয় প্রজ্ঞাপন নং: কৃম/উপ-২/সার-১/২০০৮/১৫৬; তারিখ ০২ এপ্রিল ২০০৮

Appendix-4

Nutrient concentration in different organic manure/materials

Manure	Moisture (%)	N (%)	P (%)	K (%)
Cowdung (decomposed)	35±3.5	1.0±0.1	0.3±0..03	0.46±0.05
Farmyard manure	67±6.7	1.6±0.16	0.83±0.08	1.7±0.17
Poultry manure (decomposed)	35±3.5	1.25±0.13	0.70±0.07	0.95±0.10
Bio-slurry (cowdung)	20±2.0	1.10±0.01	0.59±0.06	0.28±0.03
Bio-slurry (poultry manure)	20±2.0	1.48±0.01	0.69±0.07	0.36±0.04
Compost (rural)	40±4.0	0.75±0.07	0.6±0.06	1.0±0.1
Compost (urban)	40±4.0	1.5±0.15	0.6±0.06	1.5±0.5
Compost (water hyacinth)	70±7.0	1.5±0.15	0.8±0.08	3.0 ±0.3
Mustard oilcake	15±1.5	5.0±0.5	1.8±0.18	1.2±0.12
Linseed oilcake	15±1.5	5.5±0.55	1.4±0.14	1.2±0.12
Sesame oilcake	15±1.5	6.2±0.62	2.0±0.2	1.2±0.12
Pressmud	55±5.5	1.85±0.18	0.13±0.02	0.54±0.05
Bone meal (raw)	8±0.8	3.5±0.35	9±0.9	NA*
Bone meal (steamed)	7±0.7	1.5±0.15	10±1.0	NA
Dried blood	10±1.0	11±1.1	1.1±0.11	0.7±0.07
Fishmeal	10±1.0	7±0.70	3.5±0.35	1.0±0.10

Nutrient concentration in green manure and crop residues **Appendix-5**

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	-

Nutrient supply from organic materials **Appendix-6**

Organic material	Nutrient supply (kg) from 1 ton material		
	N	P	K
Cowdung (decomposed)	5.0	1.5	2.3
Farmyard Manure	3.0	0.7	2.5
Poultry Manure (decomposed)	6.0	3.5	4.8
Compost (rural)	2.5	1.0	3.0
Mustard oilcake	25.5	4.0	5.0
Linseed oilcake	28.0	3.0	5.0
Sesame oilcake	31.5	4.5	5.0
Groundnut oilcake	36.0	3.5	5.5
Bone meal	19.5	52.0	NA
Dried blood	59.5	2.5	3.0
Dhaincha (*Sesbania*)	2.5	0.3	2.0
Mungbean residues	4.5	0.5	4.5
Rice straw	2.0	0.5	6.5
Wheat straw	3.0	0.5	5.5

Note : The values estimated considering the nutrient concentration in the material (Appendix-5 & 6) and their mineralization.

Inoculant and seed requirement of different legumes **Appendix-7**

Crop	Seed rate (kg/ha)	Inoculum rate	
		g/kg seed	kg/ha
Lentil	30	50	1.5
Chickpea	50	40	2.0
Mungbean	30	50	1.5
Blackgram	30	50	1.5
Cowpea	40	40	1.6
Grasspea	50	40	2.0
Groundnut (shelled)	72	30	2.2
Soybean	60	20	1.2

Appendix-8

Interpretation of soil test values based on critical limits for different nutrients

Soil Analysis Interpretation class	Interpretation of soil test values for macronutrients						
	N (%)	P (µg/g)		K (meq/100g)	Mg (meq/100g)	S (µg/g)	Ca (meq/100g)
		Upland crops	Wetland rice				
Very Low	≤ 0.09	≤9.0	≤7.5	≤ 0.09	≤0.40	≤10.8	≤ 1.5
Low	0.091-0.18	9.10-18.0	7.6-15.0	0.091-0.18	0.41-0.80	10.9-21.6	1.51-3.0
Medium	0.181-0.27	18.1-27.0	15.1-22.5	0.181-0.27	0.81-1.20	21.7-32.4	3.1-4.5
Optimum	0.271-0.36	27.1-36.0	22.6-30.0	0.271-0.36	1.21-1.60	32.5-43.2	4.51-6.0
High	0.361-0.45	36.1-45	30.1-37.5	0.361-0.45	1.61-2.00	43.3-54.0	6.1-7.5
Very high	>0.45	>45.0	>37.5	>0.45	>2.00	>54.0	>7.5

Table contd. ---------

Soil Analysis Interpretation class	Interpretation of soil test values for micronutrients					
	Cu (µg/g)	Zn (µg/g)	Fe (µg/g)	Mn (µg/g)	B (µg/g)	Mo (µg/g)
Very Low	≤ 0.15	≤0.54	≤ 3.0	≤ 0.75	≤0.203	≤ 0.075
Low	0.16-0.3	0.55-1.08	3.1-6.0	0.756-1.5	0.204-0.406	0.076-0.15
Medium	0.31-0.45	1.09-1.62	6.1-9.0	1.51-2.25	0.407-0.609	0.151-0.225
Optimum	0.46-0.6	1.63-2.16	9.1-12.0	2.256-3.0	0.610-0.812	0.226-0.30
High	0.61-0.75	2.17-2.70	12.1-15.0	3.1-3.75	0.813-1.015	0.31-0.375
Very high	>0.75	>2.70	>15.0	>3.75	>1.015	>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)	12	Olsen method (upland crops)
P (µg/g)	10	Olsen method (wetland rice)
S (µg/g)	14.4	Calcium dihydrogen phosphate extraction
K (meq/100g)	0.12	N NH_4OAc method
Ca (meq/100g)	2.0	N NH_4OAc method
Mg (meq/100g)	0.55	N NH_4OAc method
Zn (µg/g)	0.72	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)	0.27	Calcium chloride extraction
Mo (µg/g)	0.1	NH_4-oxalate extraction

Appendix -9

Location specific and Yield goal basis fertilizer recommendation for crops

Based on soil test values

Example: Crop Wheat (High Yield Goal; HYG) = 4.5 ± 0.45 t/ha

Location: Village …… Upazila …… District …..
Fertilizer requirement of crops based on given soil test values can be computed by three methods**.** The methods are outlined below.

Method 1. Computation of fertilizer requirement for crops by using formula -1

$$NR = MRN - \frac{MRN}{Opt/Med} \text{ X } STV$$

Where,

NR = Nutrient requirement based on Soil Test Value (STV)
MRN = Maximum recommended nutrient dose for target yield
Opt = Highest STV Value of class OPTIMUM for Macronutrients
Med = Highest STV Value of class MEDIUM for Mg* and Micronutrients

Step-I : Use the maximum recommended nutrient **(MRN)** dose for respective crop as depicted in Chapter 7.

Example: Wheat (yield 4.5 t/ha)

Name of nutrient	Maximum nutrient dose (kg/ha)
N	160
P	40
K	120
Mg	12
S	20
Zn	3.9
B	3

Step-II: Use the highest STV of class OPTIMUM for Macronutrients and highest STV of class MEDIUM for Mg and micronutrients (**Appendix 8**)
*Mg use for wheat, potato, sweet potato, mustard and sunflower.

Example: Wheat (yield 4.5 t/ha)

Highest value of class Optimum				Highest value of class Medium		
N %	P mg/kg	K meq/100g	S mg/kg	Zn µg/g	B µg/g	Mg meq/100g
0.36	36.0	0.36	43.2	1.62	0.609	1.20

Calculation of fertilizer dose:

$$\text{N (kg/ha)} = 160 - \frac{160}{0.36} \times 0.1 = 116$$

$$\text{Urea (kg/ha)} = 116 \times \frac{100}{46} = 252$$

$$\text{P (kg/ha)} = 40 - \frac{40}{36} \times 20 = 17.8$$

$$\text{TSP/DAP (kg/ha)} = 17.8 \times \frac{100}{20} = 89$$

$$\text{K (kg/ha)} = 120 - \frac{120}{0.36} \times 0.15 = 70$$

$$\text{MOP (kg/ha)} = 70 \times \frac{100}{50} = 140$$

$$\text{Mg (kg/ha)} = 12 - \frac{12}{1.20} \times 0.80 = 4.0$$

$$\text{Magnesium sulphate (kg/ha)} = 4.0 \times \frac{100}{9.5} = 42.1$$

$$\text{S (kg/ha)} = 20 - \frac{20}{43.2} \times 15 = 13.1$$

$$\text{Gypsum (kg/ha)} = 13.1 \times \frac{100}{18} = 73$$

$$\text{Zn (kg/ha)} = 3.9 - \frac{3.9}{1.62} \times 1.2 = 1.01$$

$$\text{Zinc sulphate (hepta-hydrate) (kg/ha)} = 1.01 \times \frac{100}{21} = 4.86$$

$$\text{B (kg/ha)} = 3 - \frac{3}{0.609} \times 0.21 = 1.97$$

$$\text{Boric acid (kg/ha)} = 1.97 \times \frac{100}{17} = 11.6$$

Hence, the final recommendation would be

Name of nutrient	Nutrient dose (kg/ha)	Name of fertilizer	Fertilizer (kg/ha)	Fertilizer / Nutrient Ratio
N	116	Urea	252	2.17
P	17.8	TSP or DAP	89	5.00
K	70.0	MOP	140	2.00
Mg	4.00	Magnesium sulphate	42.1	10.52
S	13.1	Gypsum	73	5.55
Zn	1.02	Zinc sulphate, hepta-hydrate	4.86	4.75
B	1.97	Boric acid	11.6	5.88

Note: When magnesium sulphate and zinc sulphate (hepta- hydrate) are used, sulphur is also supplied (10.5% S in $ZnSO_4.7H_2O$ and 12.5 % Mg in $MgSO_4.H_2O$). Thus, if 4.86 kg of zinc sulphate (hepta-hydrate) and 42.1 kg Magnesium sulphate are used

$\frac{42.1 \times 12.5}{100}$ = 5.26 kg of S will be supplied from magnesium sulphate

$\frac{4.86 \times 10.5}{100}$ = 0.51 kg of S will be supplied from zinc sulphate

Thus, the S requirement can be reduced to 13.1 – (5.26 + 0.51) = 7.33 kg S/ha. The new calculation for sulphur from gypsum would then be -

$\frac{100 \times 7.03}{18}$ = 39.05 kg gypsum per hectare

Method 2. Computation of fertilizer requirement for crops by using formula -2

$$NR = U_f - X \frac{C_i}{C_s} X (S_t - L_s)$$

Where,

NR = Nutrient requirement based on Soil Test Value (STV)
$\mathbf{U_f}$ = Upper limit of the recommended 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: Given Soil Test Value (STV) and its interpretation for upland crops

Soil analysis	**Soil test value (STV)**	**Soil test value interpretation (Appendix- 8)**	**Range of values used within the interpretation class (Appendix- 8)**
Total N (%)	0.10	Low	0.091 – 0.18
Available P (mg/kg)	20.00	Medium	18.1 – 27.0
Exchangeable K (meq/100g)	0.15	Low	0.091 – 0.18
Exchangeable Mg (meq/100g)	0.80	Low	0.41 – 0.80
Available S (mg/kg)	15.00	Low	10.9 – 21.6
Available Zn (µg/g)	1.20	Medium	1.09 – 1.62
Available B (µg/g)	0.21	Low	0.204 – 0.406

Method 3. Computation of fertilizer requirement for crops by statistical method

Boro rice

Element	Regression Eq.
N	232.2-642.3x
P	24.0-0.79x
K	160.13-442.9x
S	23.99-0.553x
Zn	3.89-2.385x

T. Aus rice

Element	Regression Eq.
N	96.0-265.8x
P	16.0-0.53x
K	88.07-243.6x
S	11.99-0.277x
Zn	2.09-1.284x

T. Aman rice

Element	Regression Eq.
N	120.1-332.2x
P	20.0-0.66x
K	108.0-299.ox
S	15.99-0.369x
Zn	2.69-1.651x

Wheat

Element	Regression Eq.
N	160-443x
P	40.0-1.11x
K	40-1.11x
Mg	11.97-9.522x
S	19.99-0.46x
Zn	3.89-2.39x
B	3.0-4.92x

Maize

Element	Regression Eq.
N	320.26-885.9x
P	72.06-1.99x
K	180.1-498.3x
Mg	20.02-11.9x
S	47.9-1.107x
Zn	5.99-3.669x
B	3.00-4.926x

Jute

Element	Regression Eq.
N	140.1-387.6x
P	24.02-0.66x
K	101-276.8x
S	23.99-0.553x
Zn	5.99-3.669x

Cauliflower

Element	Regression Eq.
N	160.1-442.9x
P	60.06-1.66x
K	120.1-332.2x
Mg	10.01-5.99x
S	23.99-0.553x
Zn	4.49-2.752x
B	2.40-3.94x

Mustard

Element	Regression Eq.
N	1201.1-332.2x
P	32.03-0.89x
K	100.08-276.8x
Mg	9.00-7.142x
S	31.99-0.738x
Zn	3.896-2.385x
B	3.00-4.926x

Potato

Element	Regression Eq.
N	160.1-442.9x
P	40.04-1.11x
K	180.1-490.3x
Mg	15.0-11.905x
S	19.99-0.461x
Zn	5.99-3.669x
B	2.40-3.94x

Tomato

Element	Regression Eq.
N	160.1-442.9x
P	60.05-1.66x
K	100.1-276.9x
Mg	16.01-9.59x
S	27.99-0.641x
Zn	4.79-2.935x
B	3.00-4.926x

Onion

Element	Regression Eq.
N	1201.1-332.2x
P	40.04-1.11x
K	100.1-276.9x
S	39.99-0.922x
Zn	3.896-2.385x
B	2.10-3.448x

Sugarcane

Element	Regression Eq.
N	219-611.3x
P	72.06-1.99x
K	212.2-586.9x
S	23.99-0.553x
Zn	4.795-2.935x
B	3.00-4.926x

All are regression equations, Y = a + bx, where x is the soil test value. It is a very easy method to calculate nutrient requirement for a crop. The equation would be different for nutrient to nutrient and for crop to crop.

Appendix-10

Conversion factors from nutrient to fertilizer

Amount of Nutrient	Multiply by	Amount of Fertilizer
N	2.17	Urea
P	5.0	TSP or DAP
K	2.0	MOP
Mg	10.5	$MgSO_4.H_2O$
S	5.6	Gypsum
Zn	4.76	$ZnSO_4.7H_2O$
	2.78	$ZnSO_4.H_2O$
	10.0	Chelated Zinc
B	5.88	Boric acid
	5.0	Solubor
	6.1	Granuor nature
	6.67	Fertibor

Appendix-11

Symbols and atomic weights of some elements

Element	Symbol	Atomic Weight	Element	Symbol	Atomic Weight
Aluminum	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-12

Some useful conversion factors

Chemicals & fertilizers	Metric/Imperial	Solid manure
% P = % P_2O_5 × 0.437	1 ha = 10000 sqm	$kg/t\ FW = \frac{mg/kg\ nutrient}{1000} x \frac{\%\ DM}{100}$
P_2O_5 = % P × 2.29	1 sqm = 1 × 10^{-4} ha	$kg/t\ FW = g/kg\ nutrient\ x \frac{\%\ DM}{100}$
% K = % K_2O × 0.83	1 kg = 2.24 lb	$kg/t\ FW = \%\ nutrient\ x \frac{\%\ DM}{10}$
% K_2O = % K × 1.21	1 lb = 0.454 kg	*Example:*
Urea (kg) = kg N × 2.17	1 lb/acre = 1.12 kg/ha	Manure with 27% DM and 4.0% N & 3.0% P in DM.
DAP (kg) = kg N × 5.56, kg P × 5.0	1 kg/ha = 0.89 lb/acre	4.0% N x (27% DM /10) = 10.8 kg N/t FW
TSP (kg) = kg P × 5.0	1 ha = 2.47 acre	3.0% P x (27% DM/10) = 8.1 kg P/t FW
MOP (kg) = kg K × 2.0	1 acre = 0.40 ha	FW means fresh weight DM means dry matter
Gypsum (kg) = kg S × 5.56	1 acre = 100 decimal	
Zinc sulphate heptahydrate (kg) = kg Zn × 4.35	1 decimal = 40.48 sqm	
Boric acid (kg) = kg B × 5.88	1 inch = 2.54 cm	

Appendix-13

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-14

Classification of soils on the basis of soil pH values

Soil reaction class	pH
Very strongly acidic	<4.5
Strongly acidic	4.6-5.5
Slightly acid	5.6-6.5
Neutral	6.6-7.3
Slightly alkaline	7.4-8.4
Strongly alkaline	8.5-9.0
Very strongly alkaline	>9.0

Source: SRDI

Appendix-15

Classification of soils on the basis of soil salinity values

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

* 1 dS/m = 640 ppm (Approx.)

Appendix-16

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-17

Available forms of plant nutrients

Nutrient	Available Forms	Sources
Carbon	CO_2	Atmosphere
Hydrogen	H_2O	Soil water
Oxygen	H_2O, O_2, CO_2	Soil water, Atmosphere
Nitrogen	NO_3^-, NH_4^+	Soil organic matter, Fertilizers
Phosphorus	$H_2PO_4^-$, HPO_4^{2-}	Soil organic matter, Minerals, Fertilizers
Potassium	K^+	Minerals, Fertilizers
Sulphur	SO_4^{2-}	Soil organic matter, Minerals, Fertilizers
Calcium	Ca^{2+}	Minerals, Fertilizers
Magnesium	Mg^{2+}	Minerals, Fertilizers
Iron	Fe^{2+}, Fe^{3+}	Minerals, Fertilizers
Manganese	Mn^{2+}, Mn^{4+}	Minerals, Fertilizers
Zinc	Zn^{2+}	Minerals, Fertilizers
Copper	Cu^+, Cu^{2+}	Minerals, Fertilizers
Boron	H_3BO_3, $H_2BO_3^-$, HBO^{2-}	Minerals, Fertilizers
Molybdenum	MoO_4^{2-}	Minerals, Fertilizers
Chlorine	$C1^-$	Minerals, Fertilizers

Appendix-18

Methods of soil sample collection

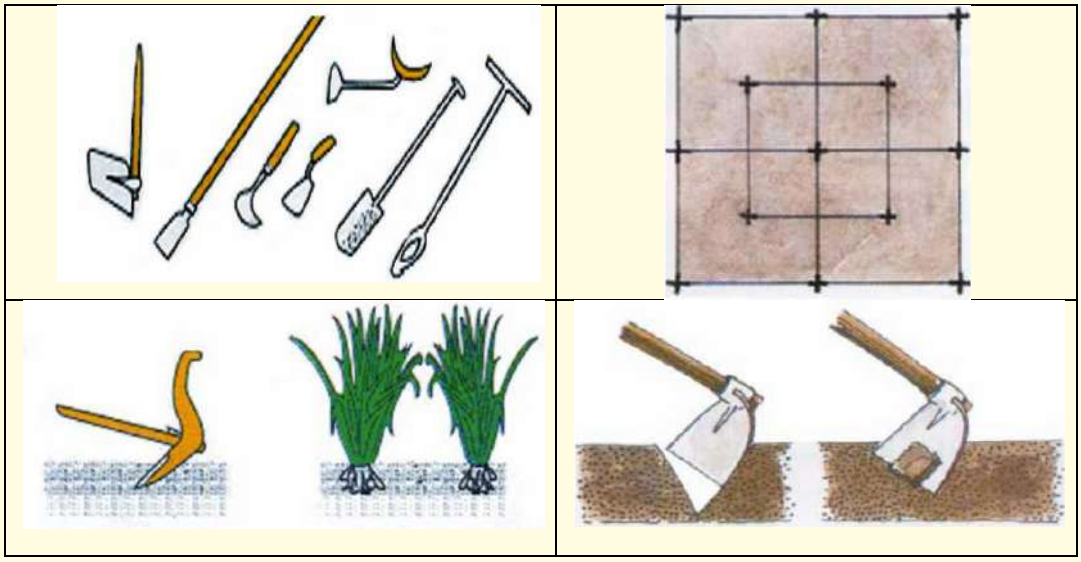
For continuing sustainable crop harvest from a piece of land, maintenance of soil health is a must. Soil sample analysis can be done of the important criteria for understanding the present status of particular field and adjustment of fertilizer recommendation as per need of the soil. As such correct soil sampling is of great importance.

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

a) Country spade, shovel, push anger, weeding tools, Dutch auger, etc (any one).
b) Plastic bucket or polyethylene sheet.
c) Thick poly bag and thread ball.
d) Level (tag), pencil or pen, towel, permanent marker.

Step 2: Leave 1.0-1.5 meter distance along the 4 field boundary (ails) of the sample field and demarcate minimum of 9 sampling spots irrespective of plot size as shown in the figure above. But it is better to collect more samples for accurate and precise results.

Step 3: Before start sampling identify the ploughing depth through digging hole in the field. Plough pan should be avoided for sampling. Plough pan generally exists just beneath the plough layer (within 8-10 cm depth).



Step 4: Dig a `V' shaped hole up to the plough pan with a clean country spade/spade/ shovel etc. Take a slice of soil of about 7-8 cm uniform thickness from one side of the hole. Size the sub-samples by discarding excess soil from both the sides of the slice and plough pan at 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.

tep 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.

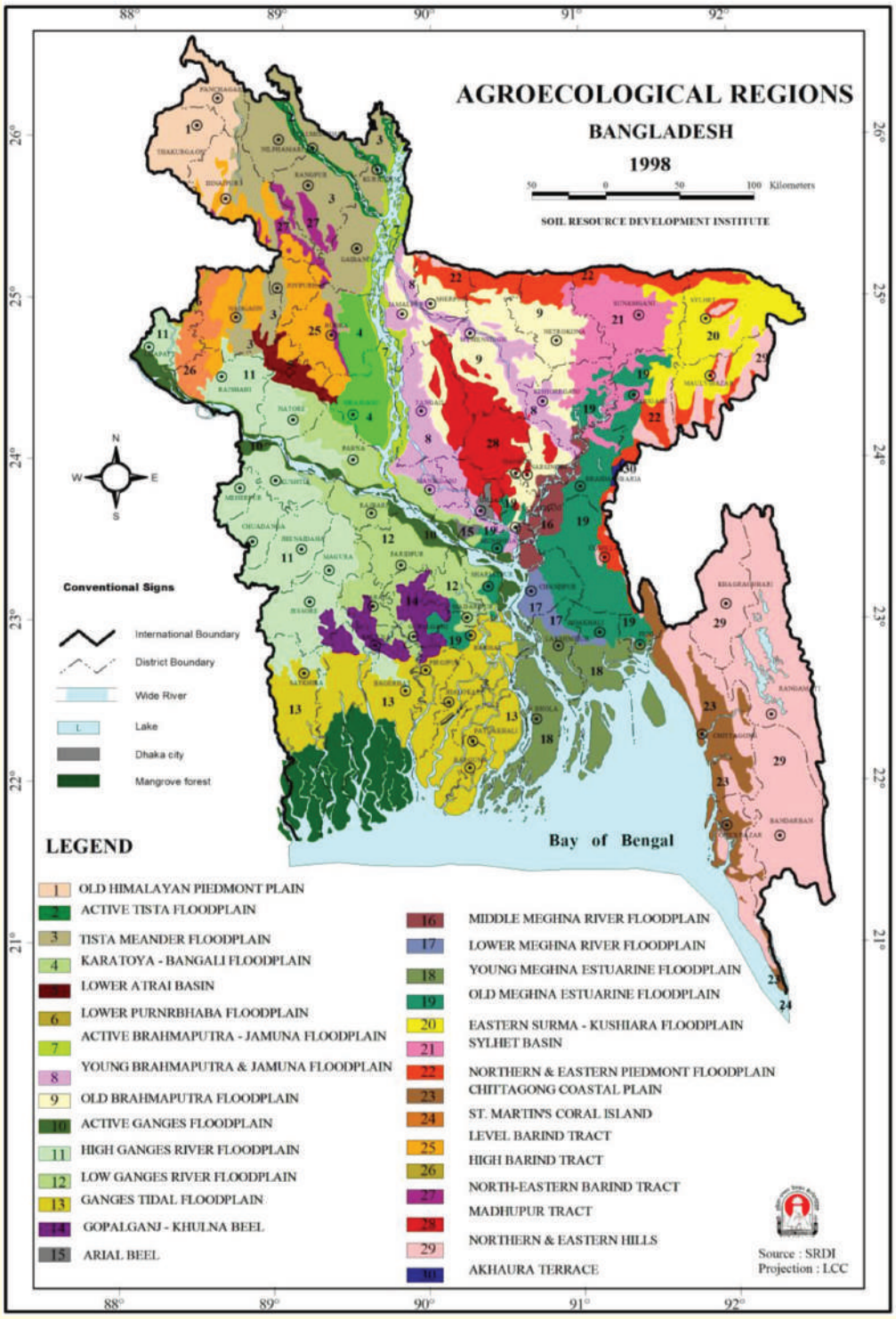
Step 8: The plastic bag with soil sample should be tightly closed with thread and placed inside another plastic bag. An information sheet (Tag) should be placed between two plastic bags and again the bag should be tightly closed with thread. An additional information sheet (Tag) should be tied at the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

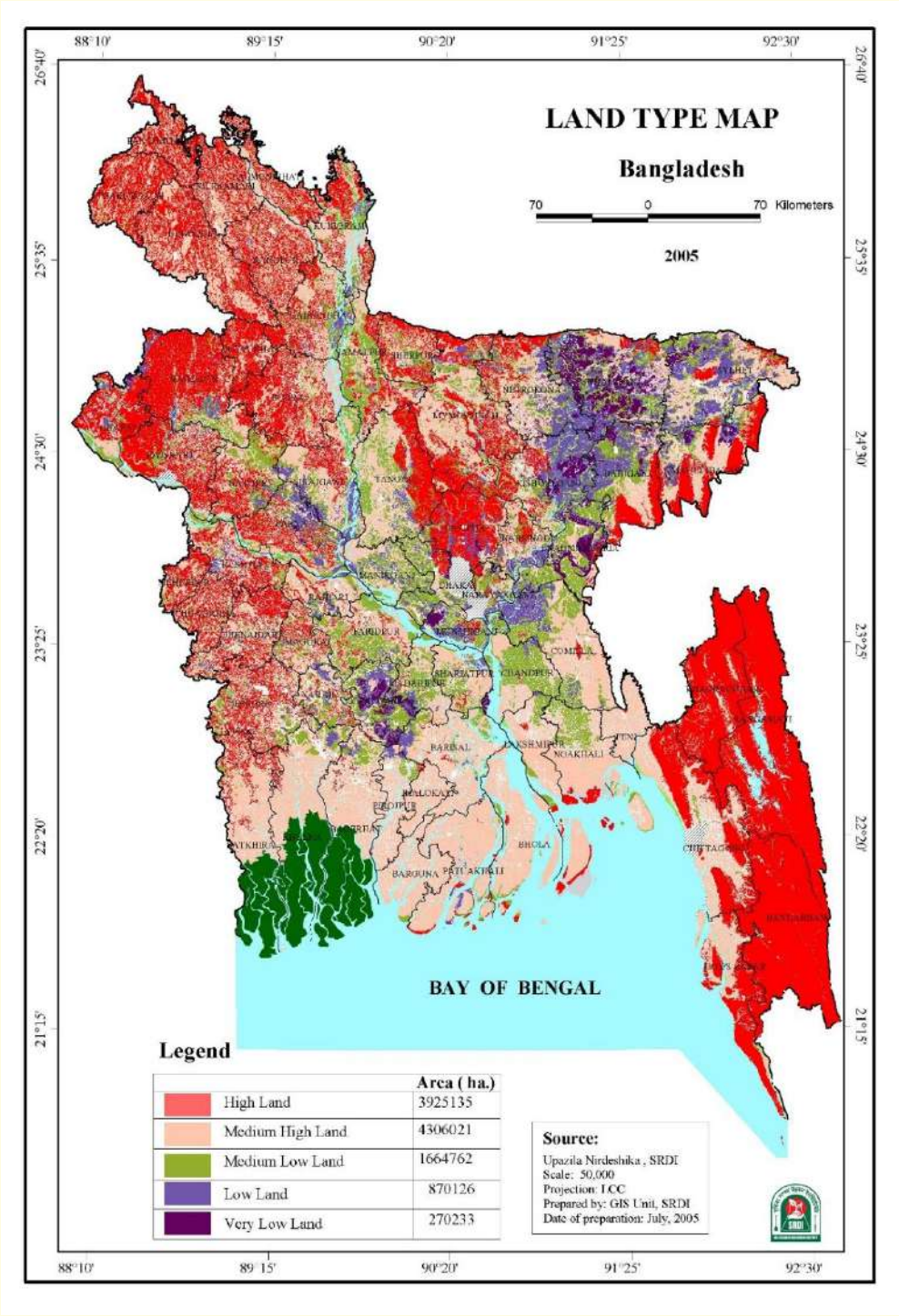
Information Sheet

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.	:

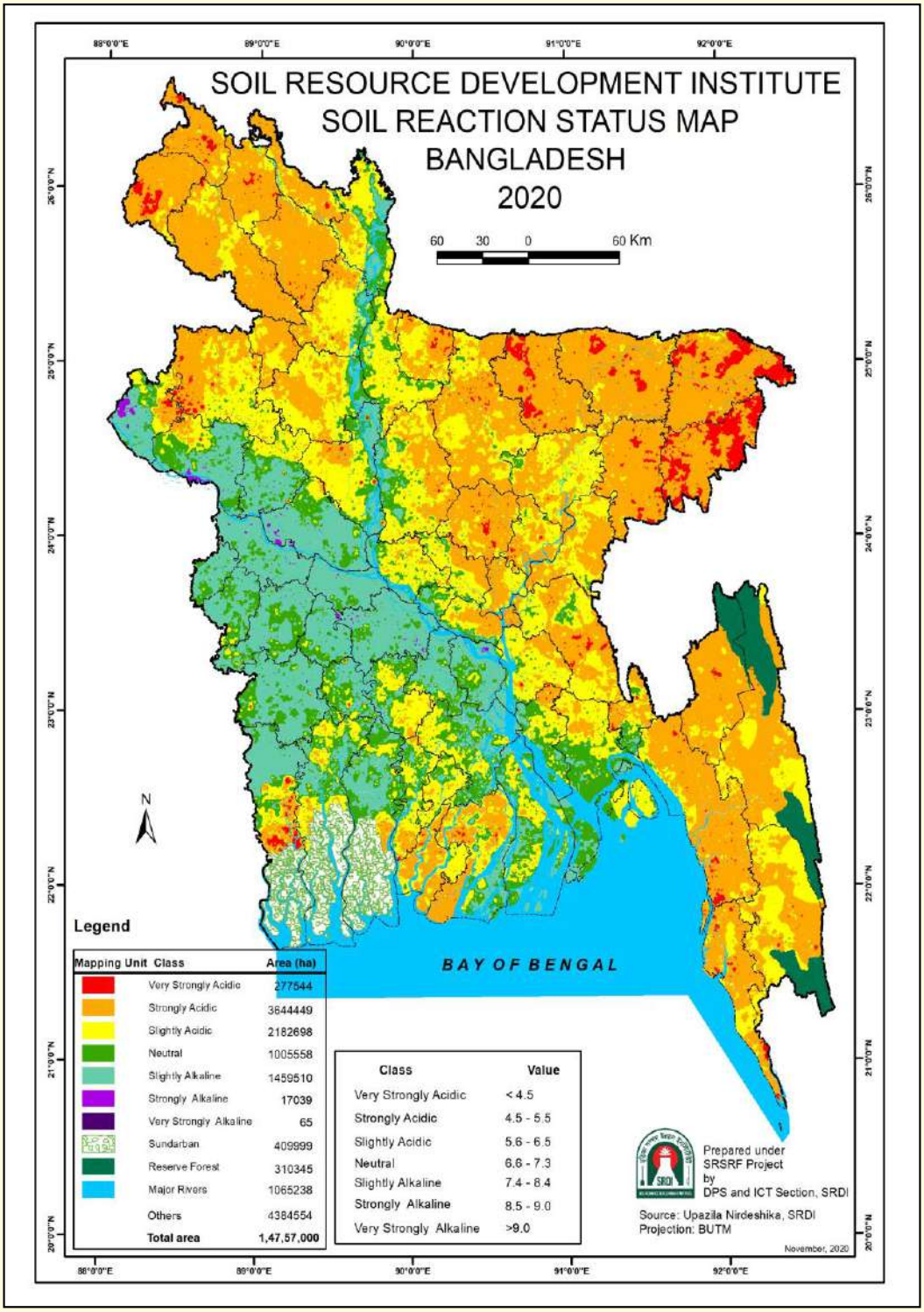
Appendix-19


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 PURNRBHABA 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

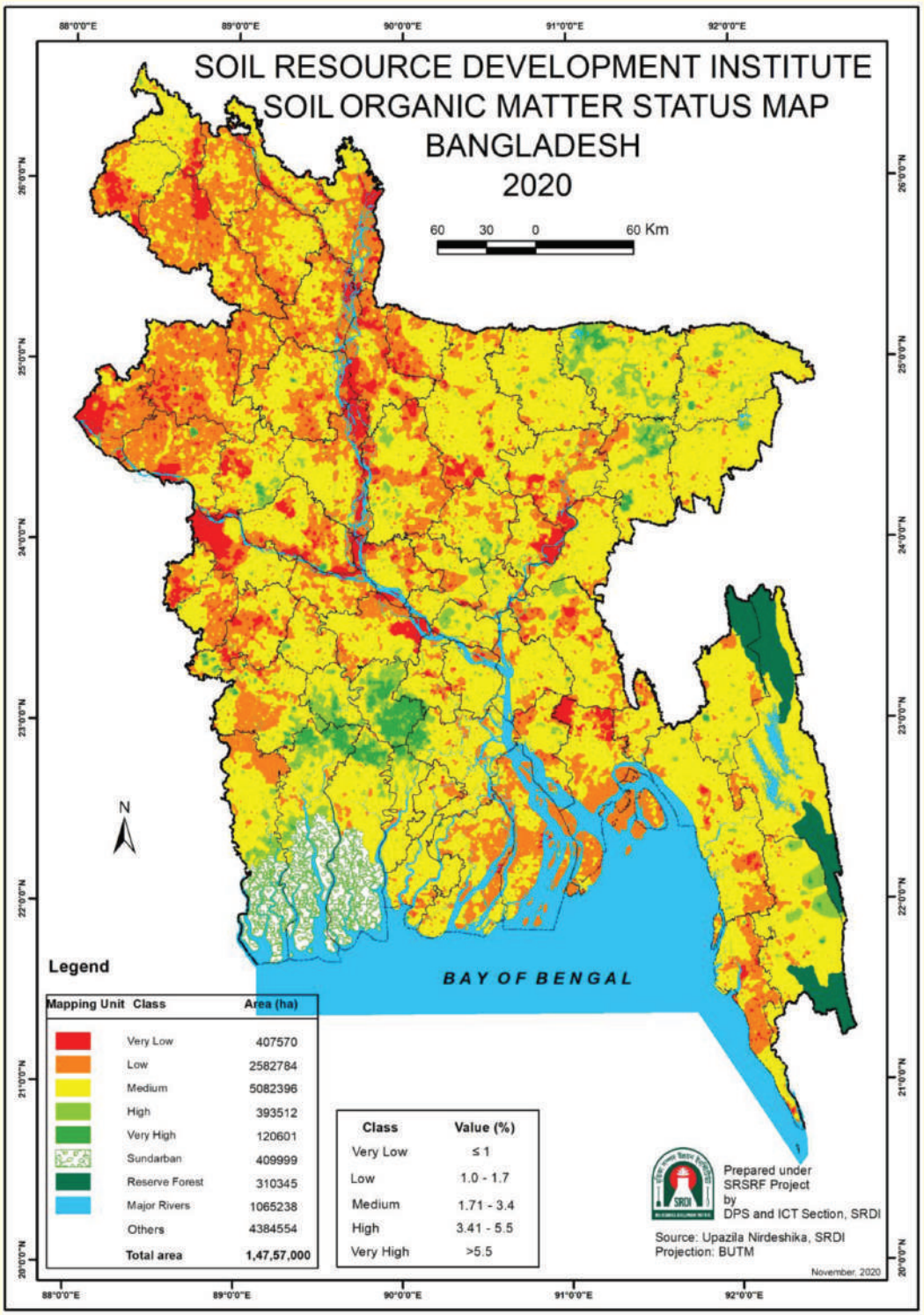
Appendix-20


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

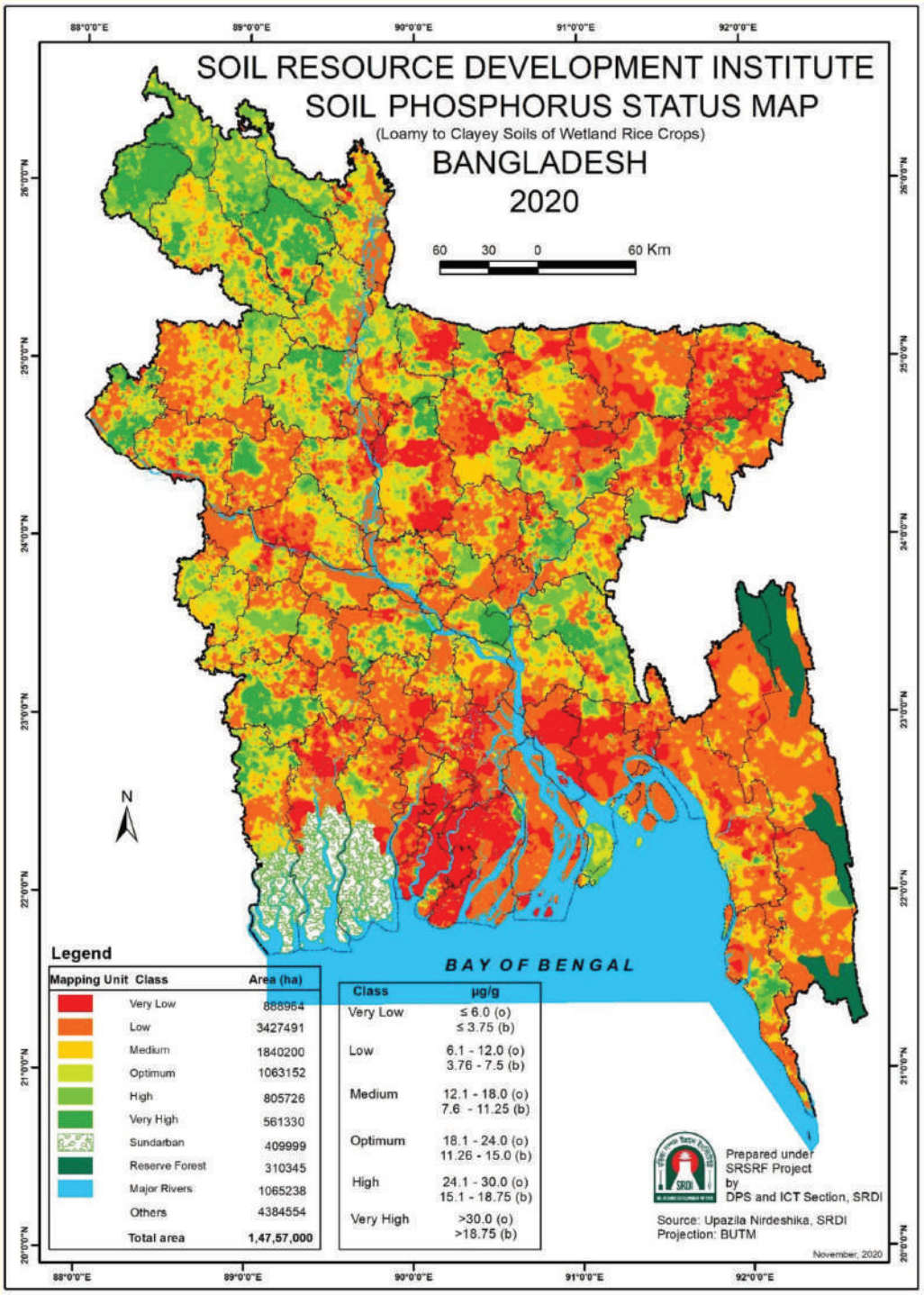
Appendix-21


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL REACTION STATUS MAP
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class | Area (ha)
Very Strongly Acidic 277544
Strongly Acidic 3644449
Slightly Acidic 2182698
Neutral 1005558
Slightly Alkaline 1459510
Strongly Alkaline 17039
Very Strongly Alkaline 65
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class | Value
Very Strongly Acidic < 4.5
Strongly Acidic 4.5 - 5.5
Slightly Acidic 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
Prepared under SRSRF Project by DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

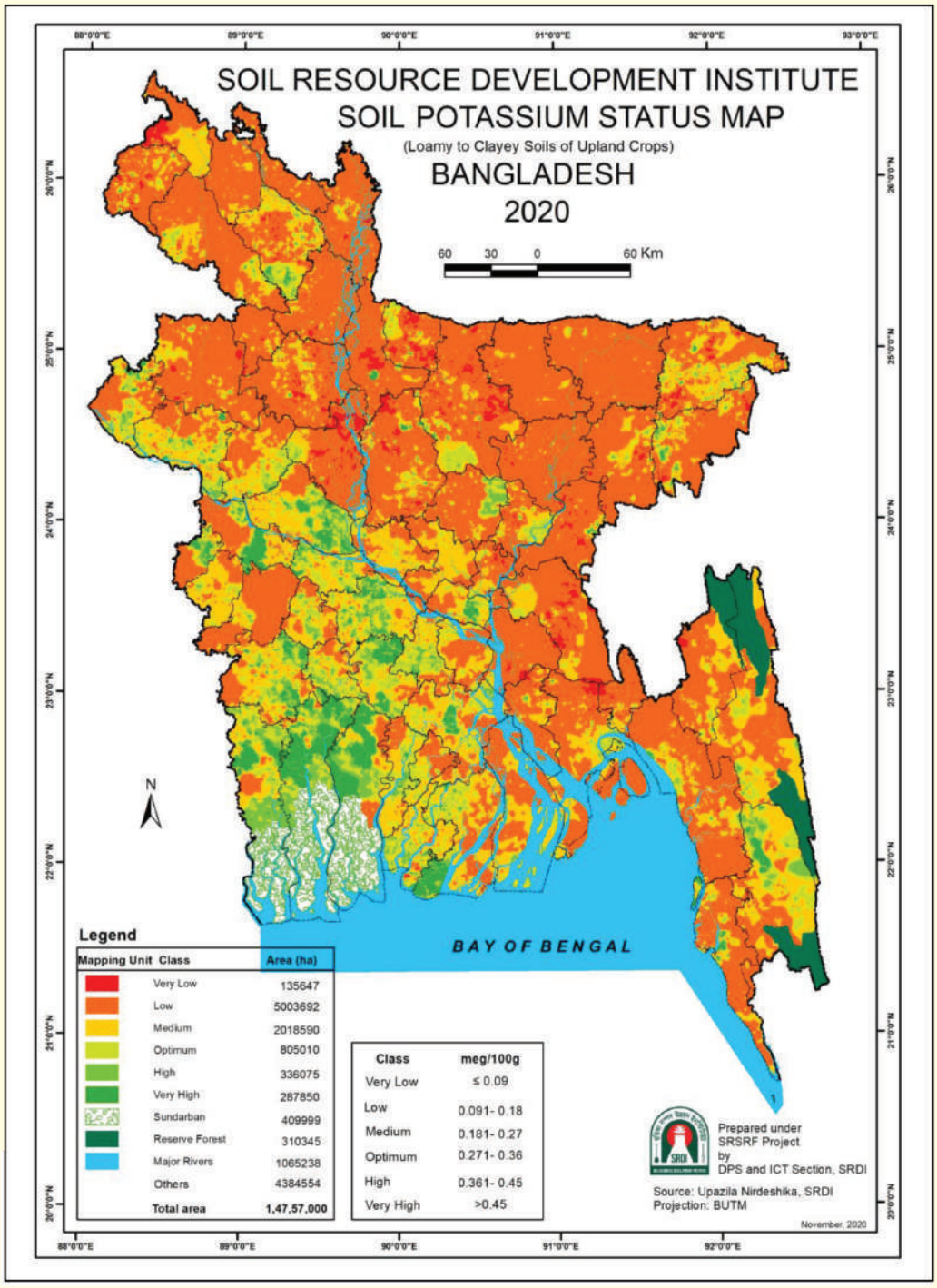
Appendix-22


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL ORGANIC MATTER STATUS MAP
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class Area (ha)
Very Low 407570
Low 2582784
Medium 5082396
High 393512
Very High 120601
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class Value (%)
Very Low ≤ 1
Low 1.0 - 1.7
Medium 1.71 - 3.4
High 3.41 - 5.5
Very High >5.5
Prepared under SRSRF Project by DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

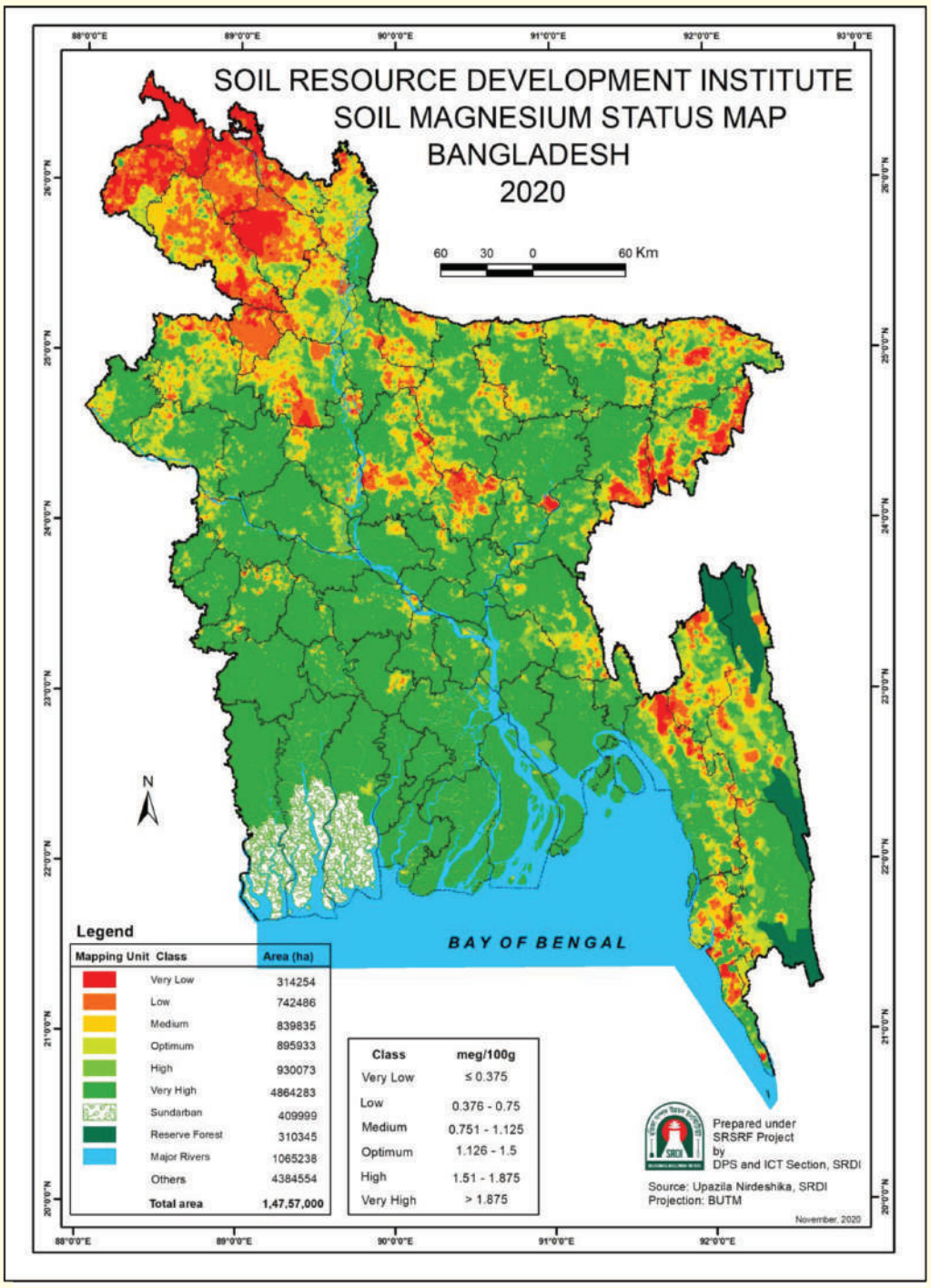
Appendix-23


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL PHOSPHORUS STATUS MAP
(Loamy to Clayey Soils of Wetland Rice Crops)
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class | Area (ha)
Very Low 888964
Low 3427491
Medium 1840200
Optimum 1063152
High 805726
Very High 561330
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class | µg/g
Very Low ≤ 6.0 (o) ≤ 3.75 (b)
Low 6.1 - 12.0 (o) 3.76 - 7.5 (b)
Medium 12.1 - 18.0 (o) 7.6 - 11.25 (b)
Optimum 18.1 - 24.0 (o) 11.26 - 15.0 (b)
High 24.1 - 30.0 (o) 15.1 - 18.75 (b)
Very High >30.0 (o) >18.75 (b)
Prepared under SRSRF Project by DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

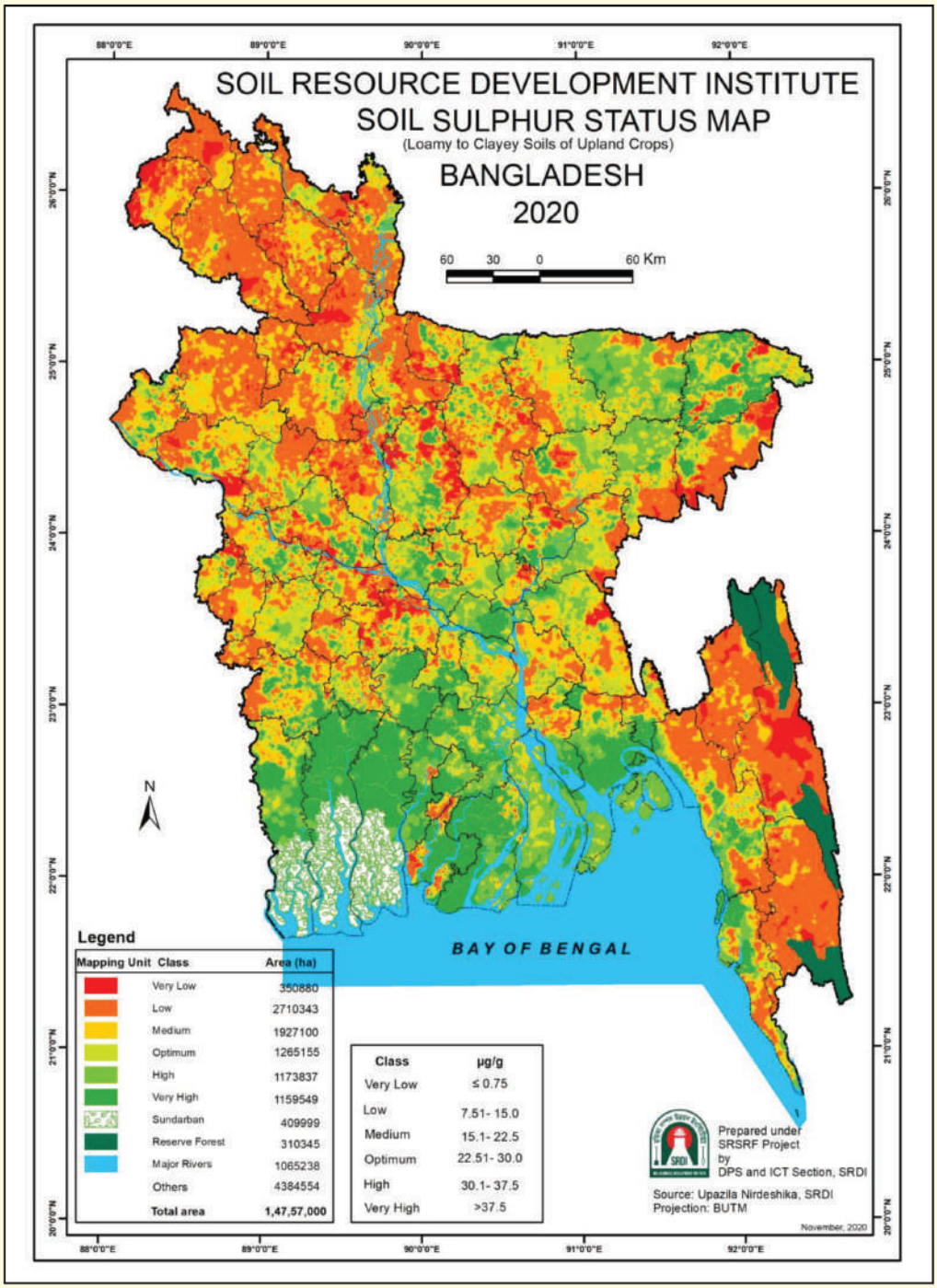
Appendix-24


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL POTASSIUM STATUS MAP
(Loamy to Clayey Soils of Upland Crops)
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class | Area (ha)
Very Low 135647
Low 5003692
Medium 2018590
Optimum 805010
High 336075
Very High 287850
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class | meg/100g
Very Low ≤ 0.09
Low 0.091- 0.18
Medium 0.181- 0.27
Optimum 0.271- 0.36
High 0.361- 0.45
Very High >0.45
Prepared under SRSRF Project by DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

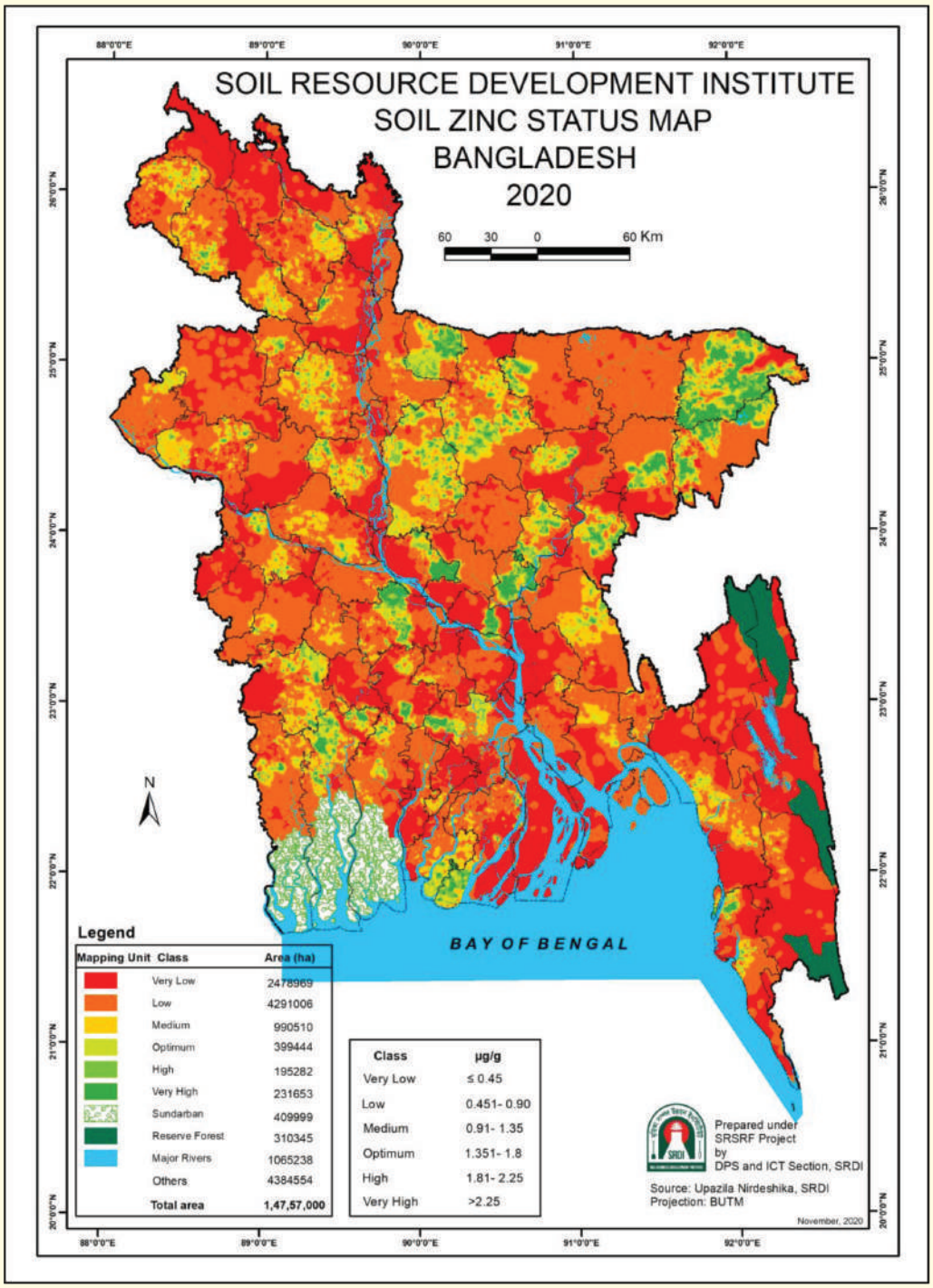
Appendix-25


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL MAGNESIUM STATUS MAP
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class | Area (ha)
Very Low 314254
Low 742486
Medium 839835
Optimum 895933
High 930073
Very High 4864283
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class | meg/100g
Very Low ≤ 0.375
Low 0.376 - 0.75
Medium 0.751 - 1.125
Optimum 1.126 - 1.5
High 1.51 - 1.875
Very High > 1.875
Prepared under SRSRF Project by DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

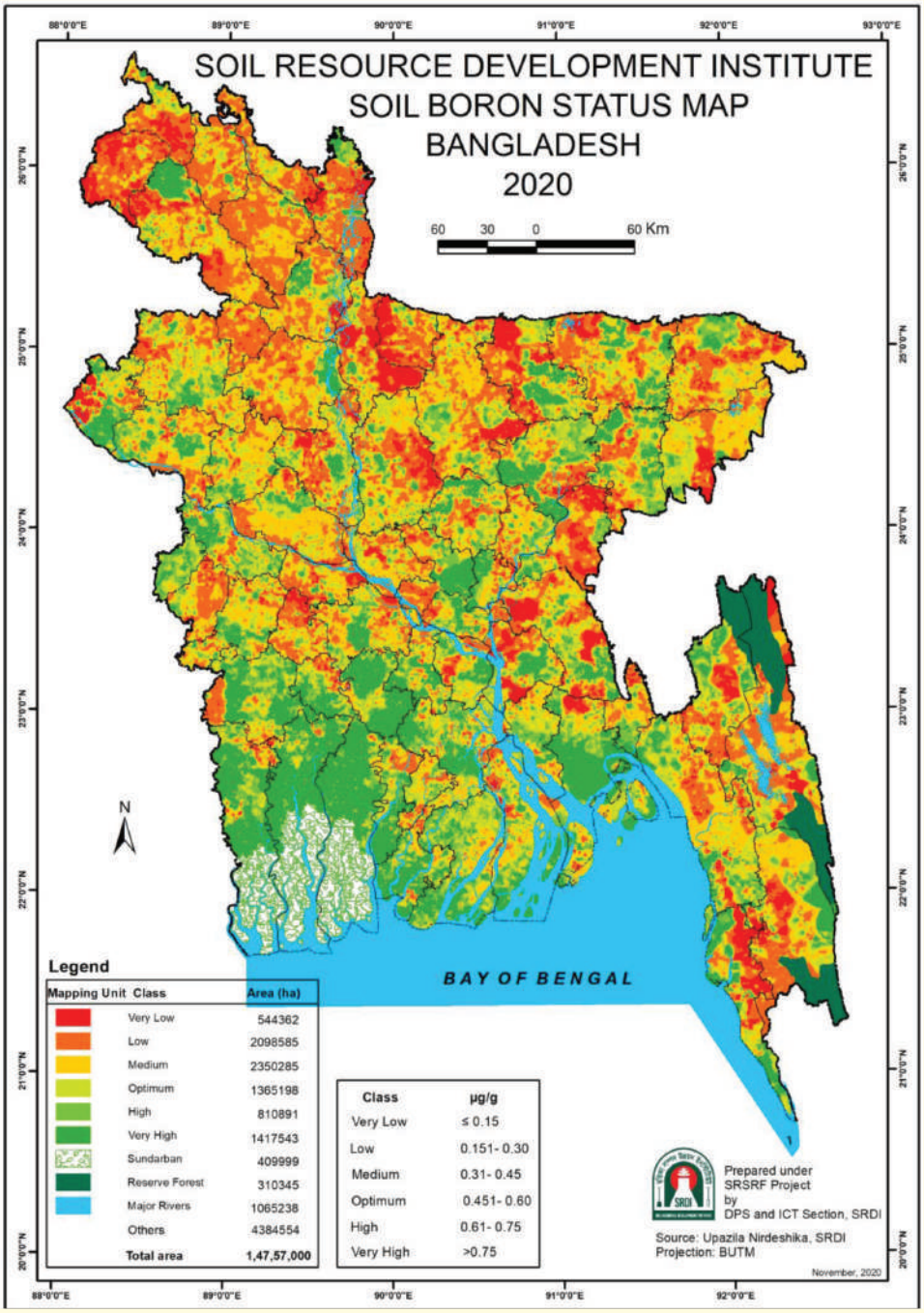
Appendix-26


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL SULPHUR STATUS MAP
(Loamy to Clayey Soils of Upland Crops)
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class Area (ha)
Very Low 350880
Low 2710343
Medium 1927100
Optimum 1265155
High 1173837
Very High 1159549
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class µg/g
Very Low ≤ 0.75
Low 7.51- 15.0
Medium 15.1- 22.5
Optimum 22.51- 30.0
High 30.1- 37.5
Very High >37.5
Prepared under SRSRF Project by DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

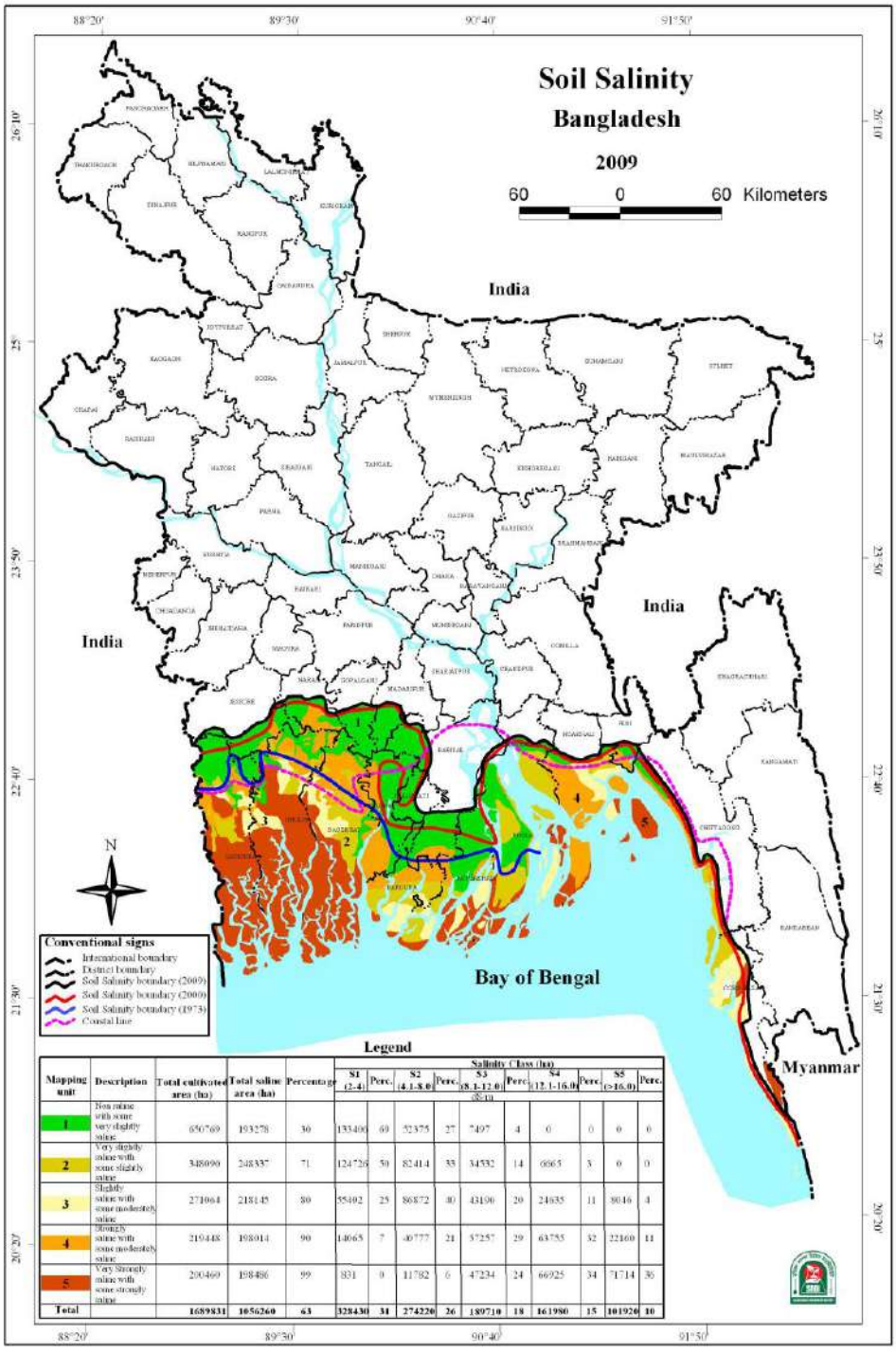
Appendix-27


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL ZINC STATUS MAP
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class Area (ha)
Very Low 2478969
Low 4291006
Medium 990510
Optimum 399444
High 195282
Very High 231653
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class µg/g
Very Low ≤ 0.45
Low 0.451- 0.90
Medium 0.91- 1.35
Optimum 1.351- 1.8
High 1.81- 2.25
Very High >2.25
Prepared under
SRSRF Project
by
DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

Appendix-28


SOIL RESOURCE DEVELOPMENT INSTITUTE
SOIL BORON STATUS MAP
BANGLADESH
2020
60 30 0 60 Km
N
BAY OF BENGAL
Legend
Mapping Unit Class | Area (ha)
Very Low 544362
Low 2098585
Medium 2350285
Optimum 1365198
High 810891
Very High 1417543
Sundarban 409999
Reserve Forest 310345
Major Rivers 1065238
Others 4384554
Total area 1,47,57,000
Class | µg/g
Very Low ≤ 0.15
Low 0.151- 0.30
Medium 0.31- 0.45
Optimum 0.451- 0.60
High 0.61- 0.75
Very High >0.75
Prepared under SRSRF Project by DPS and ICT Section, SRDI
Source: Upazila Nirdeshika, SRDI
Projection: BUTM
November, 2020

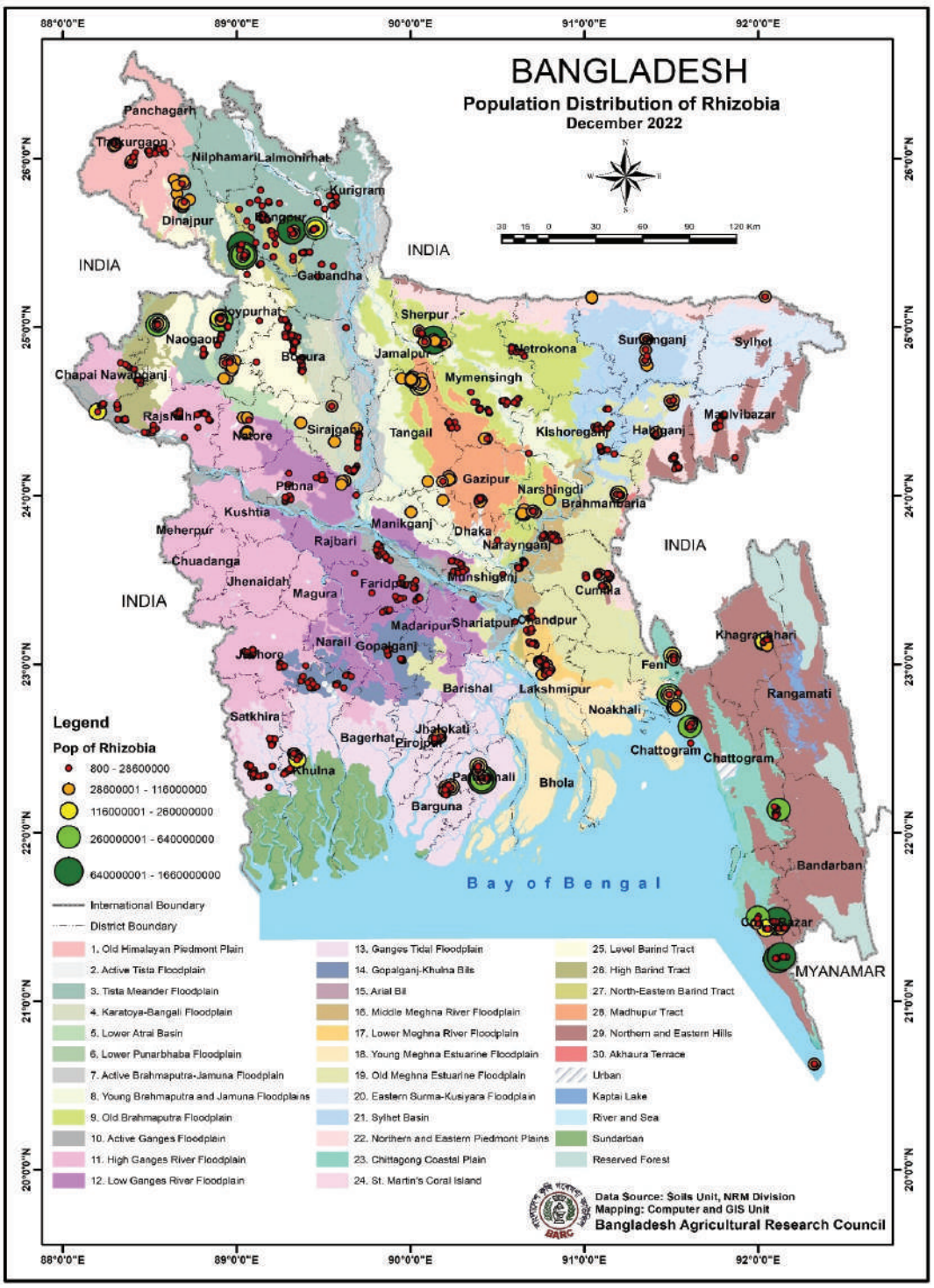
Appendix-29



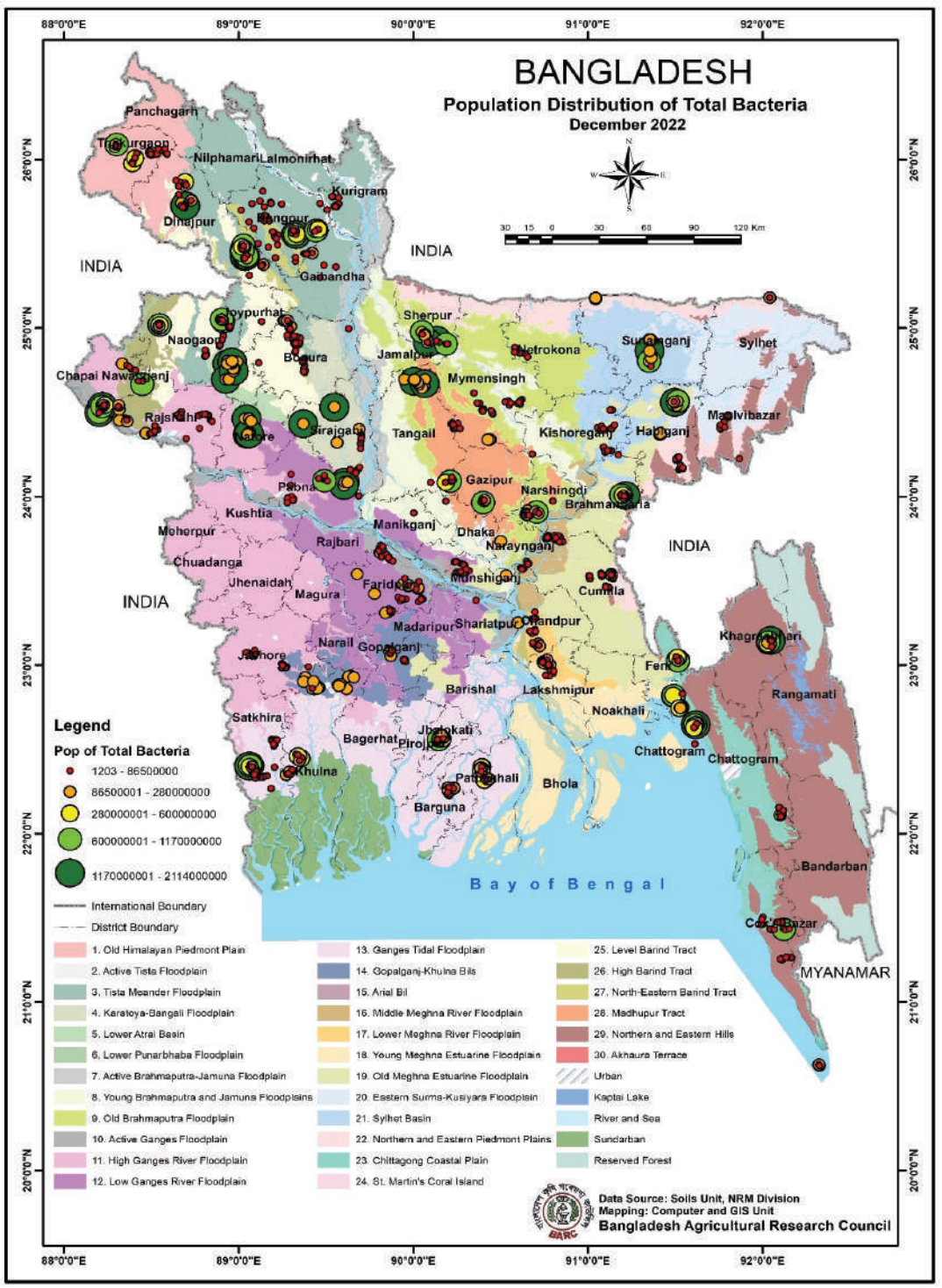
Legend

Mapping unit	Description	Total cultivated area (ha)	Total saline area (ha)	Percentage	Salinity Class (ha)									
					S1 (2-4)	Perc.	S2 (4.1-8.0)	Perc.	S3 (8.1-12.0)	Perc.	S4 (12.1-16.0)	Perc.	S5 (>16.0)	Perc.
1	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	43196	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	200469	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

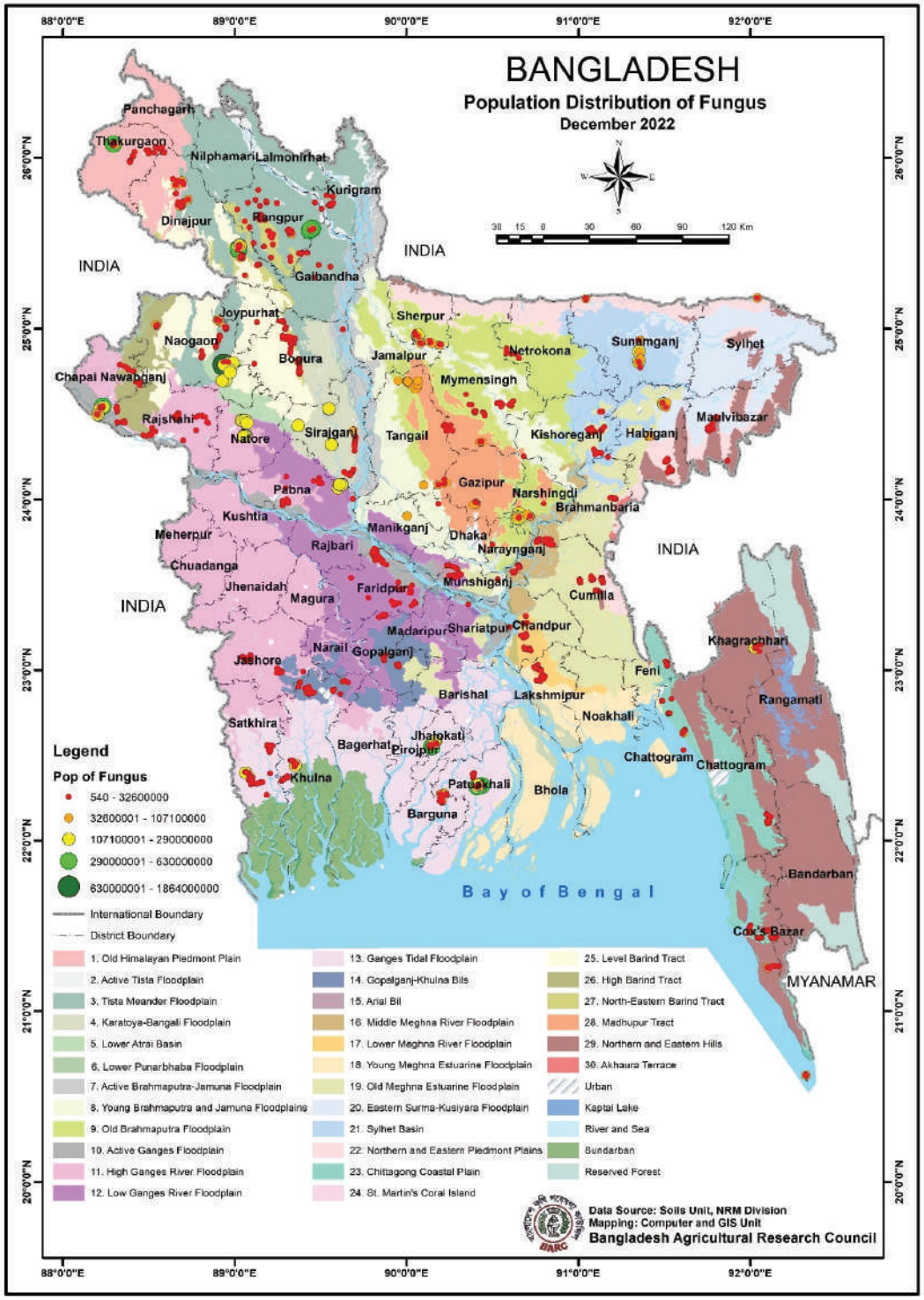
Appendix-30


BANGLADESH
Population Distribution of Rhizobia
December 2022
INDIA
INDIA
INDIA
INDIA
MYANAMAR
Bay of Bengal
Panchagarh
Thakurgaon
Nilphamari
Lalmonirhat
Kurigram
Dinajpur
Rangpur
Gaibandha
Joypurhat
Naogaon
Bogura
Chapai Nawabganj
Rajshahi
Natore
Sirajganj
Pabna
Kushtia
Meherpur
Chuadanga
Jhenaidah
Magura
Jashore
Narail
Satkhira
Khulna
Bagerhat
Jhalokati
Barguna
Pirojpur
Barishal
Patuakhali
Bhola
Lakshmipur
Noakhali
Feni
Chattogram
Cumilla
Chandpur
Shariatpur
Madaripur
Gopalganj
Faridpur
Rajbari
Manikganj
Dhaka
Munshiganj
Narayanganj
Gazipur
Narshingdi
Brahmanbaria
Tangail
Kishoreganj
Mymensingh
Jamalpur
Sherpur
Netrokona
Sunamganj
Sylhet
Habiganj
Maulvibazar
Rangamati
Khagrachhari
Bandarban
Cox's Bazar
Legend
Pop of Rhizobia
800 - 28600000
28600001 - 116000000
116000001 - 260000000
260000001 - 640000000
640000001 - 1660000000
International Boundary
District Boundary
1. Old Himalayan Piedmont Plain
2. Active Tista Floodplain
3. Tista Meander Floodplain
4. Karatoya-Bangali Floodplain
5. Lower Atrai Basin
6. Lower Punarbhaba Floodplain
7. Active Brahmaputra-Jamuna Floodplain
8. Young Brahmaputra and Jamuna Floodplains
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 Bils
15. Arial Bil
16. Middle Meghna River Floodplain
17. Lower Meghna River Floodplain
18. Young Meghna Estuarine Floodplain
19. Old Meghna Estuarine Floodplain
20. Eastern Surma-Kusiyara Floodplain
21. Sylhet Basin
22. Northern and Eastern Piedmont Plains
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 and Eastern Hills
30. Akhaura Terrace
Urban
Kaptai Lake
River and Sea
Sundarban
Reserved Forest
Data Source: Soils Unit, NRM Division
Mapping: Computer and GIS Unit
Bangladesh Agricultural Research Council
BARC
88°0'0"E
89°0'0"E
90°0'0"E
91°0'0"E
92°0'0"E
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

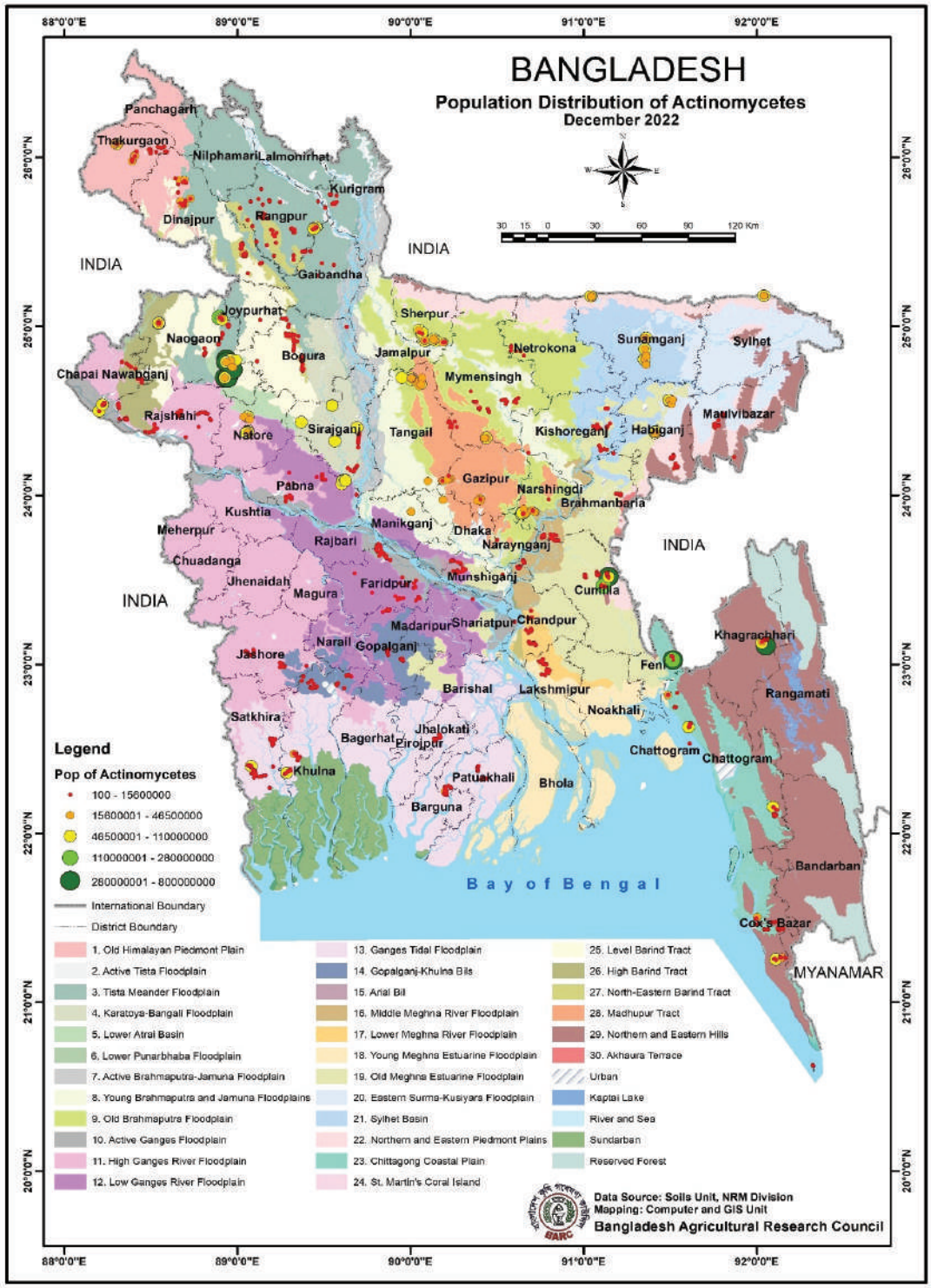
Appendix-31


BANGLADESH
Population Distribution of Total Bacteria
December 2022
INDIA
INDIA
INDIA
INDIA
MYANAMAR
Bay of Bengal
Panchagarh
Thakurgaon
Nilphamari
Lalmonirhat
Kurigram
Dinajpur
Rangpur
Gaibandha
Joypurhat
Naogaon
Bogura
Sherpur
Jamalpur
Netrokona
Sunamganj
Sylhet
Chapai Nawabganj
Rajshahi
Sirajganj
Mymensingh
Tangail
Kishoreganj
Habiganj
Moulvibazar
Pabna
Gazipur
Narshingdi
Brahmanbaria
Kushtia
Meherpur
Manikganj
Dhaka
Narayanganj
Rajbari
Chuadanga
Jhenaidah
Magura
Faridpur
Munshiganj
Cumilla
Madaripur
Shariatpur
Chandpur
Narail
Gopalganj
Jashore
Feni
Khagrachhari
Barishal
Lakshmipur
Noakhali
Rangamati
Satkhira
Jhalokati
Bagerhat
Pirojpur
Chattogram
Khulna
Patuakhali
Bhola
Barguna
Bandarban
Cox's Bazar
Legend
Pop of Total Bacteria
1203 - 86500000
86500001 - 280000000
280000001 - 600000000
600000001 - 1170000000
1170000001 - 2114000000
International Boundary
District Boundary
1. Old Himalayan Piedmont Plain
2. Active Tista Floodplain
3. Tista Meander Floodplain
4. Karatoya-Bangali Floodplain
5. Lower Atrai Basin
6. Lower Punarbhaba Floodplain
7. Active Brahmaputra-Jamuna Floodplain
8. Young Brahmaputra and Jamuna Floodplains
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 Bils
15. Arial Bil
16. Middle Meghna River Floodplain
17. Lower Meghna River Floodplain
18. Young Meghna Estuarine Floodplain
19. Old Meghna Estuarine Floodplain
20. Eastern Surma-Kusiyara Floodplain
21. Sylhet Basin
22. Northern and Eastern Piedmont Plains
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 and Eastern Hills
30. Akhaura Terrace
Urban
Kaptai Lake
River and Sea
Sundarban
Reserved Forest
Data Source: Soils Unit, NRM Division
Mapping: Computer and GIS Unit
Bangladesh Agricultural Research Council
BARC
88°0'0"E
89°0'0"E
90°0'0"E
91°0'0"E
92°0'0"E
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

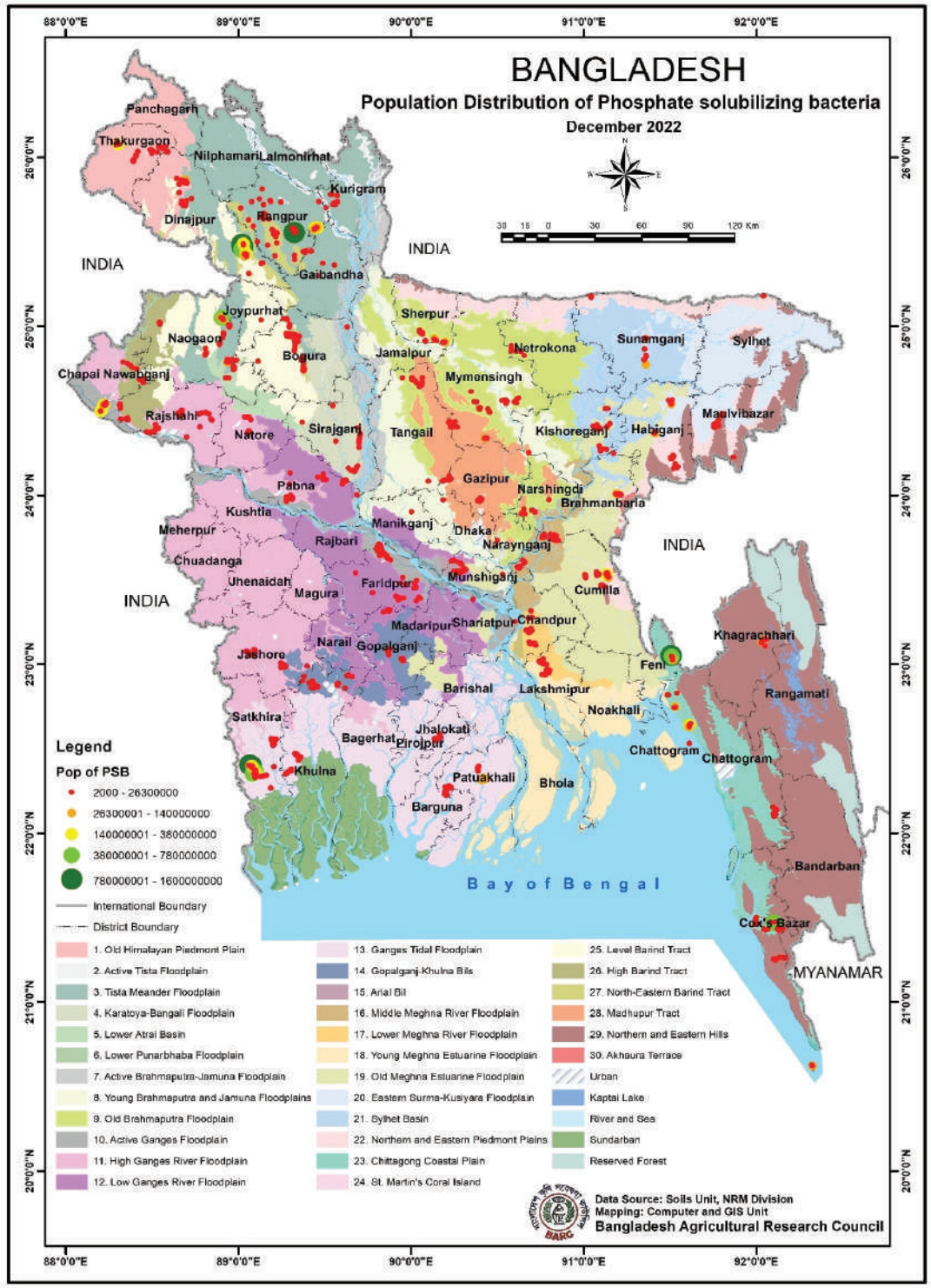
Appendix-32


BANGLADESH
Population Distribution of Fungus
December 2022
INDIA
INDIA
INDIA
INDIA
MYANAMAR
Bay of Bengal
Panchagarh
Thakurgaon
Nilphamari
Lalmonirhat
Kurigram
Dinajpur
Rangpur
Gaibandha
Joypurhat
Naogaon
Bogura
Chapai Nawabganj
Rajshahi
Natore
Sirajganj
Pabna
Kushtia
Meherpur
Chuadanga
Jhenaidah
Magura
Jashore
Satkhira
Khulna
Bagerhat
Narail
Gopalganj
Madaripur
Rajbari
Faridpur
Manikganj
Sherpur
Jamalpur
Netrokona
Mymensingh
Tangail
Gazipur
Dhaka
Narayanganj
Munshiganj
Shariatpur
Barishal
Jhalokati
Pirojpur
Patuakhali
Barguna
Bhola
Lakshmipur
Chandpur
Cumilla
Narshingdi
Brahmanbaria
Kishoreganj
Habiganj
Sunamganj
Sylhet
Maulvibazar
Feni
Noakhali
Chattogram
Khagrachhari
Rangamati
Bandarban
Cox's Bazar
Legend
Pop of Fungus
540 - 32600000
32600001 - 107100000
107100001 - 290000000
290000001 - 630000000
630000001 - 1864000000
International Boundary
District Boundary
1. Old Himalayan Piedmont Plain
2. Active Tista Floodplain
3. Tista Meander Floodplain
4. Karatoya-Bangali Floodplain
5. Lower Atrai Basin
6. Lower Punarbhaba Floodplain
7. Active Brahmaputra-Jamuna Floodplain
8. Young Brahmaputra and Jamuna Floodplains
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 Bils
15. Arial Bil
16. Middle Meghna River Floodplain
17. Lower Meghna River Floodplain
18. Young Meghna Estuarine Floodplain
19. Old Meghna Estuarine Floodplain
20. Eastern Surma-Kusiyara Floodplain
21. Sylhet Basin
22. Northern and Eastern Piedmont Plains
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 and Eastern Hills
30. Akhaura Terrace
Urban
Kaptai Lake
River and Sea
Sundarban
Reserved Forest
Data Source: Soils Unit, NRM Division
Mapping: Computer and GIS Unit
Bangladesh Agricultural Research Council
88°0'0"E
89°0'0"E
90°0'0"E
91°0'0"E
92°0'0"E
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

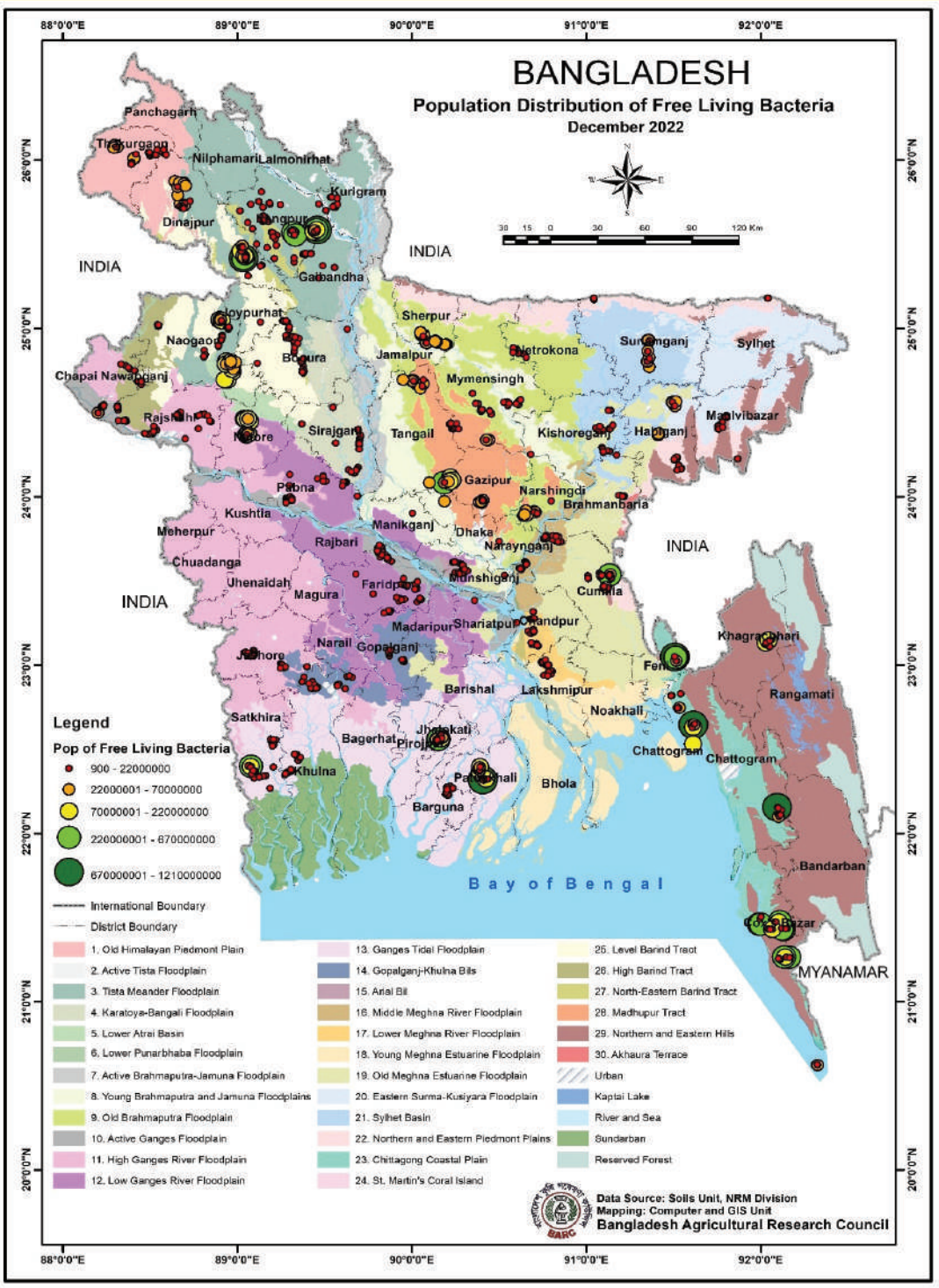
Appendix-33


BANGLADESH
Population Distribution of Actinomycetes
December 2022
INDIA
INDIA
INDIA
INDIA
MYANAMAR
Bay of Bengal
Panchagarh
Thakurgaon
Nilphamari
Lalmonirhat
Kurigram
Dinajpur
Rangpur
Gaibandha
Joypurhat
Naogaon
Bogura
Chapai Nawabganj
Rajshahi
Natore
Sirajganj
Pabna
Kushtia
Meherpur
Chuadanga
Jhenaidah
Magura
Rajbari
Manikganj
Faridpur
Madaripur
Shariatpur
Narail
Gopalganj
Jashore
Satkhira
Khulna
Bagerhat
Jhalokati
Pirojpur
Barishal
Patuakhali
Barguna
Bhola
Lakshmipur
Noakhali
Chandpur
Munshiganj
Dhaka
Narayngonj
Gazipur
Narshingdi
Brahmanbaria
Cumilla
Feni
Chattogram
Chattogram
Khagrachhari
Rangamati
Bandarban
Cox's Bazar
Sherpur
Jamalpur
Netrokona
Mymensingh
Tangail
Kishoreganj
Habiganj
Sunamganj
Sylhet
Maulvibazar
30 15 0 30 60 90 120 Km
Legend
Pop of Actinomycetes
100 - 15600000
15600001 - 46500000
46500001 - 110000000
110000001 - 280000000
280000001 - 800000000
International Boundary
District Boundary
1. Old Himalayan Piedmont Plain
2. Active Tista Floodplain
3. Tista Meander Floodplain
4. Karatoya-Bangali Floodplain
5. Lower Atrai Basin
6. Lower Punarbhaba Floodplain
7. Active Brahmaputra-Jamuna Floodplain
8. Young Brahmaputra and Jamuna Floodplains
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 Bils
15. Arial Bil
16. Middle Meghna River Floodplain
17. Lower Meghna River Floodplain
18. Young Meghna Estuarine Floodplain
19. Old Meghna Estuarine Floodplain
20. Eastern Surma-Kusiyara Floodplain
21. Sylhet Basin
22. Northern and Eastern Piedmont Plains
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 and Eastern Hills
30. Akhaura Terrace
Urban
Kaptai Lake
River and Sea
Sundarban
Reserved Forest
Data Source: Soils Unit, NRM Division
Mapping: Computer and GIS Unit
Bangladesh Agricultural Research Council
88°0'0"E
89°0'0"E
90°0'0"E
91°0'0"E
92°0'0"E
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

Appendix-34


BANGLADESH
Population Distribution of Phosphate solubilizing bacteria
December 2022
INDIA
INDIA
INDIA
INDIA
MYANAMAR
Bay of Bengal
Panchagarh
Thakurgaon
Nilphamari
Lalmonirhat
Kurigram
Dinajpur
Rangpur
Gaibandha
Joypurhat
Naogaon
Bogura
Chapai Nawabganj
Rajshahi
Natore
Sirajganj
Pabna
Kushtia
Meherpur
Chuadanga
Jhenaidah
Magura
Rajbari
Faridpur
Manikganj
Tangail
Sherpur
Jamalpur
Mymensingh
Netrokona
Sunamganj
Sylhet
Kishoreganj
Habiganj
Maulvibazar
Gazipur
Narshingdi
Brahmanbaria
Dhaka
Narayngonj
Munshiganj
Cumilla
Madaripur
Shariatpur
Chandpur
Narail
Gopalganj
Jashore
Barishal
Lakshmipur
Feni
Khagrachhari
Rangamati
Noakhali
Chattogram
Satkhira
Bagerhat
Jhalokati
Pirojpur
Khulna
Patuakhali
Bhola
Barguna
Bandarban
Cox's Bazar
Legend
Pop of PSB
2000 - 26300000
26300001 - 140000000
140000001 - 380000000
380000001 - 780000000
780000001 - 1600000000
International Boundary
District Boundary
1. Old Himalayan Piedmont Plain
2. Active Tista Floodplain
3. Tista Meander Floodplain
4. Karatoya-Bangali Floodplain
5. Lower Atrai Basin
6. Lower Punarbhaba Floodplain
7. Active Brahmaputra-Jamuna Floodplain
8. Young Brahmaputra and Jamuna Floodplains
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 Bils
15. Arial Bil
16. Middle Meghna River Floodplain
17. Lower Meghna River Floodplain
18. Young Meghna Estuarine Floodplain
19. Old Meghna Estuarine Floodplain
20. Eastern Surma-Kusiyara Floodplain
21. Sylhet Basin
22. Northern and Eastern Piedmont Plains
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 and Eastern Hills
30. Akhaura Terrace
Urban
Kaptai Lake
River and Sea
Sundarban
Reserved Forest
Data Source: Soils Unit, NRM Division
Mapping: Computer and GIS Unit
Bangladesh Agricultural Research Council
88°0'0"E
89°0'0"E
90°0'0"E
91°0'0"E
92°0'0"E
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

Appendix-35


BANGLADESH
Population Distribution of Free Living Bacteria
December 2022
INDIA
INDIA
INDIA
INDIA
MYANAMAR
Bay of Bengal
Panchagarh
Thakurgaon
Nilphamari
Lalmonirhat
Kurigram
Dinajpur
Rangpur
Gaibandha
Joypurhat
Naogaon
Bogura
Chapai Nawabganj
Rajshahi
Natore
Sirajgan
Pabna
Kushtia
Meherpur
Chuadanga
Jhenaidah
Magura
Narail
Jashore
Satkhira
Khulna
Bagerhat
Jhalakati
Barguna
Patuakhali
Bhola
Barishal
Pirojpur
Madaripur
Gopalganj
Faridpur
Rajbari
Manikganj
Dhaka
Narayanganj
Munshiganj
Gazipur
Tangail
Sherpur
Jamalpur
Mymensingh
Netrokona
Kishoreganj
Sunamganj
Sylhet
Habiganj
Maulvibazar
Narshingdi
Brahmanbaria
Cumilla
Chandpur
Shariatpur
Lakshmipur
Feni
Noakhali
Chattogram
Khagrachhari
Rangamati
Bandarban
Cox's Bazar
Legend
Pop of Free Living Bacteria
900 - 22000000
22000001 - 70000000
70000001 - 220000000
220000001 - 670000000
670000001 - 1210000000
International Boundary
District Boundary
1. Old Himalayan Piedmont Plain
2. Active Tista Floodplain
3. Tista Meander Floodplain
4. Karatoya-Bangali Floodplain
5. Lower Atrai Basin
6. Lower Punarbhaba Floodplain
7. Active Brahmaputra-Jamuna Floodplain
8. Young Brahmaputra and Jamuna Floodplains
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 Bils
15. Arial Bil
16. Middle Meghna River Floodplain
17. Lower Meghna River Floodplain
18. Young Meghna Estuarine Floodplain
19. Old Meghna Estuarine Floodplain
20. Eastern Surma-Kusiyara Floodplain
21. Sylhet Basin
22. Northern and Eastern Piedmont Plains
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 and Eastern Hills
30. Akhaura Terrace
Urban
Kaptai Lake
River and Sea
Sundarban
Reserved Forest
Data Source: Soils Unit, NRM Division
Mapping: Computer and GIS Unit
Bangladesh Agricultural Research Council
BARC
88°0'0"E
89°0'0"E
90°0'0"E
91°0'0"E
92°0'0"E
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

The nation that destroys its soil destroys itself

Franklin D. Roosevelt, 1937

Fertilizer Recommendation Guide-2024

BARC