

INTRODUCTION OF SOIL HEALTH CARD IN TRIPURA

**M. DATTA
N. P. SINGH
B. SANTHOSH
A. DASGUPTA*
S. V. NGACHAN**

**ICAR RESEARCH COMPLEX FOR NEH REGION, LEMBUCHERRA,
TRIPURA (WEST)**

***DEPARTMENT OF AGRICULTURE, GOVT. OF TRIPURA**

Chapter

- | Sl. No. | Title |
|----------------|--|
| 1. | Introduction |
| 2. | Soil Health Card – Outlines and Achievement |
| 3. | Soil test results in Districts |
| | i. West Tripura |
| | ii. Khowai |
| | iii. Sepahijala |
| | iv. Gomati |
| | v. South Tripura. |
| 4. | Average Soil Test Report of Farmers' Club |
| 5. | Nutrient Index |
| 6. | Soil Health Card – Release and Training |
| 7. | Soil Health Card – Usefulness |
| 8. | Fertilizer Requirement and Recommendation |
| 9. | Soil Health Card – Impact Analysis |
| 10. | Microbial Status |
| 11. | Conclusion |
| 12. | References |

1. Introduction

India accounts for only about 2.4 % of the world's geographical area and 4 % of its water resources, but has to support about 17 % of the world's human population and 15 % of the livestock. Agriculture is an important sector of the Indian economy, accounting for 14% of the nation's GDP, about 11% of its exports, about half of the population still relies on agriculture as its principal source of income and it is a source of raw material for a large number of industries. Accelerating the growth of agriculture production is therefore necessary not only to achieve an overall GDP target of 8 per cent during the 12th Plan and meet the rising demand for food, but also to increase incomes of those dependent on agriculture to ensure inclusiveness. Yields of all the major crops have recorded positive growth during the 11th Plan period. The Impressive rates of growth (more than 4 percent per annum) were observed in the case of wheat, bajra, maize, coarse cereals, gram, tur, total pulses, groundnut, sesamum, soyabean, total oilseeds and cotton. The increases in production in the case of wheat, bajra, maize, groundnut and total oilseeds can mainly be attributed to increase in yields, where as the growth in production in the case of gram, tur, total pulses, soyabean and cotton . Growth in yields of sugarcane and rapeseed & mustard suggest that their yields seem to have attained the plateau and need renewed research to boost their productivity levels. Rapeseed & mustard, soybean and cotton recorded lower rates by a combination of both expansion in area and increase in productivity/yield..

The Indian Agriculture growth pattern has been very diverse at the state level. As agriculture is a state subject, the overall performance of the agriculture sector in India largely depends on what happens at the state level. There is a wide variation in the performance of different states. During the 11th Plan (i.e. 2007-08 to 2011-12) the growth performance of agriculture in Madhya(7.4%), Jharkhand (6.0%) and Karnataka (5.6%), was much higher than that of Punjab (1.6%), Maharashtra (2.0%), Tamil Nadu (2.2%) West Bengal (2.8%), Uttar Pradesh (3.3%) and Haryana (3.3%). High coefficient of variation (>2) was observed in the case of Himachal Pradesh and Maharashtra. Economy of Tripura is agrarian and the contribution of agriculture & allied activities to the Gross State Domestic Product (GSDP) is about 24 % .The estimated net cropped area is 2.56 lakh hectare covering nearly 24 % of the total geographical area and the area is undulating in nature with altitude varying from below 300 m to 700 m above mean sea level thus indicating a wide variability in soil fertility . A no. of food crops, vegetables, fruit crops, fibre, spices , plantation crops and floriculture are grown over this state but the crop productivity is observed to substantially below the national average due to nutritional disorders as noted in soils of Tripura. The deficit in food grains is alarmingly increasing from 1.54 to 1.74 lakh tones in Tripura in the recent period. However , system of rice intensification (SRI) is in practice producing 20-30 % increase in rice yield as noted

The area (**10,492 Km²**) of Tripura can be broadly divided into the following physiographic units.

- i. Steeply sloping and slightly dissected high relief, structural hills and ridges.
- ii. Moderately sloping with moderately dissected, medium relief parallel ridges.
- iii. Moderately sloping and highly dissected, low relief structural hills and ridges.
- iv. Moderate to gently sloping and moderately dissected, flat topped denudation hills.
- v. Low lying residual hills with valley.
- vi. Gently sloping, undulating plains with low mounds and narrow valleys.
- vii. Moderately to gently sloping, inter hill valleys with up land.

- viii. Moderately to gently sloping inter hill valleys with upland of alluvial plains
 - ix. Flood plains.
 - x. Rolling uplands.
- i. *Steeply sloping, slightly dissected, high relief structural hills and ridges:***
 It occurs mainly in the northern part of Tripura which includes Kailasahar, Panisager, Deo reserved forest of Manu area and Baramura and Atharamura reserved forest in and around Teliamura, Purba mangul, Paschim mangul and Simbleng areas of north east Tripura bordering Mizoram. The hill ranges are characterised by north-south trending ridges.
 The area is characterised by rugged relief and high hills with the elevation ranging from 700 to 939 m above msl. Almost all the side slopes of these ranges are very steep and highly dissected. The khowai and Manu are the principal rivers of this unit. These areas are mostly under mixed natural forest. Jhum cultivation is a common practice in this tract by the tribals. However, since these steep hills are not easily accessible the area under Jhum cultivation is less.
 - ii. *Moderately sloping and moderately dissected, medium relief parallel ridges :***
 This physiographic unit occurs mostly in the north and north-eastern part of Tripura. This area is characterised by its medium relief of elevation ranging from 500 to 700 m above msl. The side slopes of these ranges are very steep and highly dissected and almost all the areas are highly eroded. These areas are under forest vegetation. Jhum cultivation is a common practice in this tract (Plate 1a)
 - iii. *Moderately sloping and highly dissected low relief, structural hills and ridges:***
 This physiographic unit is found in the north-west and southern part of the state. This range is mostly covered by forest having NW-SE strike and altitude ranges from 300 to 500 m above msl. The relief of this area is low and the side slopes of the hills are moderately steep and most of the areas are highly eroded. These areas are under forest vegetation. Jhum cultivation is a common agricultural practice in this tract.
 - iv. *Moderate to gently sloping and moderately dissected, flat topped denuded hills :***
 These hills occur mostly in the western, central and southern part of Tripura. It is characterized by a relatively flat top on the denudation hills with the adjacent narrow valleys. The area is moderately eroded in the low relief and is mostly under degraded forest or rubber plantation.
 - v. *Low lying hills with valley***
 This unit is found mainly in the Gondacherra areas of the south eastern part of Tripura. This area is characterized by low relief and moderate erosion. It is mostly under cultivation.
 - vi. *Undulating plains with low mounds and gently sloping valleys:***
 This physiographic unit is situated mostly in the western and southern part of Tripura. It is characterised by gently sloping valley areas adjacent to undulating upland (tillas). The uplands are moderately eroded and mostly under degraded forest whereas the valleys are gently sloping, slightly eroded, poorly drained and are mostly under cultivation.
 - vii. *Moderately to gently sloping interhill valleys with upland :***
 This physiographic unit occurs on the north-eastern and partly on the southern part of Tripura. It is Characterized by low lying interhill valleys with moderate to gentle

slopes. The uplands are moderately eroded and are under degraded forest whereas the low lying valleys are under cultivation.

viii. *Moderately to gently sloping interhill valleys with uplands of alluvial plains :*

This physiographic unit occurs mostly in the Kailasahar, Kumarghat, Chailengta areas of north Tripura. It extends from north to south of the state and has developed from the alluvial deposit carried by the river Manu. These areas are characterised by gently sloping alluvial plain with slight erosion and are under intensive cultivation.

ix. *Flood plains:*

Extensive areas in the south western, southern and northern part of Tripura are covered by the flood plains of the Khowai, Buriganga, Gumati and Muhari rivers. These areas are gently sloping, very slightly to slightly eroded with high ground water table. These areas have aquic moisture regime and are susceptible to seasonal flooding. These are intensively cultivated. Pisciculture has a scope in these areas.

x. *Rolling Uplands:*

Rolling uplands are common in some pockets of the west and north western part of Tripura. It is characterised by hillocks with moderate erosion. These areas are mostly under degraded forest and appears mostly in association with the valley areas.

Relief

The terrain in Tripura state consists of parallel hills and ridges running in a north-west to south-east direction and with alternating narrow valleys. The range of hills rises from the plains of Sylhet in Bangladesh at the north and proceeds southwards until they join the hills of the Chittagong hill tracts in Bangladesh. The elevation of hills gradually increases in the east. The eastern range of the Jampui is situated at an elevation of 914 m above msl and the western range of the Baramura Deotamura with its elevation 244 m above msl is the lowest. Betlingsib' in Phuldung sai with a height of 939 m is the highest point of the Jampui hill range.

Drainage

The drainage network of Tripura follows the north-south direction as it is controlled by N-S aligned hill ranges. The Longai, Manu, Dhalai and Khowai rivers flow to the north while Gumati, Muhari, Fenny and Haora rivers flow towards west. The tributaries are generally not suitable for navigation except few portion in particular season. Two tributaries namely Raima and Sarma join near Dumbur and form a water fall. After that it takes the name of Gumati. The river Fenny forms the boundary between India and Bangladesh at the southern part of the state.

The Sarma river, a tributary of Gumati originates from the Atharamura range, the Deo river from the Sakhan range, the Muhuri river from the Deotamura range. The Raima river, a tributary of the Gumati, Dhalai and Khowai originates from Longthorai range while Manu originates from Sakhan range. The Manu is the largest river. Other big rivers are Gumti, Khowai, Deo and Dhalai while Haora and Muhari rivers are smaller.

The drainage patterns are of dentritics, parallel to subparallel and rectangular types.

Geology

The Geology of the state is represented by sedimentary rocks which range in age from Miocene to loosely consolidated sediments of recent age. The rocks are sandstone, siltstone and shale grading into clay. These rock types are repeated as layers one above the other. Depending on their characters and the presence of fossils, these sedimentary rock sequences are divided into Surma group (the oldest), Tipam group and the Dupitila group (the youngest). From the nature of the grains and the texture imprinted on these rocks, it is inferred that originally the sediments were deposited in the sea and later converted into rocks. Quite a larger part of south Tripura district is occupied by the recent fluvial deposits. The sedimentary rocks are deformed and folded.

Distribution and Classification of Soils

The soils of Tripura belong to 5 orders, 7 suborders, 9 greatgroups and 19 subgroups. The 5 orders are inceptisols, entisols, ultisols, alfisols and histosols and occupy 80.6, 8.1, 6.6, 4.5 and 0.2 per cent respectively. Generally inceptisols, ultisols and alfisols are observed in patches in the hills & tilla lands. Entisols are observed in patches in the hills as well as in the interhill basins. Paddy soils are, by and large, grouped into inceptisols with aquic moisture regime and taxonomically better known as aquepts.

The following paragraphs will narrate some of the characteristics of the soils of Tripura under the following heads. The morphometric, physical and chemical properties of the dominant and sub-dominant soils are shown in the Appendix III and IV respectively. The hyperthermic temperature regime and mixed (sometime, kaolinitic) mineralogy are common for all the soils.

- Hill soils
- Soils of flat topped denudation hills
- Soils of low lying residual hill with valley
- Soils of undulating plains with low mounds and narrow valleys
- Soils of interhill valley
- Flood plain soils
- Soils of rolling uplands

Hill Soils

The hill soils of Tripura are, by and large, deep to very deep, well to somewhat excessively drained, loamy, acidic (pH 4.0 to 5.5) and contain high organic carbon. These hills are covered with forest and are non-arable except the 'areas used for jhuming. Most of these soils possess a well developed structural and/or coloured B horizon and on few occasions kandic B horizons. The intensity of jhum cultivation changes depending on the relief and physiography of the hill. Our studies from imageries as well as field observations indicate that the percentage of areas affected by

jhum cultivation is in the order: Low relief structural hills and ridges Medium relief parallel ridges High relief structural hills.

On the basis of the variation in relief and geology, the soils of the hilly terrain are grouped under three subgroups viz.

- a) High relief structural hills (sandstone)
- b) Medium relief parallel ridges (shales and siltstone)
- c) Low relief structural hills and ridges (shales)

a) Soils of high relief structural hills (Sandstone)

Soils of this region are deep to very deep, well to some what excessively drained, loamy skeletal which are developed from sandstone on very steeply sloping high relief structural hills with severe to very severe erosion hazard and moderate stoniness and mostly under dense forest vegetations. Although jhuming is a popular farming practice but the terrain conditions do not permit easy access and hence the percentage area affected by jhuming is comparatively less in this high relief hills. Taxonomically, these soils are classified as Loamy skeletal Typic Dystrochrepts, Fine loamy Umbric Dystrochrepts and Fragmental Lithic Udorthents, Fine loamy Typic Dystrochrepts, Loamy skeletal Typic Hapludalfs, Fine loamy Typic Udorthents and Fine loamy Typic Haplumbrepts.

b. Soils of medium relief parallel ridges (shales and silt stone)

Deep to very deep, well to somewhat excessively drained, fine to coarse loamy soils on moderately sloping medium relief parallel ridges are developed from shales and siltstone with severe to very severe erosion hazard and slight stoniness and mostly under moderately dense forest. The areas affected through jhum cultivation is somewhat higher than that in the high relief structural hills. Taxonomically, these soils are classified as Fine loamy Typic Hapludults, Fine loamy Umbric Dystrochrepts, Fine loamy Typic Dystrochrepts, Coarse loamy Typic Udorthents, Loamy over sandy Typic Dystrochrepts, Fine Typic Dystrochrepts, Coarse loamy over sandy Typic Udorthents and Fine loamy Typic Haplumbrepts.

c) Soils of low relief structural hills and ridges (shales)

Moderately deep to deep, well to somewhat excessively drained, fine to coarse loamy soils on the side slopes of low relief structural hills and ridges are developed from shales with moderate to severe erosion hazard and slight stoniness. Jhuming is a common practice in this tract and sometimes 50-75 per cent. area is affected under jhum cultivation. Taxonomically, these major soils are classified as Fine loamy Typic Dystrochrepts, Coarse loamy Typic Udorthents, Fine loamy Umbric Dystrochrepts, Loamy skeletal Umbric Dystrochrepts, Fine Typic Dystrochrepts,. Fine Umbric Dystrochrepts and Fine loamy Typic Haplumbrepts. The soils identified as inclusions are Fine loamy Typic Hapludults, Fine loamy Typic Paleudults and Fine loamy Umbric Dystrochrepts.

Soils of flat topped denudational hills

Very deep, well drained and fine loamy soils on moderate to gently sloping flat topped

denudation hills are developed on sandstones, with moderate erosion hazard and are under moderately dense forest. Many such soils in the southern part of the state are used for rubber cultivation. Taxonomically, the major soils are grouped under Fine loamy Typic Kandiodults, Fine loamy Typic Dystrochrepts, Fine loamy Typic Kandiodalfs and Fine loamy Aquic Dystrochrepts. The soils identified as inclusions are Fine loamy Umbric Dystrochrepts and Fine Typic Dystrochrepts.

Soils of lowlying residual hills with valleys

Very deep, well drained, fine to coarse loamy soils on low lying residual hills are developed on sandstones with moderate erosion hazard under thick forest vegetations of teak and under plantations of jackfruit and cashewnuts. The major soils are grouped under Fine loamy to Coarse loamy Typic Dystrochrepts and Fine loamy Typic Hapludalfs. The soils identified as inclusions are clay skeletal Typic Dystrochrepts.

Very deep, imperfectly drained, coarse loamy soils on gently sloping interhill basin poor to moderate cultivation of paddy. These are susceptible to severe seasonal floods. The important soils are Coarse loamy Aquic Udorthents and Fine loamy Aquic Dystrochrepts.

Soils of undulating plains with low mounds and narrow valleys

Deep to very deep, well drained, fine loamy soils are developed on the moderate to gently sloping undulating plains commonly known as tilla, with moderate erosion hazard and mostly under degraded forest and poor to moderate cultivation in some patches. These soils are reddish brown to dark brown in colour and sandy loam to sandy clay loam and clay loam in texture and/or coloured B horizon with Ochric or Umbric epipedon and low base status and qualify for Dystrochrepts. Taxonomically, these soils are classified as Fine to Coarse loamy Typic Dystrochrepts and Fine Loamy Umbric Dystrochrepts etc. Besides, very low base status and cation exchange capacities in some soils help identifying Kandic B horizons grouping them into Fine Typic Kandiodults. Due to low ground water level in these tillas, a severe moisture stress is common in most part of the year which affects normal cultivation in this area. The soils in the interhill basins are very deep, imperfectly to poorly drained and possess an aquic moisture regime. These are grouped as Fine loamy Typic Epiaquepts, Fine loamy Aquic Udorthents and Fine silty over sandy Aquic Dystrochrepts. The soils identified as inclusions are fine loamy Oxyaquic Dystrochrepts, Fine to Coarse loamy Typic Dystrochrepts.

Soils of interhill valleys

These soils are generally deep to very deep, imperfectly to moderately well drained, fine to coarse loamy and are developed on gently to moderately sloping undulating plains with low mounds and on the gently to very gently sloping interhill valleys, commonly known as lungas, with moderate to slight erosion hazard and mostly under cultivation. The soils are acidic (pH 4.5 to 5.8) and the colour varies from grey to dark brown to olive brown. Gleying of the soils with dark colour mottles in subsurface layers is common. The degree of saturation in some of the layers of the control section as evidenced by redoximorphic features and the gleying indicate an aquic moisture regime and/or episaturation. Again the presence of well developed textural and/or coloured B horizons indicate that these soils should be grouped into the inceptisols. Taxonomically, these soils are classified as Fine silty Typic Epiaquepts, Fine loamy Aquic

Dystrochrepts, Coarse loamy Aquic Udorthents and Coarse loamy Aerice Fluvaquents. Part of these interhill valleys have an upland surface away from the main stream or river channel. Soils on these uplands do not possess aquic moisture regimes and are very deep, well drained, fine loamy with moderate erosion hazards. Taxonomically these are grouped into Fine to Fine loamy Typic Dystrochrepts and Fine loamy Typic Haplumbrepts.

Flood plain soils

The flood plain soils are generally acidic in nature (pH 4.8 - 5.1) and the colour varies from grey to light brown to olive brown and are very deep, imperfectly to very poorly drained coarse/fine loamy to clayey in texture, developed on very gently sloping alluvial/flood plain with moderate to severe flooding hazard and slight erosion, Presence of well developed textural. and/or coloured B horizon qualifies such soils for Inceptisols.

The soil control section remains saturated with moisture due to the physiographic position as well as the proximity of the rivers or other drainage channels. A reducing regime virtually free of dissolved oxygen is developed with characteristic redoximorphic features viz. gleying and mottles. Since these soils are saturated with water in one or more layers within 200 cm (in other words one or more layers remain unsaturated within that depth) this is termed as episaturation.

Again the presence of redox depletions in one or more horizons within 60 cm of the mineral soil surface with a chroma of 2 or less and also the presence of aquic conditions for some time in most years qualify such soils for Aquic Dystrochrepts.

Taxonomically these soils are classified as Fine Aerice Epiaquepts, Fine loamy Typic Epiaquepts, Fine loamy Aquic Dystrochrepts, Fine Typic Epiaquepts, Coarse loamy over sandy Fluvaquentic Dystrochrepts, Fine loamy over sandy Typic Epiaquepts. A particular location of these flood plains in the north of the state possess a special kind of soils which are very fluffy, with high fibres and organic carbon. These soils are 'grouped into Ferrihumic Dysic Hydric Medifibrists.

Soils of rolling uplands

The soils of the rolling uplands are very deep, well drained, fine loamy, acidic and the colour varies from reddish brown to dark reddish brown, and are developed on moderately to gently sloping disintegrated hillocks with moderate to severe erosion hazard. Due to lack of proper soil conservation measures, the soils are totally exposed and are susceptible to erosion. The presence of B horizon in these soils qualifies them for inceptisols. Taxonomically, these soils are classified as Fine loamy Typic Haplumbrepts, Fine loamy Pachic Haplumbrepts and Fine loamy Typic Dystrochrepts.

The progressive fragmentation of land holdings, degrading natural resource base and emerging concerns of climate change are escalating pressure on land and water. Land and water resources being finite, increased agricultural production and a diversified food basket to meet the requirement of the increasing population with higher per capita income, has to emanate from the same limited net sown area by increasing productivity with an optimal use of available water and land resources. Natural resources viz. arable land, water, soil, biodiversity (plant, animal and microbial genetic resources) are rapidly shrinking due to demographic and socio-economic pressures, monsoon disturbances, increasing frequencies of

floods and droughts. Overuse of marginal lands, imbalanced fertigation, deteriorating soil health, diversion of agricultural land to nonagricultural uses, depleting aquifers & irrigation sources, salinization of fertile lands and water-logging are pressing challenges requiring urgent attention. For making agriculture sustainable to meet the country's food requirement, a prudent land use policy, water availability and soil health have to be maintained at levels that are conducive to pursue agricultural activities with higher level of productivity. 1.14 Land degradation is major threat to our food and environmental security. As per estimates, out of total geographical area of 328.73 mha, about 120.40 mha is affected by various kind of land degradation resulting in annual soil loss of about 5.3 billion tonnes through erosion. This includes water and wind erosion (94.87 mha), water logging (0.91 mha), soil alkalinity/sodicity (3.71 mha), soil acidity (17.93 mha), soil salinity (2.73 mha) and mining and industrial waste (0.26 mha). Besides, water and wind erosions are wide spread across the country. As much as 5.3 billion tonnes of soil gets eroded every year. Of the soil so eroded, 29% is permanently lost to sea, 10% is deposited in reservoirs reducing their storage capacity and rest 61% gets shifted from one place to another. Significant increase in use of chemical fertilizers particularly in the north-western part of the country coupled with imbalanced nutrient application, non-judicious use of pesticides, intensive cropping system, and decline in soil biodiversity and depletion of organic matter in soil are areas of concern requiring urgent attention.

Fertilizer consumption in India is grossly imbalanced since the beginning. It is tilted more towards N followed by P. Further the decontrol of the phosphatic and potassic fertilizers resulted in more than doubling the prices of phosphatic and potassic fertilizers. Thus, the already unbalanced consumption ratio of 6:2.4:1 (N:P₂O₅:K₂O) has widened to 7:2.7:1 in as against favourable ratio of 4:2:1 implying there from that farmers started adding more nitrogen and proportionately less phosphatic and potassic fertilizers. Even today, the situation is grim as far as fertilizer application by farmers is concerned. In many areas the imbalanced fertilization is the root cause of poor crop yields and poor soil fertility status. Accordingly, cropping systems like rice-wheat, maize-wheat, rice-pulse, potato-wheat and sugarcane demands immediate attention to correct the imbalances in nutrient consumptions to prevent further deterioration of soil quality and to break the yield barriers. There is a wide variation in the consumption ratios of fertilizers from region to region but in the absence of information on the extent of cultivated area and details of cropping patterns in each agro-ecological region, it is difficult to estimate the crop removal of each region. Chemical fertilizers are the immediate source of nutrients in soils. Consumption of nitrogenous (N), phosphatic (P) potassic (K) fertilizers has increased from 1.1 million tones in 1966-67, the year preceding the green revolution to 27.7 million tonnes in 2011-12. The all-India average consumption of fertilizers has increased from 105.5 kg per ha in 2005-06 to 144 kg per ha in 2011-12. However, our consumption is much lower than that in Bangladesh (118), Pakistan (205) and China (396). The world average consumption of fertilizer was 107 kg per hectare in 2009. Further, very high variability has been observed in fertilizer consumption across the states and crops. While per hectare consumption is 243.56 kg in Punjab and 266.11 kg in Andhra Pradesh, it is comparatively low in MP (88.36 kg/ha), Orissa (56.52 kg/ha), Rajasthan (62.35 kg/ha) and Himachal Pradesh (55.18 kg/ha) and below 5 kg/ha in some of the North Eastern. The average fertilizer use in north eastern region including Tripura (55 kg/ha) is quite low as compared to All India fertilizer consumption (144 kg/ha) thus indicating one of the important reasons for low crop productivity.

Further, lack of awareness about soil testing and intensive agriculture is leading to widespread deficiency of micronutrients such as zinc, iron, manganese and boron. Similarly

imbalanced NPK application, rising multi nutrient deficiency and lack of application of organic manure are leading to reduction in carbon content in the soil. Soil Organic Carbon (SOC) is central to soil health as it influence soil structure, water retention, microbial activities, soil aeration and nutrient retention. Depletion in soil organic carbon is leading to poor fertilizer use efficiency (FUE) of the soil which on average is estimated to be 33% for N; 15% for P; 20% for K and micronutrients as against 50% for N; 30% for P and 50% for K with the best management practices. Intensive agriculture, while increasing food production, has at the same time caused second generation problems in respect of nutrient imbalance including greater mining of soil nutrients, depletion of soil fertility, emerging deficiencies of secondary and micronutrients, decline of the water table and quality of water, decreasing organic carbon content, and overall deterioration in soil health. Government is promoting Integrated Nutrient Management (INM), advocating soil test based balanced and judicious use of chemical fertilizers in conjunction with organic sources of nutrients for improving soil fertility. Introduction of customized fertilizers on the basis of soil testing and the agronomic multi-locational trials which are crop specific and area specific are recommended. Promotion of INM which includes soil test based balanced and judicious use of chemical fertilisers in conjunction with bio-fertilisers, and organic manures like FYM, compost, vermi-compost, green manure, Fruit and Vegetable Waste Compost, MSW compost etc.; use of complex fertilisers (NPK) and customized fertilisers which are considered to be agronomically better and more balanced fertilisers in place of straight fertilizers; use of fertilisers fortified with micro-nutrients; use of Bio-fertilisers - phosphate solubilizing bacteria; Azospirillum, Azotobacter, and Rhizobium; potash mobilizing biofertilizers which can supplement upto 20-25% of chemical fertilizers (NPK). In this context seed supplying agencies may consider provision of bio-fertilisers and seed treating material along with seed packets.

So, the productivity of crops, fodder and fish is dependent upon the capacity of soils to supply the nutrients which can be evaluated through soil testing and soil health card is the outcome of soil testing. The objectives of the project or the preparation of soil health card is as follows.

- To estimate soil available nutrients, microbial assay and soil physical parameters in soils collected from the different topographical situations including water bodies.
- To make fertilizer recommendation for judicious application of fertilizers/ manures/ biofertilizers in food crops, vegetables, fruit trees, fodders, forest tree species and fish

2. Soil Health Card – Outlines and Achievement

There are farmers club constituted by NABARD in Tripura and the project being launched in 2007 has a target of preparation of 2000 cards from the members of active /vibrant club operating in districts of Tripura..

Soil samples (0-15 cm depth) were collected from the area under Farmers' Club. .Soil health card as prepared contains the information regarding the area/land owned by farmers, soil test results and fertilizer recommendation for the particular crops grown at the time of soil collection. There were 7 farmers' club in West Tripura with 157 soil samples, 2 farmers' club with 30 samples, 17 farmers'club in district Sefahijalawa with 387 soil samples, 25 farmers'club in Gomati with 749 soil samples and 20 farmers'club with 702 soil samples.

List of the Farmers' club in Districts

Sl.No	Farmer's Club	Block	No. of Sample	Latitude	Longitude	Altitude (m)
District - West Tripura						
1	Ramkrishna	Agartala Municipal Area	20	23°49'39.0" N	91°16'11.2" E	17
2	Nabajagaran	Dukli	20	-	-	-
3	Moheshkhola	Dukli	35	23°41'27.8" N	91°16'23.5" E	23
4	Sukanta	Mohanpur	30	-	-	-
5	Hwkbar Badal	Mohanpur	10	-	-	-
6	Vidyasagar	Hezamara	08	-	-	-
6	Dudhpatil	Jirania	15	-	-	-
7	Manna	Jirania	19	-	-	-
District - Khowai						
1	Kamalnagar	Kalyanpur	07	23°54'34.2" N	91°37'10.4" E	29
2	Ghilatali	Kalyanpur	23	23°55'0.50" N	91°38'1.00" E	42
District - Sepahijala						
1	Lembuthal	Bishalgarh	10	23°39'12.7" N	91°14'22.4" E	14
2	Modern	Bishalgarh	23	23°39'22.4" N	91°15'43.2" E	16
3	Green	Boxnagar	16	23°37'38.3" N	91°12'40.0" E	17
4	Krishak Bandhu	Kathalia	20	23°24'23.8" N	91°17'0.50" E	25
5	Uttar Maheshpur	Kathalia	22	23°21'53.0" N	91°19'20.0" E	33
6	Beller Dhepa	Kathalia	12	23°26'38.4" N	91°16'15.3" E	-

				N	E	
7	Gomati	Melaghar	30	23°28'23.2" N	91°16'40.1" E	18
8	Indian	Melaghar	27	23°28'44.6" N	91°16'23.4" E	18
9	Rangamati	Melaghar	30	23°29'39.2" N	91°17'18.0" E	16
10	Najrul	Melaghar	11	23°30'27.0" N	91°18'20.7" E	16
11	Garurband	Melaghar	23	23°28'40.3" N	91°18'51.0" E	22
12	Netaji	Melaghar	14	-	-	-
13	Sonali	Melaghar	29	23°29'33.8" N	91°18'36.2" E	19
14	Urmai	Melaghar	30	23°26'53.1" N	91°16'32.8" E	25
15	Khedabari	Melaghar	30	23°29'33.6" N	91°16'40.0" E	16
16	Adarsha	Melaghar	30	23°28'28.3" N	91°15'18.6" E	17
17	Little	Melaghar	30	23°30'29.5" N	91°18'08.6" E	7
District – Gomati						
1	Arabindra	Kakraban	60	23°26'33.3" N	91°25'00.1" E	30
2	Jamjuri	Kakraban	22	23°30'40.7" N	91°27'10.2" E	32
3	Netaji	Kakraban	35	23°29'37.3" N	91°24'22.5" E	22
4	Indira	kakraban	35	23°29'01.9" N	91°23'20.8" E	26
5	Suravi	Kakraban	09	23°25'11.6"	91°26'31.2"	32

				N	E	
6	Ankur 1	Kakraban	44	23°39'25.0" N	91°15'43.5" E	77
7	Ankur 2	Kakraban	45	-	-	-
8	Dishari	Matabari	30	23°54'17.5" N	91°18'53.2" E	91
9	Sukanta	Matabari	24	23°32'12.6" N	91°28'25.2" E	17
10	Pragatishil	Matabari	27	-	-	-
11	Palli Unnayan	Matabari	31	23°33'23.2" N	91°24'56.7" E	27
12	Gram Bikash	Matabari	31	23°33'44.9" N	91°25'50.4" E	30
13	Sarba	Matabari	09	23°32'44.4" N	91°30'31.5" E	26
14	Progressive	Matabari	06	23°31'32.5" N	91°26'58.8" E	25
15	Pitra	Matabari	16	23°33'18.4" N	91°31'37.7" E	27
16	Aragami	Matabari	15	23°33'53.1" N	91°24'57.8" E	32
17	Gomati	Matabari	46	23°32'29.1" N	91°31'06.8" E	28
18	Sabuj Deep	Matabari	35	23°32'02.2" N	91°27'49.9" E	28
19	Fotamati	Matabari	50	23°32'07.9" N	91°32'34.4" E	36
20	Progressive	Matabari	19	23°31'32.5" N	91°26'58.8" E	25
21	Netaji Subash	Matabari	39	23°27'24.6" N	91°29'36.6" E	49
22	Yaprkata	Amarpur	06	23°29'07.8"	91°43'04.2"	37

				N	E	
23	Sabuj Krishan Unnayan	Amarpur	41	23°33'23.2" N	91°38'09.9" E	42
24	Saiyad	Amarpur	35	-	-	-
25	Birganj	Amarpur	39	23°31'39.8" N	91°40'51.0" E	39
District – South Tripura						
1	Progressive	Santir Bazar	30	23°22'04.4" N	91°32'28.9" E	45
2	Arabindra	Santir Bazar	35	-	-	-
3	Chittaranjan	Bagafa	37	23°22'19.3" N	91°32'02.6" E	36
4	New Progressive	Bagafa	35	23°21'26.9" N	91°31'39.3" E	29
5	United	Bagafa	35	23°21'15.5" N	91°31'56.5" E	45
6	Cifaiha	Bagafa	36	23°19'27.6" N	91°33'11.5" E	39
7	Gandhiji	Bagafa	22	23°16'18.6" N	91°34'54.5" E	20
8	Mother Teresa	Bagafa	35	23°13'44.7" N	91°33'33.9" E	36
9	Pilak	Bagafa	44	-	-	-
10	Acharjee Jagadish Chandra Bose	Bagafa	39	23°14'49.4" N	91°33'23.2" E	27
11	Anirban	Hrishyamukh	34	23°11'47.8" N	91°30'21.5" E	256
12	MAA	Hrishamukh	36	23°10'55.3" N	91°30'52.5" E	239
13	Green	Hrishamukh	42	23°11'57.1" N	91°30'32.6" E	118

14	Vivekananda	Rajnagar	39	23°18'01.9" N	91°24'30.5" E	27
15	Kishan	Rajnagar	36	23°17'56.2" N	91°22'58.6" E	51
16	Krishak Bandhu	Rajnagar	40	23°19'41.8" N	91°24'33.3" E	31
17	Trishna	Rajnagar	40	-	-	-
18	Maiti	Satchand	30	-	-	-
19	Guachand	Satchad	31	-	-	-
20	Sanghati	Satchand	26	-	-	-

3. Soil test results in Districts

Soil pH, Organic carbon, Available nitrogen, Potassium, Calcium, sulphur and micronutrients (available Fe, Mn, Cu and Zn) were estimated in soil samples collected from 7 farmers' club in West Tripura. The results with range, mean, Standard division and coefficient of variation were presented below.

District- West Tripura

I. Ramkrishna (Agartala Municipal Area)

Parameter	Range	Mean	S.D	C.V(%)
pH	3.63-5.04	4.43	0.34	7.67
Organic carbon (%)	0.57-1.12	0.81	0.15	18.51
Nitrogen (kg/ha)	21.45-396.25	262.67	86.76	33.03
Phosphorus(kg/ha)	4.31-25.93	11.04	6.30	57.06
Potassium(kg/ha)	68.25-197.12	139.10	32.91	23.65
Calcium{c mole (p+)/kg}	1.56-4.88	2.49	0.97	38.95
Sulphur(kg/ha)	8.21-347.25	123.59	94.76	76.67
Iron(mg/kg)	32.03-35.98	33.62	1.18	3.5
Manganese(mg/kg)	13.35-47.11	24.32	13.07	53.74
Copper(mg/kg)	1.46-4.90	2.66	0.99	37.21
Zinc(mg/kg)	1.32-5.25	3.86	0.92	23.83

S.D-Standard Division, C.V-Coefficient of Variation

II. Nabajagaran(Dukli)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.22-5.58	5.18	0.35	6
Organic carbon	0.29-1.44	0.90	0.28	31
Nitrogen	112.5-362.50	261.87	58.38	22
Phosphorus	2.32-75.00	13.91	20.69	14.80
Potassium	50-162.50	95.99	29.32	30.54
Calcium	0.32-1.87	1.15	0.36	31

Sulphur	6.87-206.25	68.41	59.69	87
Iron	10-18	13.50	2.00	14
Manganese	2.47-19	7.94	4.14	52
Copper	0.47-3.10	1.39	0.69	49
Zinc	0.90-4.02	2.19	0.98	44

III. Moheshkhola (Dukli)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.85-6.71	5.60	0.53	9.54
Organic carbon	0.41-1.39	0.95	0.58	61.05
Nitrogen	0.68-391	234.46	81.39	34.71
Phosphorus	0.62-13.31	5.57	3.89	69.83
Potassium	3.87-31.56	9.92	5.65	56.95
Calcium	0.06-0.29	0.13	0.01	9.40
Sulphur	8.61-478.68	106.32	3.42	3.21
Iron	18.52-24.95	22.95	20.10	87.58
Manganese	3.87-16.39	11.23	5.99	53.33
Copper	0-2.42	1.06	1.29	121.69
Zinc	0.11-4.13	1.91	1.59	83.24

IV. Sukanta (Mohanpur)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.23-6.18	5.10	0.44	8.62
Organic carbon	0.49-1.46	1.11	0.26	23
Nitrogen	118.43-409.00	276.86	72.04	26.02
Phosphorus	1.93-73.75	13.37	17.04	127.44
Potassium	9.61-176.62	99.91	35.78	35.81
Calcium	0.42-1.76	1.08	0.33	30.55
Sulphur	7.18-125.37	21.69	24.43	112.63
Iron	19.07-45.12	42.23	8.09	19.15
Manganese	1.34-44.36	14.41	9.02	62.59
Copper	0.84-4.36	2.15	1.09	50.69
Zinc	0.14-4.42	2.63	0.92	34.98

V. Hwkbar Badal (Mohanpur)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.53-6.66	5.09	0.71	13
Organic carbon	0.27-1.78	0.67	0.43	64
Nitrogen	107.00-322.87	207.02	65.68	31
Phosphorus	2.18-21.00	9.16	6.56	71
Potassium	38.31-138.62	87	28.58	32
Calcium	1.16-2.48	1.61	0.45	27
Sulphur	9.43-109.50	27.71	30	10.80
Iron	21.10-30.70	25.74	2.49	9.67
Manganese	8.80-20.79	16.01	4.47	27.92
Copper	0.49-1.92	1.08	0.58	53.70
Zinc	0.86-4.67	2.22	1.43	64.41

vi. Vidyasagar (Hezamara)

Parameter	Range	Mean	S.D	C.V(%)
-----------	-------	------	-----	--------

pH	4.44-5.59	4.96	0.33	6.65
Organic carbon	0.51-1.43	3.56	0.35	9.58
Nitrogen	126.81-310.62	226.63	61.88	27.30
Phosphorus	2-8.68	4.53	1.87	41.28
Potassium	94.81-165.50	126.23	22.45	17.78
Calcium	2.15-3.62	2.76	0.41	14.85
Sulphur	18.87-128.12	58.85	9.11	15.48
Iron	10.54-45.65	27.09	9.06	33.44
Manganese	4.57-21.27	15.01	4.64	17.12
Copper	0.48-2.90	1.72	0.74	43.02
Zinc	1.14-2.56	1.77	0.60	33.89

vii. Dudhpatil (Jirania)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.42-5.28	4.48	0.23	5.13
Organic carbon	0.35-0.76	0.49	0.11	22.44
Nitrogen	89.50-310.75	205.90	72.93	35.42
Phosphorus	4.5-21.06	7.99	3.97	49.68
Potassium	70.93-140.62	106.77	22.92	21.46
Calcium	1.28-2.89	1.69	0.47	27.81
Sulphur	11.31-92.50	41.76	24.17	57.87
Iron	14.14-64.86	33.01	14.22	43.07
Manganese	9.84-21.41	16.30	4.48	27.48
Copper	0.27-4.56	2.14	1.15	53.73
Zinc	0.66-2.10	1.54	0.32	20.77

viii. Manna (Jirania)

Parameter	Range	Mean	S.D	C.V(%)
pH	3.83-5.31	4.64	0.41	8.83
Organic carbon	0.10-0.88	0.47	0.23	48.93
Nitrogen	80.75-295.18	163.54	66.31	40.54
Phosphorus	1.93-39.68	15.11	9.06	59.96
Potassium	14.37-206.06	101.23	45.24	44.69
Calcium	1.31-2.86	1.88	0.59	31.38
Sulphur	18.87-185.06	52.44	42.56	81.15
Iron	11.56-30.94	30.50	4.07	13.34
Manganese	2.28-20.05	15.22	5.42	35.61
Copper	0.35-2.28	0.93	0.75	80.64
Zinc	0.70-3.85	2.23	0.83	37.21

Soil pH, Organic carbon, Available nitrogen, Potassium, Calcium, sulphur and micronutrients (available Fe, Mn, Cu and Zn) were estimated in soil samples collected from 2 farmers' club in Khowai District. The results with range, mean, Standard division and coefficient of variation were presented below

District- Khowai

i. Kamalnagar (Kalyanpur)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.52-5.54	4.90	0.34	6.93

Organic carbon	0.16-0.75	0.52	0.37	71.15
Nitrogen	88.12-284	175.68	74.73	42.53
Phosphorus	7.93-54.87	19.54	16.71	85.51
Potassium	65.75-145.18	111.13	24.40	21.95
Calcium	1.31-3.11	2.37	0.981	34.17
Sulphur	9.43-118.75	32.21	41.76	129.64
Iron	17.74-30.50	25.76	3.86	14.98
Manganese	17.02-21.53	19.58	1.56	7.96
Copper	0.66-2.94	1.33	0.84	63.15
Zinc	1.03-2.94	2.01	0.87	43.28

ii. Ghilatali (Kalyanpur)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.52-5.54	4.90	0.34	6.93
Organic carbon	0.22-1.20	0.53	0.37	69.81
Nitrogen	88.12-284.50	175.68	806.96	459.33
Phosphorus	1.91-54.87	17.02	18	105.75
Potassium	65.75-123.87	111.12	24.40	21.95
Calcium	1.31-3.11	2.37	0.81	34.17
Sulphur	9.43-118.75	32.01	56.01	174.97
Iron	17.74-30.50	25.76	3.86	14.98
Manganese	17.02-26.92	19.58	2.88	14.70
Copper	0.66-2.94	1.33	0.84	63.15
Zinc	1.03-2.94	2.01	0.87	43.28

Soil pH, Organic carbon, Available nitrogen, Potassium, Calcium, sulphur and micronutrients (available Fe, Mn, Cu and Zn) were estimated in soil samples collected from 17 farmers' club in Sepahijala district. The results with range, mean, Standard deviation and coefficient of variation were presented below

District- Sepahijala

i. Lembuthal (Bishalgarh)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.29-6.47	5.07	0.77	15.18
Organic carbon	0.11-1.03	0.62	0.28	45.16
Nitrogen	98.87-665.06	272.13	197.73	72.66
Phosphorus	3.12-9.12	6.28	1.77	28.18
Potassium	9.81-145.56	95.14	42.71	44.89
Calcium	0.54-4.60	2.21	1.25	56.56
Sulphur	22.43-381.814	78.57	113.51	144.46
Iron	23.83-49.37	31.70	3.65	11.51
Manganese	9.44-18.50	17.11	2.77	16.18
Copper	0.53-2.96	1.58	0.88	55.69
Zinc	0.45-4.17	1.73	1.00	57.80

ii. Modern (Bishalgarh)

Parameter	Range	Mean	S.D	C.V(%)
-----------	-------	------	-----	--------

pH	4.17-5.17	4.62	0.29	6
Organic carbon	0.28-1.65	0.64	0.44	60
Nitrogen	31.52-898.87	210.55	191.63	91
Phosphorus	1.13-15.56	7.72	2.88	37
Potassium	21.23-204.87	109.78	50.01	45
Calcium	0.64-3.58	2.12	0.97	45
Sulphur	4.12-483	156.89	141.25	90
Iron	27-36.48	32.37	2.73	8
Manganese	14.04-21.84	17.98	1.61	8
Copper	0.24-3.47	1.55	0.83	53
Zinc	0.94-4.47	1.14	0.99	86

iii. Green (Boxnagar)

Parameter	Range	Mean	S.D	C.V(%)
pH	3.91-5.68	4.62	0.56	12.12
Organic carbon	0.50-0.99	0.77	0.12	15.58
Nitrogen	55.94-553.18	249.40	114.86	46.05
Phosphorus	3.37-15.18	8.89	3.87	43.53
Potassium	72.75-175.75	101.45	37.39	36.85
Calcium	0.66-5.04	3.67	1.22	33.24
Sulphur	11.18-357	79.45	109.81	138.21
Iron	28.95-36.71	32.74	2.16	6.59
Manganese	12.97-18.44	15.90	1.75	11.00
Copper	2.04-4.11	2.67	0.66	24.71
Zinc	1.10-4.06	2.16	0.80	37.03

iv. Krishak Bandhu (Kathalia)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.63-6.49	5.63	0.46	8.17
Organic carbon	0.31-1.00	0.48	0.14	29.16
Nitrogen	114.25-615.32	213.28	120.43	56.46
Phosphorus	2.81-9.87	6.27	2.01	32.05
Potassium	7.01-209.31	114.34	52.48	45.89
Calcium	0.61-1.92	1.16	0.56	48.27
Sulphur	23.15-368.75	86.99	80.05	92.02
Iron	22.13-28.83	25.80	1.57	60.85
Manganese	4.01-13.52	11.43	2.59	22.65
Copper	0.32-1.38	1.03	0.61	59.22
Zinc	0.64-4.42	1.94	0.99	51.03

v. Uttar Maheshpur (Kathalia)

Parameter	Range	Mean	S.D	C.V(%)
pH	3.12-6.44	5.29	0.74	13.98
Organic carbon	0.33-2.75	0.52	0.09	17.30
Nitrogen	88.93-353.62	157.87	88.77	56.22
Phosphorus	0.23-17.06	4.86	3.89	80.04
Potassium	72.25-205.12	135.94	44.55	32.77
Calcium	0.54-6.44	2.94	2.37	80.61

Sulphur	44.62-243.87	90.83	44.62	49.12
Iron	19.36-29.21	24.24	2.26	9.32
Manganese	5.43-77	13.20	14.85	112.5
Copper	0.36-2.19	0.95	0.55	57.89
Zinc	0.71-3.02	1.57	0.57	36.30

vi. Beller Dhepa (Kathalia)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.53-5.83	5.27	0.39	7.40
Organic carbon	0.13-0.56	0.40	0.13	32.50
Nitrogen	122-366.68	197.28	85.69	43.43
Phosphorus	2.68-30.12	96.95	7.94	8.18
Potassium	70.12-275.06	77.73	64.40	82.85
Calcium	0.60-2.32	0.70	0.72	10.28
Sulphur	39.25-145	50.96	30.10	59.06
Iron	18.80-29.43	23.06	3.20	13.87
Manganese	6.89-13.49	10.83	2.60	24.00
Copper	0.52-1.83	0.93	0.39	41.93
Zinc	0.69-1.89	1.21	0.42	34.71

vii. Gomati (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.12-6.15	5.50	0.48	8.72
Organic carbon	0.71-1.32	0.97	0.21	21.64
Nitrogen	115.75-295.18	198.89	53.25	26.77
Phosphorus	2.18-15.56	5.91	3.18	53.80
Potassium	67.62-200.68	103.54	38.90	37.57
Calcium	1.40-6.07	2.97	1.30	43.77
Sulphur	19.50-195	109.76	48.40	44.09
Iron	21.16-32.56	28.87	2.11	7.30
Manganese	4.13-18.06	11.63	3.75	32.24
Copper	0.64-3.50	1.68	0.75	44.64
Zinc	0.77-5.05	1.96	0.62	31.63

viii. Indian (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.6-6.4	5.03	0.40	7
Organic carbon	0.14-0.85	0.49	0.18	36
Nitrogen	91.12-503.75	231.70	118.96	51
Phosphorus	1.62-9.06	4.73	2.03	42
Potassium	2.75-13.18	6.56	2.75	41
Calcium	0.05-0.88	0.22	0.14	63
Sulphur	71.56-607.37	309.2	126.04	40
Iron	25.88-42.95	30.56	2.77	9
Manganese	8.34-9.41	14.06	3.08	21
Copper	0.7-2.52	1.75	0.64	34
Zinc	0.83-3.05	1.94	0.51	26

ix. Rangamati (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	5.20-6.71	4.96	0.41	8.26
Organic carbon	0.70-1.44	0.98	0.17	17.34
Nitrogen	34.81-584.31	232.71	95.03	40.83
Phosphorus	2.25-37.06	12.71	6.80	53.50
Potassium	5.12-148.43	99.49	39.89	40.09
Calcium	0.96-6.08	3.27	1.06	32.41
Sulphur	8.71-201.68	90.01	51.60	57.32
Iron	25.31-34.16	30.89	1.86	6.02
Manganese	8.50-21.61	13.32	2.63	19.74
Copper	0.30-4.29	3.26	0.77	23.61
Zinc	1.51-4.03	2.57	0.55	21.40

x. Najrul (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.80-6.35	5.29	0.49	9.26
Organic carbon	0.16-0.58	0.34	0.14	4.11
Nitrogen	78.25-472.31	152.31	117.63	77.23
Phosphorus	3.75-8.12	5.45	1.36	24.95
24.95Potassium	7.93-39.81	18.50	8.97	48.48
Calcium	0.17-0.29	0.23	0.04	17.39
Sulphur	62.81-375.18	165.77	118.51	71.49
Iron	25.95-190	45.30	22.20	49.00
Manganese	10.80-103.56	21.93	27.18	123.93
Copper	0.91-9.37	2.08	2.43	116.82
Zinc	1.73-12.43	3.66	3.05	83.33

xi. Garurband (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.97-6.61	2.39	0.43	17.99
Organic carbon	0.27-1.47	0.94	0.34	36.17
Nitrogen	87.81-901.37	302.43	206.19	68.17
Phosphorus	1.06-86.87	10.69	17.38	162.58
Potassium	4.56-45.12	14.50	9.31	64.20
Calcium	0.1-0.57	0.27	0.13	48.14
Sulphur	33.56-496.75	739.12	137.68	18.62
Iron	20.06-38.80	29.80	4.31	14.46
Manganese	8.42-18.06	14.50	2.91	20.06
Copper	0.86-3.00	1.70	0.58	34.11
Zinc	0.98-2.42	1.58	0.47	29.74

xii. Netaji (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	5.01-6.89	5.59	0.49	8.76
Organic carbon	0.14-1.14	0.57	0.30	52.63
Nitrogen	80.12-1025.68	239.97	240.83	100.35
Phosphorus	2.06-12.50	4.68	3.05	65.17
Potassium	0.07-55.12	12.85	13.50	105.05

Calcium	0.07-0.31	0.18	0.09	50
Sulphur	41.93-225.68	85.56	57.53	67.23
Iron	32.68-36.77	34.82	3.52	10.10
Manganese	4.80-16.83	13.52	0.73	5.39
Copper	1.24-4.54	2.93	0.89	30.37
Zinc	1.83-4.26	2.94	0.79	26.87

xiii. Sonali (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.29-6.93	5.07	0.56	11.04
Organic carbon	0.30-0.68	0.42	0.12	28.57
Nitrogen	47.56-354.50	169.42	88.69	52.34
Phosphorus	1.31-9.31	3.78	1.82	1.07
Potassium	3.68-25.06	9.08	4.88	53.74
Calcium	0.19-0.76	0.37	0.13	35.13
Sulphur	16.12-421.81	129.27	108.18	83.68
Iron	18.72-33.66	28.45	3.51	12.33
Manganese	2.21-27.01	14.91	4.46	29.91
Copper	0.42-2.41	1.42	0.50	35.21
Zinc	1.40-4.96	2.17	0.81	37.32

xiv. Urmai (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.73-6.94	5.44	0.58	10.66
Organic carbon	0.21-1.01	0.49	0.19	38.77
Nitrogen	8.01-282.93	139.41	65.19	46.76
Phosphorus	1.43-8.06	4.37	1.57	35.92
Potassium	4.31-60.62	16.82	14.20	84.42
Calcium	0.07-1.28	0.23	0.21	91.30
Sulphur	99.75-468.56	301.68	99.94	33.12
Iron	15.62-59.48	30.41	4.02	13.21
Manganese	3.16-19.26	13.23	4.11	31.06
Copper	0.23-1.68	0.98	0.48	48.97
Zinc	1.21-4.63	3.02	0.90	29.80

xv. Khedabari (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.81-6.90	5.94	0.54	9.09
Organic carbon	0.56-1.42	0.93	0.24	25.80
Nitrogen	113.93-547	215.40	85.84	39.85
Phosphorus	1.93-14.62	6.28	2.97	47.29
Potassium	5.12-30.62	12.83	6.07	47.31
Calcium	0.11-1.03	0.26	0.18	69.23
Sulphur	8.37-184.62	76.55	41.34	54.00
Iron	21.81-34.01	30.08	2.87	9.54
Manganese	9.40-29.42	14.93	3.92	26.25
Copper	0.20-2.81	1.34	0.65	48.50
Zinc	0.11-4.09	2.00	1.02	51.00

xvi. Adarsha (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.81-6.90	5.93	0.56	9.44
Organic carbon	0.46-1.42	0.94	0.24	25.53
Nitrogen	108.50-547	219.24	94.36	43.03
Phosphorus	2.18-14.62	6.54	2.97	45.41
Potassium	5.12-30.62	12.96	6.07	46.83
Calcium	0.11-0.41	0.20	0.07	35
Sulphur	6.21-184.62	84.78	41.83	49.33
Iron	21.18-34.01	31.62	2.97	9.39
Manganese	0.91-17.88	13.40	2.87	21.41
Copper	0.20-2.81	1.32	0.67	50.75
Zinc	0.11-4.09	2.08	1.01	48.55

xvii. Little (Melaghar)

Parameter	Range	Mean	S.D	C.V(%)
pH	4.45-6.10	5.34	0.48	8.98
Organic carbon	0.75-1.14	0.91	0.12	13.18
Nitrogen	115.75-302	184.13	42.96	23.33
Phosphorus	2.26-20.31	9.93	5.31	53.47
Potassium	3.81-160.68	87.91	35.39	40.25
Calcium	1.61-5.64	3.47	0.93	26.80
Sulphur	49.43-190	94.38	46.65	49.42
Iron	26.30-33.47	31.74	1.69	5.32
Manganese	10.32-16.92	15.45	1.47	9.51
Copper	1.40-3.80	2.26	0.76	33.62
Zinc	0.55-4.12	2.22	0.87	39.18

Soil pH, Organic carbon, Available nitrogen, Potassium, Calcium, sulphur and micronutrients (available Fe, Mn, Cu and Zn) were estimated in soil samples collected from 20 farmers' club in Gomati district. The results with range, mean, Standard deviation and coefficient of variation were presented below

District- Gomati**i. Arabindra (Kakraban)**

Parameter	Range	Mean	S.D	C.V (%)
pH	4.91-6.53	5.67	0.38	6.70
Organic carbon (%)	0.38-1.40	0.94	0.26	27.65
Nitrogen (kg/ha)	88-397.68	232.30	89.47	38.51
Phosphorus (kg/ha)	1.53-120.37	8.39	17.07	203.45
Potassium (kg/ha)	4.10-22.50	9.96	4.63	46.48
Calcium {c mole (p ⁺)/kg}	0.61-2.66	1.70	0.61	35.88
Sulphur (kg/ha)	7.01-294.63	90.92	1.65	1.81
Iron (mg/kg)	22.14-30.59	28.27	2.80	9.90
Manganese (mg/kg)	1.78-13.78	6.80	2.88	42.35
Copper (mg/kg)	0.33-2.06	0.91	0.46	50.54
Zinc (mg/kg)	1-3.08	1.68	0.67	39.88

S.D-Standard Division, C.V-Coefficient of Variation.

ii. Jamjuri (Kakraban)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.13-6.67	5.13	0.70	13.67
Organic carbon	0.33-0.60	0.47	0.09	19.14
Nitrogen	80-220.50	134.96	47.45	35.15
Phosphorus	5.0-12.43	6.90	2.36	34.20
Potassium	6.62-58.93	14.46	11.57	80.01
Calcium	2.67-4.88	3.70	0.70	18.91
Sulphur	24.56-135.93	82.61	32.41	39.23
Iron	18.02-25.20	22.45	2.02	8.99
Manganese	6.07-14.29	12.60	1.87	14.84
Copper	1.05-3.12	2.12	0.60	28.30
Zinc	0.78-2.91	1.46	0.73	50.00

iii. Netaji (Kakraban)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.98-6.58	5.13	1.49	9.55
Organic carbon	0.15-0.65	0.38	0.13	34.21
Nitrogen	72.37-423.06	168	65.10	38.75
Phosphorus	4.50-21.18	11.67	3.90	33.41
Potassium	5.62-21.50	13.98	6.44	46.06
Calcium	0.42-4.24	2.42	0.69	28.51
Sulphur	20.75-111.37	47.55	26.88	56.52
Iron	18.88-26.08	22.90	1.44	6.28
Manganese	7.55-14.84	12.31	2.09	16.97
Copper	0.57-4.73	1.71	0.88	51.46
Zinc	0.56-3.18	1.26	0.54	42.85

iv. Indira (kakraban)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.37-6.67	5.59	0.74	13.23
Organic carbon	0.10-0.69	0.39	0.13	33.33
Nitrogen	94.5-347.06	176.50	69.56	39.41
Phosphorus	2.25-13.06	6.58	1.88	28.57
Potassium	7.12-49.18	16.31	8.7	53.34
Calcium	1.54-5.09	2.84	0.85	29.92
Sulphur	11-345.25	54.14	64.82	119.72
Iron	19.68-31.42	26.37	3.16	11.98
Manganese	1.60-21.47	13.79	4.92	35.67
Copper	0.37-3.64	1.69	0.96	56.80
Zinc	0.51-2.24	1.32	0.79	59.84

v. Suravi (Kakraban)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.99-6.26	5.46	0.49	8.97
Organic carbon	0.38-1.19	0.81	0.32	39.50

Nitrogen	90.75-334.87	197.20	82.31	41.73
Phosphorus	5.31-15.43	9.27	3.51	37.86
Potassium	6.12-12.25	8.49	2.73	32.15
Calcium	1.37-1.91	1.55	0.17	10.96
Sulphur	29.43-112.18	53.18	31.22	58.70
Iron	26.15-31.03	27.97	2.14	7.65
Manganese	1.71-10.72	6.03	3.04	50.41
Copper	0.35-0.86	0.59	0.21	35.59
Zinc	0.99-2.18	1.54	0.40	25.97

vi. Ankur 1 (Kakraban)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.16-5.84	5.12	0.33	6.44
Organic carbon	0.23-1.28	1.66	0.12	7.22
Nitrogen	90.75-366.75	200.47	69.50	34.66
Phosphorus	5.5-18.06	8.67	2.24	25.92
Potassium	3.06-51.75	14.19	12.20	85.97
Calcium	0.18-4.92	2.38	0.99	41.59
Sulphur	18.87-245.56	69.58	38.85	55.83
Iron	20.38-24.96	23	1.44	6.26
Manganese	1.31-14.66	12.87	1.46	11.34
Copper	0.36-3.96	1.88	0.98	5.21
Zinc	0.54-3.46	2.22	0.86	38.73

vii. Ankur2 (Kakraban)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.02-5.51	4.16	0.40	9.61
Organic carbon	0.14-1.75	0.64	0.37	57.81
Nitrogen	28.75-416.81	198.93	79.42	39.92
Phosphorus	2.68-26.12	7.35	4.63	62.99
Potassium	18.62-271.68	151.61	52.97	34.93
Calcium	0.22-99	3.53	14.56	412.46
Sulphur	0.44-335	133.54	74.51	55.79
Iron	8.99-38.74	41.34	53.02	128.25
Manganese	4.29-16.72	14.96	2.42	16.17
Copper	0.32-8.69	2.20	1.65	75
Zinc	0.82-4.35	2.65	0.80	30.18

viii. Dishari (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.81-6.21	4.98	0.61	12.24
Organic carbon	0.14-0.56	0.37	0.12	32.43
Nitrogen	86.37-247.62	143.10	42.15	29.45
Phosphorus	0.75-31.87	4.20	5.39	128.33
Potassium	2.06-32.06	19.01	34.55	181.74
Calcium	1.43-5.26	2.51	0.78	31.07
Sulphur	14.62-219.93	69.83	48.21	69.03
Iron	18.40-29.31	24.79	1.94	7.82

Manganese	0.93-15.84	12.20	4.42	36.22
Copper	0.16-3.10	1.75	0.76	43.42
Zinc	1.11-4.77	1.97	0.87	44.16

ix. Sukanta (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.15-5.91	5.29	0.49	9.26
Organic carbon	0.11-0.81	0.38	0.16	42.10
Nitrogen	98.18-284.87	153.48	47.52	30.96
Phosphorus	1.87-6.56	3.96	1.35	34.09
Potassium	1.87-6.56	16.57	7.75	46.77
Calcium	5.87-36.87	2.58	0.67	25.96
Sulphur	9.12-86.31	27.15	17	62.61
Iron	25.34-33.51	31.56	2.34	7.41
Manganese	9-15.94	13.88	2.76	19.88
Copper	0.84-3.54	1.86	0.98	52.68
Zinc	2-3.46	2.3	0.63	27.39

x. Pragatishil (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.68-5.76	4.75	0.57	12
Organic carbon	0.20-0.80	0.41	0.13	31.70
Nitrogen	86.37-279.68	169.74	53.96	31.17
Phosphorus	2.25-13.56	6.07	2.67	43.98
Potassium	10.75-25.62	17.62	4.71	26.73
Calcium	1.42-2.57	2.12	1.38	65.09
Sulphur	9.12-67.93	32.60	16.64	51.04
Iron	10.77-31.85	21.98	7.13	32.43
Manganese	6.26-22.03	1.54	5.44	353.24
Copper	0.83-2.77	1.40	0.48	34.28
Zinc	0.77-2.46	1.42	0.43	30.28

xi. Palli Unnayan (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.51-5.82	5.23	0.54	10.32
Organic carbon	0.60-1.40	1.05	0.22	20.95
Nitrogen	119.50-391.50	245.77	57.33	23.32
Phosphorus	3.18-20	10.57	4.25	40.20
Potassium	2-17	10.58	4.23	39.98
Calcium	0.04-44.25	0.16	0.11	68.75
Sulphur	26.87-101.62	54.56	27.67	50.71
Iron	22.28-32.07	24.31	2.33	9.58
Manganese	1.18-2.89	2.35	0.47	20
Copper	0.54-2.55	1.54	0.57	37.01
Zinc	0.43-3.71	2.02	0.86	42.57

xii. Gram Bikash (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.78-6.92	5.22	0.31	5.93
Organic carbon	0.63-1.22	0.80	0.20	25
Nitrogen	8.12-391.31	234.22	74.06	31.61
Phosphorus	2-21.75	12.95	4.83	37.29
Potassium	7-97.50	19.24	17.42	90.54
Calcium	0.04-0.62	0.10	0.09	90
Sulphur	10.62-248.25	100.93	78.91	78.18
Iron	14.52-22.07	20.66	1.51	7.3
Manganese	1.22-3.25	2.44	0.46	18.85
Copper	0.57-2.01	1.7	0.25	14.70
Zinc	0.66-2.64	1.53	0.41	26.79

xiii. Sarba (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.38-5.52	5.1	0.41	8.03
Organic carbon	0.25-0.56	0.41	0.11	26.82
Nitrogen	98.87-366.56	168.47	98.72	58.59
Phosphorus	1.43-51.06	22.70	17.22	75.85
Potassium	7.87-12.81	10.10	1.91	18.91
Calcium	1.37-3.83	3.06	1.07	34.96
Sulphur	11.06-114.68	54.93	36.97	67.30
Iron	14.21-27.26	23.79	4.43	18.62
Manganese	9.95-16.44	14.14	2.34	16.54
Copper	0.59-3.29	1.65	0.93	56.36
Zinc	3.01-6.26	3.73	1.2	32.17

xiv. Progressive (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	5.38-6.75	5.88	0.47	7.99
Organic carbon	0.64-1.16	0.89	0.23	25.84
Nitrogen	197-263.25	243.58	36.46	14.96
Phosphorus	2.06-9.87	5.55	3.29	59.27
Potassium	9.5-30.50	17.12	7.94	46.40
Calcium	0.11-0.23	1.93	0.04	2.07
Sulphur	54.37-105.18	81.16	18.62	22.94
Iron	23.55-24.93	24.59	0.52	2.11
Manganese	1.46-2.93	2.51	0.58	23.10
Copper	1.05-3.17	1.87	0.85	45.45
Zinc	0.76-2.83	1.98	0.79	39.89

xv. Pitra (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.38-5.62	4.99	0.38	7.61

Organic carbon	0.33-0.67	0.46	0.11	23.91
Nitrogen	115.75-285.93	182.51	61.53	33.71
Phosphorus	2.12-8.56	3.98	1.70	42.71
Potassium	6.31-60.68	18.73	13.88	74.10
Calcium	1.57-3.02	2.19	0.37	16.89
Sulphur	11-208.62	87.85	77.85	88.61
Iron	19.37-23.50	21.15	1.43	6.76
Manganese	8.6-16.31	18.87	4.20	22.25
Copper	0.41-4.24	1.69	0.89	52.66
Zinc	0.52-1.41	0.98	0.30	30.61

xvi. Agragami (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.48-5.91	5.13	0.36	7.01
Organic carbon	1.04-1.48	1.22	0.13	10.65
Nitrogen	122-422.87	262.37	71.65	27.30
Phosphorus	2.18-12.93	5.68	2.89	50.88
Potassium	4-30.5	10.03	7.62	73.98
Calcium	0.02-0.11	0.06	0.03	50
Sulphur	26.87-153.37	82.76	34.47	41.65
Iron	17.64-24.43	22.81	1.78	7.80
Manganese	0.88-3.35	2.21	0.50	22.62
Copper	0.38-1.55	0.92	0.44	47.82
Zinc	0.40-2.63	1.22	0.67	54.91

xvii. Gomati (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.99-5.92	4.89	0.54	11.04
Organic carbon	0.26-0.91	0.49	0.17	34.69
Nitrogen	86.37-522.50	176.31	87.56	49.66
Phosphorus	0.62-10.62	3.17	2.25	70.97
Potassium	7.87-34.56	13.73	6.57	47.85
Calcium	1.43-5.21	2.78	0.87	31.29
Sulphur	2.75-151.00	46.65	22.08	47.33
Iron	14.36-26.75	23.05	2.24	9.71
Manganese	10.33-15.87	13.99	2.76	19.72
Copper	1.25-4.33	2.48	1.13	45.56
Zinc	0.62-2.96	1.20	0.56	46.66

xviii. Sabuj Deep (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.7-6.4	4.67	0.68	14.56
Organic carbon	0.22-0.77	0.39	0.12	30.76
Nitrogen	87.5-390.12	186.81	77.62	41.55
Phosphorus	6.12-65.5	35.29	18.18	51.51
Potassium	1.66-54.93	15.04	11.43	75.99

Calcium	1.01-2.39	2.13	2.16	101.4
Sulphur	15.31-406.25	187.01	54.66	29.22
Iron	19.05-29.53	25.86	2.85	11.02
Manganese	11.12-17.94	15.8	2.06	13.03
Copper	0.51-3.04	1.68	0.56	33.33
Zinc	2.60-3.71	3.09	0.45	14.56

xix. Fotamati (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.15-5.75	4.16	0.59	14.18
Organic carbon	0.22-0.88	0.58	0.14	24.13
Nitrogen	106.25-490.06	190.23	75.25	39.55
Phosphorus	0.75-61.87	17.28	17.02	98.49
Potassium	7.06-48.93	11	3.02	27.45
Calcium	0.91-2.53	1.44	0.45	31.25
Sulphur	17.37-324.12	39.02	20.39	52.25
Iron	24.64-30.34	28.68	1.62	5.65
Manganese	12.20-18.21	16.23	3.09	19.03
Copper	0.93-5.86	2.84	1.40	49.29
Zinc	0.91-3.28	1.78	0.62	34.83

xx. Progressive (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.62-5.55	4.59	0.50	10.89
Organic carbon	0.33-0.81	0.53	0.13	24.52
Nitrogen	106.25-310.81	187.57	67.10	35.77
Phosphorus	7.43-29.68	17.39	4.82	27.71
Potassium	11.37-551.62	171.03	98.04	57.32
Calcium	1.90-2.83	2.01	0.35	17.41
Sulphur	11.68-255.56	134.49	57.75	42.93
Iron	15.3-32.4	54.34	146.37	269.35
Manganese	14.86-16.16	15.52	0.36	2.31
Copper	0.92-3.27	1.72	0.54	31.39
Zinc	1.41-4.02	2.37	0.62	26.16

xxi. Netaji Subash (Matabari)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.70-5.95	4.42	0.42	9.50
Organic carbon	0.41-0.84	0.46	0.18	39.13
Nitrogen	75-522.12	240.71	117.43	48.78
Phosphorus	1.12-9.93	4.87	2.19	44.96
Potassium	1.52-437.5	129.66	86.11	66.41
Calcium	1.01-2.5	1.47	0.36	24.48
Sulphur	20-171.37	98.97	30.13	30.44
Iron	21.92-29.9	26.74	1.96	7.32

Manganese	2.38-13.14	10.62	2.64	24.85
Copper	0.33-2.38	1.15	0.55	47.82
Zinc	1.25-5.58	2.24	0.70	31.25

xxii. Yaprkata (Amarpur)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.66-5.56	4.87	0.34	6.98
Organic carbon	0.41-0.72	0.54	0.12	22.22
Nitrogen	94.93-541.81	261.76	173.38	66.23
Phosphorus	2.62-19.50	6.41	6.57	102.49
Potassium	10.18-36.25	22.69	9.33	41.11
Calcium	1.61-4.75	3.01	1.24	41.19
Sulphur	29.18-122.75	88.63	37.96	42.82
Iron	24.48-28.99	27.56	1.66	6.02
Manganese	16.72-18.13	17.74	0.52	2.93
Copper	1.15-4.60	2.43	1.35	55.55
Zinc	0.80-2.50	1.68	0.66	39.28

xxiii. Sabuj Krishan Unnayan (Amarpur)

Parameter	Range	Mean	S.D	C.V (%)
pH	4-6.52	5.16	0.59	11.43
Organic carbon	0.32-1.24	0.59	0.19	32.20
Nitrogen	92.62-391.56	184.24	72.36	39.27
Phosphorus	1.31-54.68	8.72	8.36	95.87
Potassium	5.56-64.81	20.31	16.28	80.15
Calcium	0.83-5.92	3.70	1.59	42.97
Sulphur	2.91-175.37	93.54	52.48	56.10
Iron	22.17-30.88	27.24	1.88	6.90
Manganese	7.24-17.99	15.97	2.41	15.09
Copper	0.73-4.08	2.43	1.18	48.55
Zinc	0.67-4.11	1.37	0.52	37.95

xxiv. Saiyad (Amarpur)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.57-7.01	5.42	0.54	9.96
Organic carbon	0.05-0.87	0.47	0.20	42.55
Nitrogen	88.25-634.43	268.61	129.06	48.04
Phosphorus	0.06-198.42	12.52	35.27	281.70
Potassium	108.18-549.43	298.44	129.36	43.34
Calcium	1.01-2.56	1.93	0.43	22.27
Sulphur	1.74-589.56	186.78	152.74	81.77
Iron	17.24-25.58	20.87	1.88	9.00
Manganese	6.44-20.23	16.39	3.22	19.64
Copper	0.31-4.51	2.60	1.17	45
Zinc	0.57-2.75	1.43	0.49	34.26

xxv. Birganj (Amarpur)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.615-7.0	4.76	0.43	9.03
Organic carbon	0.17-1.42	0.60	0.26	4.33
Nitrogen	116.683-7.3	287.82	124.32	43.19
Phosphorus	0.87-33.75	12.73	9.20	72.27
Potassium	133.18-552.25	319.43	137.85	43.15
Calcium	0.04-2.53	1.77	0.52	29.37
Sulphur	11-589.56	146.89	171.17	116.52
Iron	20.27-25.55	39	3.10	7.94
Manganese	13.76-20.74	18.51	1.59	8.58
Copper	1.14-5.13	2.33	1.30	55.79
Zinc	0.76-3.10	1.77	0.52	0.29

Soil pH, Organic carbon, Available nitrogen, Potassium, Calcium, sulphur and micronutrients (available Fe, Mn, Cu and Zn) were estimated in soil samples collected from 25 farmers' club in South Tripura. The results with range, mean, Standard deviation and coefficient of variation were presented below

District- South Tripura

i. Progressive (Santir Bazar)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.54-5.32	5.09	0.24	4.71
Organic carbon	0.33-0.84	0.48	0.13	27.08
Nitrogen	94-471.37	220.15	89.59	40.69
Phosphorus	0.75-38.87	45.16	10.93	24.20
Potassium	7.62-21.81	18	3.88	21.55
Calcium	0.52-2.58	1.47	0.65	44.21
Sulphur	1.06-16.62	8.40	5.96	70.95
Iron	25.94-35.61	31.81	3.11	9.77
Manganese	4.03-12.44	10.85	1.98	18.24
Copper	0.49-3.32	1.40	0.72	51.42
Zinc	1.71-3.77	2.57	0.58	22.56

ii. Arabindra (Santir Bazar)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.02-5.11	4.05	0.59	14.56
Organic carbon	0.1-1.68	0.47	0.29	61.70
Nitrogen	74.56-556.25	204.40	96.28	47.10
Phosphorus	2.45-219.37	22.18	39.58	178.44
Potassium	1.90-330	146	55.27	37.85
Calcium	0.1-2.42	1.80	0.42	23.33
Sulphur	7.87-123.43	49.58	31.25	63.02
Iron	22.68-37.09	31.29	3.21	10.25
Manganese	2.0-31.68	14.36	6.05	42.13
Copper	0.3-3.44	1.49	0.65	43.62
Zinc	0.41-6.76	3.88	1.82	46.90

iii. Chittaranjan (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.08-5.38	4.32	0.52	12.03
Organic carbon	0.15-1.86	0.80	0.39	48.75
Nitrogen	10-578.31	269.97	67.99	25.18
Phosphorus	0.62-5.18	3.31	1.84	55.58
Potassium	4.93-27	12.27	5.29	43.11
Calcium	0.24-5.75	2.42	1.12	46.28
Sulphur	18.5-222	40.22	29.96	74.49
Iron	9.10-33.85	27.24	3.89	14.28
Manganese	8.97-17.38	15.25	1.48	9.70
Copper	0.48-2.46	1.47	1.03	7
Zinc	0.41-5.37	3.32	1.02	30.72

iv. New Progressive (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.86-5.52	4.39	0.40	9.11
Organic carbon	0.12-1.02	0.45	0.17	37.77
Nitrogen	80.12-372.62	188.49	93.85	49.79
Phosphorus	1.12-28.68	11.20	8.63	77.05
Potassium	6.25-30.81	16.27	6.68	41.05
Calcium	0.52-3.23	1.70	1.03	60.58
Sulphur	0.25-35.12	5.68	5.50	96.83
Iron	26.92-37.73	33.57	2.48	7.38
Manganese	3.08-13.35	11.65	1.74	14.93
Copper	0.37-2.63	1.22	0.59	48.36
Zinc	0.33-4.22	3.10	0.88	28.38

v. United (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.24-5.66	4.74	0.36	7.59
Organic carbon	0.40-1.28	0.68	0.28	41.17
Nitrogen	94.50-553.37	219.95	93.59	42.55
Phosphorus	0.37-32.75	6.58	6.02	92
Potassium	1.93-32.81	13.10	8.39	64.04
Calcium	0.36-3.73	2.02	1.28	63.36
Sulphur	0.12-6.56	1.53	1.08	70.58
Iron	27.29-43.12	33.39	2.82	8.44
Manganese	9.26-13.06	12.31	0.83	6.74
Copper	0.40-4.62	1.93	1.14	59.06
Zinc	0.91-3.92	2.11	1.02	48.34

vi. Cifaiha (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.02-5.20	3.91	0.38	9.71
Organic carbon	0.26-1.22	0.58	0.19	32.75

Nitrogen	14.52-391.12	198.61	86.70	43.65
Phosphorus	0.62-6.37	2.19	1.53	69.86
Potassium	2-40.68	10.39	9.13	87.87
Calcium	0.10-2.22	0.75	0.54	72
Sulphur	2.21-222	50.91	50.01	98.23
Iron	21.91-28.99	26.34	2.04	7.74
Manganese	7.08-16.36	12.51	0.78	6.23
Copper	0.59-2.64	1.36	1.02	75
Zinc	1.16-4.01	2.95	0.88	29.83

vii. Gandhiji (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	5.11-6.7	5.84	.40	6.84
Organic carbon	0.16-.50	.34	.11	32.35
Nitrogen	92.62-301.56	163.21	54.62	33.46
Phosphorus	3.18-12.81	7.07	3.69	52.19
Potassium	12.75-17.37	16.23	1.4	8.62
Calcium	1.79-3.24	2.38	.41	17.22
Sulphur	11.87-399	147.57	128.00	86.73
Iron	30.61-36.22	33.38	1.53	4.58
Manganese	16.33-22.67	21.04	1.81	8.60
Copper	1.32-2.95	2.26	0.65	28.76
Zinc	2.32-4.68	3.20	0.65	20.31

viii. Mother Teresa (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.59-6.44	5.38	0.44	8.17
Organic carbon	0.23-0.82	0.84	1.41	167.85
Nitrogen	92.62-398	191.88	86.61	45.24
Phosphorus	6.37-43.68	21.80	8.01	36.74
Potassium	7.25-17.37	17.63	26.84	152.24
Calcium	1.49-2.53	2.04	0.33	16.17
Sulphur	2.67-571.12	129.27	170.5	131.89
Iron	29.87-36.19	33.47	1.81	5.40
Manganese	8.21-22.8	19.75	3.07	15.54
Copper	0.73-3.76	2.01	.56	27.86
Zinc	0.61-2.2	2	1.11	55.50

ix. Pilak (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.15-4.82	4.09	0.46	11.24
Organic carbon	0.1-0.9	0.55	0.2	36.36
Nitrogen	113.62-366.82	224.66	72.49	32.26
Phosphorus	2.37-37.87	14.94	13.59	90.96
Potassium	5.75-69.31	16.17	15.77	97.52

Calcium	0.21-3.24	1.59	0.49	30.81
Sulphur	6.87-124.06	54.30	40.52	74.62
Iron	21.24-27.32	25.13	1.83	7.28
Manganese	12.48-19.67	17.52	3.23	18.43
Copper	0.9-4.1	2.94	1.03	35.03
Zinc	1.11-8.3	2.76	1.18	42.75

x. Acharjee Jagadish Chandra Bose (Bagafa)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.12-5.30	4.29	0.55	12.82
Organic carbon	0.18-0.86	0.47	0.14	29.78
Nitrogen	88.25-472.37	223.88	101.38	45.52
Phosphorus	1.25-32.62	11.88	6.74	56.73
Potassium	68.37-311.81	162.39	72.09	44.39
Calcium	0.14-2.93	1.73	0.48	27.74
Sulphur	1.31-244.56	50.73	56.49	111.35
Iron	24.24-38.75	32.28	3.14	9.72
Manganese	5.72-20.12	12.65	4.68	36.99
Copper	0.15-3.89	3.76	11.63	309.30
Zinc	0.64-6.66	2.53	1.48	58.49

xi. Anirban (Hrishyamukh)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.09-6.27	5.30	0.51	9.62
Organic carbon	0.08-0.71	0.40	0.15	37.5
Nitrogen	80.21-509.68	251.62	19.28	7.66
Phosphorus	0.06-426.87	38.54	97.80	253.76
Potassium	1.57-472.68	198.74	118.50	59.62
Calcium	0.98-2.67	1.86	0.55	29.56
Sulphur	0.32-589.18	239.58	139.44	58.20
Iron	11.06-27.02	20.95	4.79	22.86
Manganese	10.22-23.04	13.15	1.85	58.73
Copper	0.4-2.88	1.70	0.56	32.94
Zinc	0.86-5.28	2.34	0.70	29.91

xii. MAA (Hrishamukh)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.3-5.6	4.75	0.27	5.68
Organic carbon	0.11-0.64	0.39	0.15	38.46
Nitrogen	88.25-390.56	216.95	68.08	31.38
Phosphorus	3.06-17.68	6.37	3.67	57.61
Potassium	6.31-44.62	21.55	15.86	73.59
Calcium	1.15-4.5	1.68	0.64	38.09
Sulphur	19.56-106.31	74.81	28.50	38.09
Iron	24.12-31.47	28.35	1.52	5.36

Manganese	5.13-14.02	12.69	1.71	13.47
Copper	1.2-3.92	2.29	0.74	32.31
Zinc	0.81-3.26	2.10	0.80	38.09

xiii. Green (Hrishamukh)

Parameter	Range	Mean	S.D	C.V (%)
pH	4.24-5.85	5.06	0.56	11.06
Organic carbon	0.16-0.79	0.39	0.17	43.58
Nitrogen	80.72-289.20	157.46	69.98	44.44
Phosphorus	2.5-57.25	15.20	10.21	67.71
Potassium	3.25-57.25	11.08	3.72	33.57
Calcium	0.95-2.25	1.35	0.32	0.23
Sulphur	47.56-291.06	56.02	39.01	69.63
Iron	19.44-30.88	26.47	4.7	17.75
Manganese	8.15-13.88	15.25	3.02	19.8
Copper	0.21-4.28	1.52	0.8	52.63
Zinc	0.82-3.23	2.01	1.1	54.72

xiv. Vivekananda (Rajnagar)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.84-4.84	4.30	0.25	5.81
Organic carbon	0.28-1.02	0.49	0.13	26.53
Nitrogen	82.37-391.75	193.29	86.67	44.86
Phosphorus	5.43-122	16.7	19.19	114.91
Potassium	1.97-188.75	112.10	38.20	37.07
Calcium	0.02-8.43	1.44	1.18	81.94
Sulphur	4.18-152.18	48.03	3.63	7.55
Iron	6.78-37.59	33.62	4.62	13.74
Manganese	1.0-21.17	12	5.37	44.75
Copper	0.72-2.11	1.27	0.37	29.13
Zinc	1.54-5.37	2.92	0.81	27.73

xv. Kishan (Rajnagar)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.34-5.7	4.62	0.48	10.38
Organic carbon	0.11-0.66	0.43	0.14	32.55
Nitrogen	21.5-391.75	172.57	71.69	41.54
Phosphorus	5.81-213.12	25.57	35.98	140.71
Potassium	54.87-280.62	130.91	56.86	43.43
Calcium	1.01-4.50	1.52	0.62	40.78
Sulphur	4.18-143.75	40.02	28.84	72.06
Iron	11.81-38.54	33.52	4.43	13.21
Manganese	2.12-37.66	12.18	9.39	77.09
Copper	0.14-2.46	1.13	0.54	47.78
Zinc	0.16-4.65	2.20	1.34	60.90

xvi. Krishak Bandhu (Rajnagar)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.41-5.12	4.24	0.31	7.31
Organic carbon	0.20-1.1	0.62	0.18	29.03
Nitrogen	93.75-360.12	225.99	60.60	26.81
Phosphorus	1.06-23.37	4.31	4.43	102.78
Potassium	81.25-725	211.04	117.27	55.56
Calcium	0.16-2.39	1.35	0.51	37.77
Sulphur	4.62-242.37	59.85	65.74	109.84
Iron	16.53-27.85	23.10	1.72	7.44
Manganese	5.63-11.78	10.03	1.51	15.05
Copper	0.46-3.0	1.27	0.50	39.37
Zinc	1.27-4.0	2.20	0.65	29.54

xvii. Trishna (Rajnagar)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.48-5.60	4.30	0.42	9.76
Organic carbon	0.17-1.16	0.69	0.22	31.88
Nitrogen	26.25-385.31	224.48	85.24	37.97
Phosphorus	0.68-19.93	4.36	5.91	135.55
Potassium	45.0-287.5	196.90	58.85	29.88
Calcium	1.10-2.18	1.24	0.20	16.12
Sulphur	4.62-419.56	71.31	97.17	136.26
Iron	9.41-27.85	24.46	2.82	11.52
Manganese	3.33-12.32	9.57	2.19	22.88
Copper	0.34-2.97	1.11	0.45	40.54
Zinc	0.98-3.73	2.42	0.70	28.92

xviii. Maiti (Satchand)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.2-5.65	4.2	0.58	13.80
Organic carbon	0.24-0.79	0.5	0.15	3
Nitrogen	100-441.31	219.5	92.82	42.28
Phosphorus	8.37-56.43	16.02	9.84	61.42
Potassium	6.75-75.68	36.76	25.40	69.09
Calcium	0.84-2.18	1.32	0.33	25
Sulphur	17.18-261.75	94.64	58.60	62.18
Iron	17.45-24.81	20.71	3.23	15.59
Manganese	3.24-19.38	14.33	3.43	23.93
Copper	0.35-3.30	1.41	0.82	58.15
Zinc	0.85-2.91	1.61	0.54	33.54

xix. Guachand (Satchad)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.76-6.18	5.52	0.55	9.96
Organic carbon	0.1-0.73	0.39	0.13	33.33

Nitrogen	86.37-590.75	207.32	3.96	19.88
Phosphorus	0.25-37.31	13.50	12.14	89.92
Potassium	14.37-578.81	220.87	157.02	71.09
Calcium	1.05-2.56	1.78	0.47	26.40
Sulphur	1.62-433.75	87.31	114.57	131.22
Iron	20.92-29.76	27.94	1.67	5.97
Manganese	2.29-18.53	12.22	4.17	34.12
Copper	0.49-1.95	0.99	0.37	37.37
Zinc	0.30-5.33	2.27	0.90	39.64

xx. Sanghati (Satchand)

Parameter	Range	Mean	S.D	C.V (%)
pH	3.84-5.96	4.87	0.44	9.03
Organic carbon	0.25-0.93	0.52	0.17	62.69
Nitrogen	81.25-872.87	273.17	166.34	60.89
Phosphorus	0.25-19.68	3.25	4.68	144
Potassium	64.87-613.06	151.83	57.78	38.05
Calcium	1.0-2.25	1.50	0.35	23.33
Sulphur	16.62-500.5	134.45	140.83	104.74
Iron	25.21-29.02	27.13	1.06	3.90
Manganese	2.53-19.62	15.37	5.09	43.58
Copper	0.24-2.17	1.17	0.51	36.60
Zinc	0.16-4.58	2.97	1.07	

4. Average Soil Test Report of Farmers' Club

District wise average soil test report is presented below.

Parameter	Range	Mean	S.D	C.V(%)
District- West Tripura				
pH	3.63-6.71	4.94	0.42	8.18
Organic carbon (%)	0.10-1.78	1.12	0.30	34.81
Nitrogen (kg/ha)	0.68-409	229.87	70.67	31.25
Phosphorus(kg/ha)	0.62-75	10.09	8.67	61.38
Potassium(kg/ha)	3.87-206.06	95.77	27.86	32.86
Calcium{c mole (p+)/kg}	0.06-4.88	1.60	0.45	26.37
Sulphur(kg/ha)	6.87-478.68	62.60	36.02	55.60
Iron(mg/kg)	10.00-64.86	28.58	7.65	27.97
Manganese(mg/kg)	1.34-47.11	15.06	6.40	41.22
Copper(mg/kg)	0-4.9	1.64	0.91	61.21
Zinc(mg/kg)	0.11-5.25	2.29	0.95	42.79

District- Khowai				
pH	4.52-5.54	4.90	0.34	6.93
Organic carbon (%)	0.16-1.2	0.53	0.37	70.48
Nitrogen (kg/ha)	88.12-284.50	175.68	440.85	250.93

Phosphorus(kg/ha)	1.91-54.87	18.28	17.36	95.63
Potassium(kg/ha)	65.75-145.18	111.13	24.40	21.95
Calcium{c mole (p+)/kg}	1.31-3.11	2.37	0.90	34.17
Sulphur(kg/ha)	9.43-118.75	32.11	48.89	152.31
Iron(mg/kg)	17.74-30.50	25.76	3.86	14.98
Manganese(mg/kg)	17.02-26.92	19.58	2.22	11.33
Copper(mg/kg)	0.66-2.94	1.33	0.84	63.15
Zinc(mg/kg)	1.03-2.94	2.01	0.87	43.28

District- Sepahijala				
pH	3.12-6.94	5.12	0.51	6.93
Organic carbon (%)	0.11-2.75	0.67	0.20	70.48
Nitrogen (kg/ha)	8.01-1025.68	210.95	118.12	250.93
Phosphorus(kg/ha)	0.23-86.87	12.12	4.16	95.63
Potassium(kg/ha)	0.07-275.06	60.55	27.73	21.95
Calcium{c mole (p+)/kg}	0.05-6.44	1.44	0.67	34.17
Sulphur(kg/ha)	4.12-607.37	160.57	82.18	152.31
Iron(mg/kg)	15.62-190	30.73	3.96	14.98
Manganese(mg/kg)	0.91-103.56	14.55	4.90	11.33
Copper(mg/kg)	0.2-9.37	1.73	0.77	63.15
Zinc(mg/kg)	0.11-12.43	2.11	0.90	43.28

District- Gomati				
pH	3.02-7.01	5.03	0.53	9.85
Organic carbon (%)	0.05-1.75	0.64	0.17	28.51
Nitrogen (kg/ha)	8.12-683.73	203.83	78.81	38.45
Phosphorus(kg/ha)	0.06-198.4	10.11	7.32	71.40
Potassium(kg/ha)	1.52-552.25	54.77	27.89	58.43
Calcium{c mole (p+)/ kg}	0.02-99	2.12	1.24	52.19
Sulphur(kg/ha)	0.44-589.56	85.81	49.04	56.76
Iron(mg/kg)	8.99-38.74	27.25	10.12	24.48
Manganese(mg/kg)	0.88-22.03	11.61	2.34	33.83
Copper(mg/kg)	0.16-8.69	1.81	0.84	43.98
Zinc(mg/kg)	0.40-6.26	1.85	0.64	35.26

District- South Tripura				
pH	3.02-6.7	4.66	0.44	9.46
Organic carbon (%)	0.08-1.86	0.52	0.25	42.71
Nitrogen (kg/ha)	10-872.87	212.38	78.39	38.16
Phosphorus(kg/ha)	0.06-426.87	14.51	15.22	95.11

Potassium(kg/ha)	1.57-578.81	86.01	42.71	55.46
Calcium{c mole (p+)/kg}	0.02-8.43	1.65	0.60	36.05
Sulphur(kg/ha)	0.12-589.18	72.21	61.78	83.42
Iron(mg/kg)	6.78-43.12	28.71	2.82	10.11
Manganese(mg/kg)	1.0-37.66	13.73	3.17	26.55
Copper(mg/kg)	0.14-4.62	1.69	1.23	54.61
Zinc(mg/kg)	0.16-8.3	2.57	0.96	38.25

From the average value of soil test report as presented in Table, it is observed that soil pH varied from 3.02 to 6.92 thus indicating the change in soil acidity from strongly acidic to mild acidic. Organic carbon, nitrogen and phosphorus underwent a variation from very low to very high in status. Availability of potassium was found to be low. Calcium availability was also varying from low to high. There was a wide variation in sulphur from low to high with 58.42% coefficient of variation. Among the micronutrients, soils are having a high concentration of Fe (critical limit 4.5 mg/kg), some soils are low in Mn availability but majority of soils are containing high Mn content (critical limit 2.0 mg/kg). Both Cu and Zn varied from 0.16-5.86 mg/kg and 0.33-8.30 mg/kg, respectively thus indicating deficiency (critical limit 0.6 mg/kg for Zn and 0.2 mg/kg for Cu) in some soils and abundant supply in most of the soils.

5. Nutrient Index

Nutrient index (N.I) for NPK in soils collected from the different area under Farmers Club was estimated and thus presented in Fig.1. The index varied from 1-2.14 for N & P and 1-1.94 for K thus indicating low to medium in nutrient status in soils as studied. If N.I is below 1.5, the nutrient is low, value,1.5-2.5,nutrient is medium and in case of N.I >2.5,nutrient is high in status.

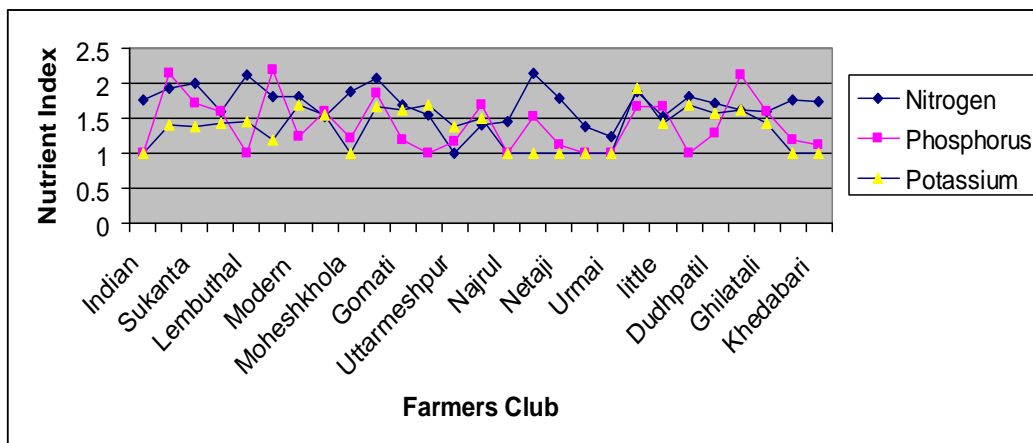


Fig.1.Nutrient index for NPK in soils

6. Soil Health Card – Release and Training

Soil health card was released by Hon'ble Minister of Agriculture, Govt. of Tripura, Shri Aghore Debbarma and SHC was distributed among 100 farmers belonging to six farmers club from Jirania, Kalikapur, Lefunga, Bamutia and Bishalgarh in West Tripura. Soil health card was thereafter released by Shri Joygovinda Debroy, Hon'ble Minister of Science and Technology, Govt. of Tripura at Bagma, South Tripura and farmers from 5 club of that locality had received soil health card. A continuous programme on training of farmers for effectively using the card is also in operation.



Shri Aghore Debbarma,
Hon'ble Minister of Agriculture,
Govt. of Tripura



Shri Joygovinda Debroy, Hon'ble Minister
of Science and Technology,
Govt. of Tripura

. A continuous programme on training of farmers for effectively using the card is also in operation.



A woman farmer receiving a SHC
In South Tripura



Training on the Use of SHC

A training programme on Soil Health and Fertility has also been organised by ICAR Research Complex for NEH Region, Tripura Centre at Lembucherra and the programme has been sponsored by Department of Agriculture, Govt. of Tripura. In this programme . Soil testing kits (10 no.s) are distributed . The following recommendations are emerged-

1. Amelioration of soil acidity- with specific application of 200-250 kg lime/ha in furrows of crops.
2. Selection of crops as per soil acidity tolerance behaviour.
3. Use of basic slag a residual product of steel industry as soil ameliorant.
4. Refinement of composting technology for ready supply of compost.
5. Vermicomposting with an increased amount of organic matter (not less than 12-14%).
6. Use of biofertilizers particularly phosphate solubilising organisms and rhizobial technology.
7. Supply of all sorts of manure to reduce the adverse effect of soil acidity and increase of soil fertility.
8. Soil testing service and identification of nutrient deficiencies/ excess for requisite fertilizer recommendation



Welcome address by Dr. M. Datta,
Joint Director, ICAR, Tripura



Participants in soil health and soil fertility
management programme

7. Soil Health Card –Usefulness

The soil health card is prepared after the analysis of soil samples collected from farmers' plot and the analytical parameters included in the card are as follows. Microbial assay of some selected soil samples is also explored.

- Soil pH
- Per cent organic carbon
- Available Nitrogen

- Available Phosphorus
- Available Potassium
- Exchangeable Calcium
- Available Sulphur
- Available micronutrients such as Zinc, Copper, Iron, Manganese

Soil health card issued to the farmers has the following components.

- Farmer's Area Description
- Soil Analytical Data with nutrient rating
- Fertilizer Recommendation
- Fertilizer dose for crops
- Organic manure requirement
- Biofertilizer requirement
- Lime

The format of the soil health card as issued is illustrated below.

Farmer/Person ID	Land/Soil Information				
Name	Land topography	Land area			
Village	Irrigation facility	Soil texture			
Block	Sample collection Date	Soil depth			
District	Last crop grown	Crop			
Farmers' Club	Last fertilizer applied				
Parameters	Soil Test Rating				
	Very low	Low	Medium	High	Very High
Per cent organic carbon	<0.4	0.4-06	0.6-0.75	0.75-1.5	1.5
Nitrogen (kg/ha)	100	100-200	200-300	300-400	400-500
Phosphorus (-Do)	<5	5-10	10-15	15-20	20-25 & more
Potassium (Do)	<75	75-150	150-225	225-300	300-375 & more
Calcium {cmole (P+)/kg}	<1.51	1.51-2.16	2.16-2.88	2.88-4.32	>4.32
Sulphur (kg/ha)	<21.88	21.88-31.25	31.25-50	50-68.75	>68.75
Iron (mg/kg)	<4	4-6	6-12	12-20	➤ 20
Manganese (-Do)	<2	2-5	5-10	10-15	➤ 15

Copper (-Do)	<0.2	0.2-0.4	0.4-0.5	0.5-1.5	> 1.5
Zinc (-Do)	<0.4	0.4-0.5	0.5-1.0	1.0-2.0	>2.0

Finally, the usefulness of the soil health card is revealed by fertilizer recommendation for the crops grown by the farmer.

8. Fertilizer Requirement and Recommendation.

Soil test rating	Fertilizer dose
Very low	Full dose
Low	80% of nutrient recommended
Medium	60% of nutrient
High	40% of nutrient
Very high	20% of nutrient

After identifying soil fertility status according to soil test rating, viz., very low, low, medium, high and very high, quality of NPK fertilizers can be estimated considering 100, 80, 60, 40 and 20 % of recommended fertilizer doses in crops. The recommended fertilizer doses of different crops in Tripura are presented below.

Crop	Recommended Fertilizer Doses (kg/ha)		
	Nitrogen	Phosphate	Potash
Rice :			
Aus (Direct Sowing)	60	30	30
Amal (Transplanting)	80	40	40
Aman (Hybrid)	100	50	50
Jhum Rice	60	30	30
Boro Rice(Rabi)	100	50	50
Boro Hybrid	120	60	60
Wheat	80	40	40
Maize	80	40	40
Mung	20	40	20
Blackgram	20	40	20
Lentil	20	40	20
Field pea	20	40	20
Pigeon pea	20	40	20
Groundnut	20	40	40
Mustard (Torja)	40	20	20
Sesamum	40	20	20
Potato	120	100	100
Potato (TPS)	150	100	150
Jute	50	25	25
Sweet Potato	60	40	60
Sugarcane	130	50	40
Cabbage	120	50	50

Cauliflower	100	60	80
Brinjal	120	85	50
Cucumber	100	50	50
Okra	120	70	60
Cowpea	25	70	50
Pumpkin	100	50	50
Radish	60	50	50
Indian spinach	80	60	60
Ash gourd	100	50	50
Bitter gourd	40	30	30
Ridge gourd	50	40	30
Pointed gourd	150	60	80
Spine gourd	50	40	30
Sponge gourd	30	50	40
Bottle gourd	50	40	40
Dolichous	35	25	40
Chilli	120	60	50
Tomato	120	60	50
Broad bean	10	40	30
Colocasia	100	70	135
Banana (Sabri) g/plant/yr	200	70	130
Banana (Champa) g/plant/yr	224	56	112
Pineapple	400	200	400
Assam Lemon	200	50	200
Congo grass	160	40	30
Jatropha	40	30	30
Betel leaf	100	100	100
Papaya (g/plant/yr)	240	200	200
Mango (g/plant/yr)	100-500*	50-250	100-500
Tuberose	200	150	150
Rubber	80	60	40
Teak (g/plant/yr)	12	12	6
Tea	120	60	40
Coffee	120	90	120
Cashewnut (g/plant/yr)	500	125	125
Aquaculture (Fish)	40	35	8

*Fertilizer doses from 1-5 years of planting

On the basis of the recommended fertilizer doses as stated above, quantity of NPK fertilizers can be estimated considering the fertility status of soils in which the particular crops are grown. In the case of very low soil fertility, total quantity of fertilizer doses (100 %) would be required but 20 % of the recommended fertilizer would be sufficient in the soil where the soil fertility as assessed through analysis is of very high magnitude thus indicating 80 % saving in fertilizer. There is a saving of fertilizer through the use of soil health card and the quantity of fertilizer to be added to the plot is governed by the soil test rating as evaluated through soil analysis. An example of fertilizer (Nitrogen) application for a crop of rice in Tripura is cited below.

Application of nitrogen containing fertilizer in rice

Soil fertility	Dose of Nitrogen	Dose of Urea in a Kani	Fertilizer saving	Monetary Saving
Low	100 kg N /ha	35 kg Urea	-	-
Medium	60 kg N /ha	21 kg Urea	14 kg Urea	Rs 77/-
V. high		7 kg Urea	28 kg Urea	Rs 154/-

1 hectare = 6.25 kani, Cost of 1kg urea = Rs 5.50

Soil Health Card issued for fertilizer recommendation in rice (Bengali Version)

মাটি পরীক্ষার তথ্য

ক্রমিক নং	মাটির প্রকারভেদ	সরিষামাত্র	প্রদত্ত সর্বাধিক সঞ্চয়				
			মূল কয়	কয়	মাঝারি	বেশী	মূল বেশী
১.	নিম্ন	৪.৫৪	৪.৫ এর কম	৪.৫-৪.৬	৪.৬-৪.৭	৪.৭-৪.৮	৪.৮-৪.৯
২.	শক্তকরা জৈব কার্বন	৩.৬২	৩.৬ এর কম	৩.৬-৩.৭	৩.৭-৩.৮	৩.৮-৩.৯	৩.৯ এর বেশী
৩.	নাইট্রোজেন (কেজি প্রতি কানি)	৪৬.৪৪	১৬	১৬-১৭	১৭-১৮	১৮-১৯	১৯-২০
৪.	কমলগুণ (-ই-)	৩.৬২	৩.৬ এর কম	৩.৬-৩.৭	৩.৭-৩.৮	৩.৮-৩.৯	৩.৯-৪.০ এবং এর বেশী
৫.	পটাশিয়াম (-ই-)	১.০০	১.২ এর কম	১.২-১.৩	১.৩-১.৪	১.৪-১.৫	১.৫-১.৬ এবং এর বেশী
৬.	ক্যালসিয়াম (-ই-)	১০০.৭৪	১০০ এর কম	১০০-১০১	১০১-১০২	১০২-১০৩	১০৩ এর বেশী
৭.	সালফার (-ই-)	০.০৪	০.৪ এর কম	০.৪-০.৫	০.৫-০.৬	০.৬-০.৭	০.৭-০.৮ এর বেশী
৮.	সোডিয়াম (পিপিএম)	৩০.০২	৪.০ এর কম	৪.০-৪.৫	৪.৫-৫.০	৫.০-৫.৫	৫.৫ এর বেশী
৯.	ম্যাগনেসিয়াম (-ই-)	১২.৮৬	২.০ এর কম	২.০-২.৫	২.৫-৩.০	৩.০-৩.৫	৩.৫ এর বেশী
১০.	কপার (-ই-)	২.৭১	০.২ এর কম	০.২-০.৪	০.৪-০.৬	০.৬-১.০	১.০ এর বেশী
১১.	মহা (-ই-)	০.২০	০.৪ এর কম	০.৪-০.৬	০.৬-১.০	১.০-১.৫	১.৫ এর বেশী

সার (কেজি প্রতি কানি) সম্পর্কে পরামর্শ (Fertilizer Recommendation)
ফসল - উচ্চফলনশীল জাতের ধান (১০০ ই ১৫০ ই ২০)

হ্যান্ডিয়া	১৪ কেজি
সিঙ্গল সুপার ফসফেট	৪০ কেজি
ডিউরোট অফ পটাশ	১৩ কেজি
গোবর সার	৫০০-১০০০ কেজি
বীজসূ সার (স্যালাইনাইটাইজড এবং নি-এস বি)	০.৬-১.০ কেজি
মহা সারের অনুপাত	১.৫-২ কেজি

Soil Health Card issued for fertilizer recommendation to potato

মাটি পরীক্ষার তথ্য

ক্রমিক নং	মাটির প্রকারভেদ	সরিষামাত্র	প্রদত্ত সর্বাধিক সঞ্চয়				
			মূল কয়	কয়	মাঝারি	বেশী	মূল বেশী
১.	নিম্ন	৪.৫৪	৪.৫ এর কম	৪.৫-৪.৬	৪.৬-৪.৭	৪.৭-৪.৮	৪.৮-৪.৯
২.	শক্তকরা জৈব কার্বন	৩.৬২	৩.৬ এর কম	৩.৬-৩.৭	৩.৭-৩.৮	৩.৮-৩.৯	৩.৯ এর বেশী
৩.	নাইট্রোজেন (কেজি প্রতি কানি)	৪৬.৪৪	১৬	১৬-১৭	১৭-১৮	১৮-১৯	১৯-২০
৪.	কমলগুণ (-ই-)	৩.৬২	৩.৬ এর কম	৩.৬-৩.৭	৩.৭-৩.৮	৩.৮-৩.৯	৩.৯-৪.০ এবং এর বেশী
৫.	পটাশিয়াম (-ই-)	১.০০	১.২ এর কম	১.২-১.৩	১.৩-১.৪	১.৪-১.৫	১.৫-১.৬ এবং এর বেশী
৬.	ক্যালসিয়াম (-ই-)	১০০.৭৪	১০০ এর কম	১০০-১০১	১০১-১০২	১০২-১০৩	১০৩ এর বেশী
৭.	সালফার (-ই-)	০.০৪	০.৪ এর কম	০.৪-০.৫	০.৫-০.৬	০.৬-০.৭	০.৭-০.৮ এর বেশী
৮.	সোডিয়াম (পিপিএম)	৩০.০২	৪.০ এর কম	৪.০-৪.৫	৪.৫-৫.০	৫.০-৫.৫	৫.৫ এর বেশী
৯.	ম্যাগনেসিয়াম (-ই-)	১২.৮৬	২.০ এর কম	২.০-২.৫	২.৫-৩.০	৩.০-৩.৫	৩.৫ এর বেশী
১০.	কপার (-ই-)	২.৭১	০.২ এর কম	০.২-০.৪	০.৪-০.৬	০.৬-১.০	১.০ এর বেশী
১১.	মহা (-ই-)	০.২০	০.৪ এর কম	০.৪-০.৬	০.৬-১.০	১.০-১.৫	১.৫ এর বেশী

সার (কেজি প্রতি কানি) সম্পর্কে পরামর্শ (Fertilizer Recommendation)
ফসল - আলু (১২০ ই ১০০ ই ১২০)

হ্যান্ডিয়া	৩০ কেজি
সিঙ্গল সুপার ফসফেট	১০০ কেজি
ডিউরোট অফ পটাশ	৩০ কেজি
গোবর	৫০০-১০০০ কেজি

Soil Health Card issued for fishery

মাটি পরীক্ষার তথ্য							
ক্রমিক নং	মাটির প্রকার	পরিমাণ	প্রমাণ সম্পর্কিত স্বেচছিকরণ				
			খুব কম	কম	মাঝারি	বেশী	খুব বেশী
১.	শি.এইচ	৪.৪২	৪.৪ এর কম	৪.৪-৪.০	✓ ৪.১-৪.৪	৪.৬-৫.০	৫.১-৫.৪
২.	শতকরা জৈব কার্বন	০.১২	✓ ০.৪ এর কম	০.৪-০.৬	০.৬-১.০	১.০-১.৪	১.৪ এর বেশী
৩.	নাইট্রোজেন (কেজি প্রতি কানি)	৪৭.৭৪	১৬	১৬-৩২	✓ ৩২-৪৮	৪৮-৬৪	৬৪-৮০
৪.	ফসফরাস (-ই-)	৬.১৮	✓ ০.৮ এর কম	০.৮-১.৬	১.৬-২.৪	২.৪-৩.২	৩.২-৪.০ এবং এর বেশী
৫.	পটাশিয়াম (-ই-)	২.৪১	✓ ১.২ এর কম	১.২-২.৪	২.৪-৩.৬	৩.৬-৪.৮	৪.৮-৬.০ এবং এর বেশী
৬.	ক্যালসিয়াম (-ই-)	২৫.৮৮	✓ ২০৪ এর কম	২০৪-২৪০	২৪০-২৭৬	২৭৬-৩১২	৩১২ এর বেশী
৭.	সালফার (-ই-)	০.০৪	✓ ০.৪ এর কম	০.৪-০.৮	০.৮-১.২	১.২-১.৬	১.৬ এর বেশী
৮.	পেইড (শিলিমা)	২৫.৯২	৪.০ এর কম	৪.০-৬.০	৬.০-৮.০	৮.০-১০.০	✓ ১০.০ এর বেশী
৯.	ম্যাগনেসিয়াম (-ই-)	৪.০৮	২.০ এর কম	২.০-৪.০	✓ ৪.০-৬.০	৬.০-৮.০	৮.০ এর বেশী
১০.	কপার (-ই-)	০.৫৭	০.২ এর কম	✓ ০.২-০.৪	০.৪-০.৬	০.৬-১.০	১.০ এর বেশী
১১.	লোহা (-ই-)	০.১৬	০.৪ এর কম	০.৪-০.৮	০.৮-১.২	১.২-২.০	✓ ২.০ এর বেশী

মৎস চাষ সম্পর্কে পরামর্শ (৪০ : ৩৫ : ৮) সার কেজি প্রতি কানি

ইরিবিয়া	৮ কেজি
সিলন সুনার ফসফেট	৩৫ কেজি
মিউরেট অফ পটাশ	২ কেজি
গোবর সার	২৪০০ কেজি
সুড়া চুন	৪০ কেজি
সারের গাটীকতা	৪.৫ ফুট এবং তার উপরে

9. Soil Health Card - Impact Analysis

The impact of soil health card as issued among the farmers has been assessed through interaction with two farmers' club. In West Tripura, the farmer' club selected for the impact analysis was Modern F/C in Nabinagar Gaon Panchayat under Bishalgarh Block and in South Tripura, the selected farmers' club was Ankur in Dudpushkurani Gaon Panchayat under Matabari Block.

MODERN F/C

Impact analysis of SHC at Modern F/C

Crop	Production without following SHC	Production with following SHC and improved package of practices	Difference in Production	Sale price of extra produce due to SHC and improved package of practices
Paddy	4.25 ton/ha	5.5 ton /ha	1.25 ton/ha	Rs 13,750/-

Sale price of paddy Rs 11/kg

ANKUR F/C

Impact analysis of SHC at Ankur F/C

Crop	Production without following SHC	Production with following	Difference in Production	Sale price of extra produce due to SHC
------	----------------------------------	---------------------------	--------------------------	--

		SHC and improved package of practices		and improved package of practices.
Paddy	2.0 ton/ha	6.25 ton /ha	4.25 ton/ha	Rs 46,750/-
Potato	5.35 ton/ha	10.71 ton/ha	5.36 ton/ha	Rs 80,400/-

Sale price of potato Rs 15/kg



Discussion with farmers regarding the use of SHC at Bishalgarh



Discussion at Ankur F/C in South Tripura

10. Microbial Status

Soil microbial status of soils collected from different locations in South Tripura was estimated and the data are presented below. Most probable number for microbial population (MPN) consisting of the Bacteria, Fungi and Actinomycetes etc are varying from 7 to 13 thousand /g of soil and of which bacterial population are 4 to 8 thousand /g of soil thus indicating the poor microbial life present in the soils under study.

Microbial Status of Soils From Different Locations

Sl. No.	Sample source	Number ($\times 10^3$) per g of soil (average of three isolates)					
		Bacteri	Fungi	Actinomycetes	PSB+PSF	N-fixing	Tota

		a				bacteria	l micr o- Orga nism s
District South Tripura							
1.	Vivekananda F.C. Barpathari, Rajnagar	8	2	3	6	6	13
2.	Trishna F.C. Rajnagar	7	4	2	7	5	13
3.	Aravinda F.C. Bamchara (Muhuripur) Santirbazar	7	4	2	7	4	13
4.	Kishan F.C. (South Kashari), Rajnagar	6	3	4	7	4	13
5.	Krishak Bandhu F.C. Indira Palli (Barpathari) Rajnagar	7	3	3	5	4	13
6.	J.C Bose F.C., Latua Tilla Bagafa	5	2	3	4	NA	10
7.	Pilak F.C., JalaiBari Bagafa	5	3	4	6	4	12
8.	Maitree F.C. Sindhuk Bihar Satchand	5	2	2	4	4	12
9.	Green F.C. Hrishya Mukh	7	3	3	5	3	13
10.	Maa F .C., Hrishya Mukh	4	1	2	2	2	7
11.	Anirban F.C., Matai Hrismukh	6	2	1	4	3	9
12.	Progressive F.C., Santirbazar	7	3	2	4	4	12
13.	Mother Teresa F/C Baikhora , Bagafa	7	2	1	5	4	11
14.	Gandhiji F/C Baikhora , Bagafa	8	3	2	5	4	12
15.	Guachand F.C. Guachand Satchand	7	3	2	5	3	12
16.	Sanghati F.C. East Harina, Satchand	6	2	2	5	4	11
17.	New Progressive F.C., Bagafa	7	3	2	5	4	12
18.	Cifaia F .C. Santir Bazar, Bagafa	8	2	2	5	4	12
19.	Chittaranjan F.C., Mog	7	3	2	5	4	12

	para, Bagafa						
20	United F.C., Birchandra Manu, Bagafa	8	2	2	5	4	12
District Gomati							
1.	Netaji Subhash F.C. Basan Khala, Matabari	5	3	3	4	NA	11
2.	Birganj F.C., Birganj Amarpur	5	3	4	4	2	12
3.	Saiad F.C., Mailak Amarpur	8	2	1	5	4	11
4.	Sabuj Deep F.C. Gokulpur, Matabari	6	4	2	5	4	12
5.	Fotamati F.C. Maharani, Matabari	8	2	2	5	4	12
6.	Gram Vikash, F.C., Matabari	7	3	2	5	4	12
7.	Suravi F.C, Kakraban	8	3	2	5	6	13
8.	Aragami F.C, Matabari	8	3	2	5	6	13
9.	Palli Unnayan F.C., Matabari	8	3	2	6	6	13
10.	Netaji F.C, Kakraban	8	3	2	6	6	13
11.	Aravinda, F.C., Kakraban	8	3	2	5	6	13
12.	Dishari F.C, Matabari	8	4	2	6	6	14
13.	Gomati (Pitra), Matabari		2	2	5	6	12
14.	Pitra F.C, Matabari	8	2	1	4	5	10
15.	Pragrassive F.C. Salghara, Matabari	8	2	2	5	4	12
16.	Rajnagar, Udaipur, Matabari	8	2	2	5	4	12
17.	Pragatishil F .C., Matabari	6	4	1	4	3	11
18.	Ankur F.C., Kakraban	9	1	2	5	4	12
19.	Jamjuri F.C. , Kakraban	8	2	2	5	4	12
20.	Sukanta F.C., Gokulpur, Matabari	7	3	2	4	2	12
21.	S.K.Unnayan, Amarpur	7	3	2	4	2	12
22.	Yapkata, Amarpur	6	4	1	5	4	11
23.	Aravind	3	6	2	7	NA	11
24.	Palli Unnayan	8	2	1	8	4	11
25.	Suravi	2	5	3	5	NA	10
26.	Gram Vikash	8	2	1	8	4	11
27.	Aragami	4	7	2	5	1	13
28.	Progressive	3	6	4	4	1	13
District Sepahijala							
1.	Morden FC	4	7	2	8	2	13
2.	LTM (Lembuthal FC)	3	6	2	7	1	11
3.	Green FC (Boxnagar)	4	7	2	7	1	13
4.	Rangamati FC	3	6	2	7	3	11
5.	Krishak Bandu	3	5	4	7	2	12

6.	Uttar Maheshpur	2	4	NA	5	NA	6
7.	Gomati	3	7	2	7	1	12
8.	Baleerdepa	4	7	3	8	1	14
9.	Little	3	6	2	6	2	11
10.	Indian FC	3	5	3	6	NA	11
11.	Garur Band FC	2	6	3	5	NA	11
12.	Urmai FC (M)	8	2	1	8	4	11
13.	Najrul FC	2	4	1	4	NA	7
14.	Sonali FC	3	7	2	7	NA	12
15.	Khedabari FC	4	8	NA	10	NA	12
16.	N.C. Nagar	3	8	1	8	NA	12
District West Tripura							
1.	RKM (Ramkrishna FC)	3	4	2	6	2	9
2.	Moheshkhola	3	6	NA	6	NA	9

11. Conclusion

Soil testing helps diagnose soil health and evolve soil specific and crop specific solutions. It helps to identify problematic soils, their nutritional status, texture and structure. Based on the analysis, farmers are advised on soil fertility management through rational use of manure, fertilizers and amendments to make agriculture more productive and sustainable. Soil testing becomes indispensable to assure national food security, nutritional security, maintenance of soil health, enhancement of soil fertility and to leave a good heritage for the future generations.

Land, water resources, soil and biodiversity which are the natural resources for agriculture are under considerable strain. India's total gross cropped area is about 192.2 million hectares and the net sown area is 140 million ha. Over the last three to four decades, net sown area remains stagnant and possibility of increasing it is minimal due to increasing demand on land for other purposes. The ultimate irrigation potential of the country is estimated to be about 140 million ha out of which about 76 million ha is met by surface water and remaining 64 million hectare from ground water sources. Presently, about 63 million ha (45%) of cropped area, is reported to be irrigated. The demand for meeting food and water for a growing population from a shrinking natural resource base has shifted focus to enhance agricultural production in a sustainable manner. The regressive fragmentation of land holdings, degrading natural resource base and emerging concerns of climate change will further escalate pressure on land and water. Land and water resources being finite, increased production has to come from the same restricted net sown area by increasing productivity. Thus, increase in agricultural production will mainly come from enhancement in farm productivity with optimal use of available water and land resources. Agriculture production is mainly dependent on natural resources e.g. land, water, soil, biodiversity (plant, animal and microbial genetic resources), along with air and sunlight. But these natural resources are rapidly shrinking due to demographic and socio-economic pressures, monsoonal disturbances, increasing frequencies of floods and droughts etc. Overuse of marginal lands, imbalanced fertigation, deteriorating soil health, diversion of agricultural land to nonagricultural uses, misuse of irrigation water, depleting aquifers & irrigation sources, salinization of fertile lands and water-logging continue apace. During the last three decades while considerable emphasis has been laid on development of natural resources (land, water

and perennial biomass), negligible attention towards sustainable socio-economic management of these resources have reached to unprecedented levels. For making agriculture sustainable, to meet country's food requirement, soil health and water availability are to be maintained at levels that would re-assure farmers to pursue agricultural activities with higher level of productivity

12. References

- Adepetu, J.A, Obi, O. and Amusan, A. 1984. (eds.). 1984. Soil Science Laboratory Manual. Dept. of Soil Science, O.A.U., Ife.
- Chand Ramesh and L.M. Pandey (2008). *Fertilizer Growth, Imbalances and Subsidies: Trends and Implications*, Discussion Paper NPP 02/2008, National Centre for Agricultural Economics and Policy Research, New Delhi.
- Jackson, M.L. (1973) Soil Chemical Analysis, Prentice Hall of India Pvt. Ltd. ,new Delhi.
- Lindsay, W. L. and Norvell, W.A. (1978) Development of DTPA soil test for Zn , Fe, Mn, and Cu. Soil Science Society of America journal, 42, 421-428.
- Piper , C.S. (1942) Soil and Plant analysis .The hassel press, Adelaide, p. 183.
- Sehgal ,J.L. (1987) Soil resource map of India 9 1;1 m scale) meeting the challenge. Soil Survey and Land Evaluation, 7 , 123-125.
- Singh, D., Chhonkar, P.K. & Pandey, R.N. 1999. Soil plant water analysis – a methods manual. New Delhi, Indian Agricultural Research Institute
- Sharma ,P. D. and Sarkar , A.K. (2005) Managing acid soils for enhancing productivity , NRM Division, KAB-II, Pusa Campus, New Delhi, Tech. Bulletin, 23 p.
- Subbaiah , B. V. and Asija, G.L. (1956) A rapid procedure for the estimation of available Nitrogen in soils , Current Science ,25,259.
- Velayutham , M. , Bhattachrjee, T. (2000) Soil Resources management. In yadav, J.S. P., Singh , G.B. (eds) Natural Resorce Management for Agricultural Production in India.
- Wollum, II, A.G. (1982) Methods of Soils Analysis (Part II) Chemical and Microbiological properties (A. L. Page et al. eds) American Society of Agronomy , Soil Science Society of America, Inc., Number 9, (Part 2) in the series, 2nd edition, Madison, Wisconsin, USA , p. 781-802.
