

WORKSHOP ON SOIL FERTILITY MANAGEMENT ACTIVITIES IN NEPAL

— PAST, PRESENT AND FUTURE —

Organized by
**Department of Agriculture
Soil Testing & Service Section
Japan International Cooperation Agency
Harihar Bhawan, Lalitpur, Nepal
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1. Introduction

It is frequently pointed out that the soil fertility is deteriorating year by year. During the last 25 years, crop production increased 79 %, while the population increased 83 %. the increase of crop production was mainly due to the expansion of cultivated land. The yield of major cereal crops was stagnant or rather declining during the past three decades. Nepal slid down from food exporter to net importer several years ago. To overcome the food crisis, the improvement of soil fertility plays very important role.

STSS and JICA jointly organized "Workshop on Soil Fertility Management Activities in Nepal ---Past, Present and Future---", on 11th June 1999 at Conference room of DPTC, Lalitpur. Soil scientists from STSS, RSTL and Fruit Development division participated. Other higher officials of CDD, DOA and MOA were invited. their valuable suggestions and comments were highly appreciated.

2. Objective of Workshop

To look back the soil fertility management activities of the past.

To pick up the problems in implementing the soil fertility management activities and find the countermeasure to conquer the problems.

Welcome address by G. P. Pandey, Chief, Crop Development Division, DOA

In his welcome address he has pointed out

- Major problems of soil fertility decline mainly due to decreasing organic matter in the soil.
- There should be proper and efficient channel for quality fertilizer distribution.

Directive speech from Chief Guest, J.C. Gautam, Special Secretary, MOA

- Soil which is natural resource, element of agriculture and base for agricultural growth emphasized in APP.
- There is scarce of organic manure in Nepalese Agriculture. chemical fertilizer is playing key role in our agricultural production whereas there is loss of fertilizer nutrients during storage and it's application by the farmers in the field so it should be minimized.
- Soil lab should be strengthened with essential equipment's and trained man power.
- Soil problems and recommendation should be identified according to physiographic unit rather than regional basis.
- Suggest to think towards the Japanese technical and financial support for soil fertility management.
- Research and Extension work should go on simultaneously.

Remarks of Chairperson, S. B. Aryal DDG (Administration), DOA

- Realized to improve organizational set up and additional manpower in STSS & RSTL to support the soil fertility management program efficiently.
- Lab activities increases for fertilizer analysis also so additional manpower most required.
- Results from soil analysis, output from demonstration should be diffused among the farmers.
- Fertilizer recommendation sheet should be improved so as farmers can easily understand

Suggestion from A. Jha, DDG (Planning), DOA

- Emphasize on mass scale green manuring to minimize adverse effect of chemical fertilizer
- Suitable technological packages to the pocket area enhance crop production.
- Soil fertility management technology should be disseminated to SMS, JT/JTA, farmers through soil labs, training center, soil campaign also.
- Suggest to link between STSS and GIS unit of MOA for GIS program.
- Monitoring should be done to the farmer either they follow or not the fertilizer recommendation send by soil laboratories.

Soil fertility management activities in past, present & future in Nepal

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Introduction

Soil management services in Nepal was started in 1958. After separation of NARC from Department of Agriculture in 1992 the services mandated as research and development work separately. Previously established soil testing laboratories are working for research under NARC and for development work five Regional Soil Laboratories later established in five development regions at Jhumka, Trisuli, Khairanitar, Khajura and Dhangadi and one central soil laboratory at Harihar Bhawan under DOA, which have been providing soil management services to the farmers.

Soil fertility management in past

In the early days, shifting and Mono Cropping Cultivation System was dominant and the farmers relied on long fallow periods with natural vegetation to recondition soil exhausted by cultivation. With the advent of rice and maize cultivation the up lands and low land agriculture system developed and livestock became increasingly integrated in to the farming system. Compost FYM becoming important source for supplying the nutrients requirement for up land (Bari cultivation). In the past the traditional rice grower did not rely on additional nutrient supplement in the common rice fallow system. The most significant change to agriculture was came with the introduction of winter wheat that fit nicely in to the rice fallow and maize fallow system. As the population continued to increase the demand on food grain expanded rapidly. Fields were traditionally fallowed in the winter had been used to graze live stock and in situ-manuring for maintaining the fertility of the crop land. The demand of compost also increased at the same time as the crop production area increased. With the introduction of quality seeds and chemicals in modern agriculture system, farmers rely more on chemicals (fertilizer and pesticides) without understanding the complexity of soil fertility management, unbalanced and unscientific use of chemical results soil fertility decline.

Past review on soil analysis

The past work compiled and summarized by D.L. Bajracharya as given below.

Table: 1. Soil fertility status of Nepal

<u>Nutrients \ rank</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>
Nitrogen	35.3%	59.1%	5.6%
Phosphorus(P)	30%	65.7%	4.2%
Potassium(K)	8.6%	67.1%	24.3%

Source: D.L. Bajracharya. Nutrient fertility status of Nepal. paper presented in 12th winter crops workshop, September 2-4, 1985.

Bajracharya categorized the districts as low medium and high as below for the major nutrients

Table: 2. Fertility classes of the zone /district with respect to Total nitrogen

Fertility status of soil			
<u>I. EDR</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>
Mechi	Jhapa	Illam. Panchthar. Teplejung. Sunsari. Morang. Terhthum.	-
Koshi	Dhankuta	Bhojpur. Sankhuwashawa.	-
Sagarmatha	Siraha. Saptari. Udayapur. Okhal dhunga.	Khotang. Solukhumbu.	--
<u>II. CDR</u>			
Janakpur	Dhanusha Mohotari. Sarlahi	Ramechhap. Sindhuli	Dolakha
Bagmati	Bhaktapur	Katmandu. Lalitpur. Kabhrepalanchok. Dhading Nuwakot. Sindhupalchok.	Rasuwa
Narayani	Bara. Parsa. Rautahat.	Makawanpur. Chitwan	

III. WDR

Gandaki	Gorkha	Shyanja, Lamjung, Tanahun Kaski, Manang.
Lumbini	Nawal parasi, Palpa, Rupandehi, Kapilbastu.	Arghakhanchi, Gulmi
Dhaulagiri		Mustang, Myagdi, Parbat Baglung.

IV. MWDR

Rapti	-	Salyan., Rukum. Dangdeuhkuri, Pyuthan. Rolpa	
Karnali		Dolpa, kalikot	Jumla, Humla
Bheri	Surkhet, Dailekh, Jajarkot.	Banke, Bardiya	

V. FWDR

Seti	Kailali, Bajura, Achham	Doti, Bajhang	
Mahakali	Kanchanpur		
71	25(35.3%)	42(59.1%)	4(5.6%)

Table : 3 Fertility classes of the zone /district with respect to Available phosphorus

<u>LEDR</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>
Mechi	Jhapa	Illam, Panchthar, Teplejung,	
Koshi		Sankhuwashawa, Terhthum, Bhojpur, Sunsari, Morang, Dhankuta	

Sagarmatha	Siraha, Saptari,	Khotang, Solukhumbu Udayapur, Okhaldhunga
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II CDR

Janakpur	Mohotari, Dolakha Sarlahi.	Dhanusha	Ramechhap. Sindhuli
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Bagmati	Bhaktapur	Katmandu. Lalitpur. Rasuwa Kabhrepalanchok. Dhading, Nuwakot Sindhupalchok.
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Narayani	Bara. Parsa. Rautahat	Makawanpur. Chitwan
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III. WDR

Gandaki	Tanahun	Shynja. Kaski. Lamjung Gorkha. Manang.
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Lumbini	Nawaiparasi. Palpa. Rupandehi. Kapilbastu Arghakhanchi	Gulmi
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Dhaulagiri		Mustang	Myagdi.	Parbat
		Baglung.		

IV. MWDR

Rapti		Salyan. Pyuthan. Rukum. Dangdeuhkuri. Rolpa.
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Karnali	Jumla	Kalikot
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Bheri	Banke. Bardia.	Surkhet. Dailekh. Jajarkot.
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V. FWDR

Seti	Kailali.	Doti, Bajhang Bajura, Achham	
Mahakali 70	Baitadi 21 (30%)	Kanchanpur 46 (63.71%)	3 (4.29%)

Table : 4. Fertility classes of the zone /district with respect to Available potassium

<u>LEDR</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>
Mechi	-	Jhapa	Ilam, Panchthar, Taplejung
Koshi		Dhankuta, Sunsari, Morang, Sankhuwashawa	Terhthum, Bhojpur
Sagarmatha	Siraha.	Udayapur, Khotang.	Saptari, Okhaidhunga, Solukhumbu
<u>II CDR</u>			
Janakpur		Dhanusa, Mohotari, Sariahi, Dolakha, Sindhuli.	Ramechhap.
Bagmati		Lalitpur, Bhaktapur, Kathmandu, Dhading, Nuwakot, Rasuwa.	Kavrepalanchok Sindhupalchok
Narayani	Bara, Parsa, Rautahat Chitwan		Makawanpur

III. WDR

Gandaki	Tanahu, Shynja, Kaski Lamjung, Manang, Gorkha.
Lumbini	Gulmi, Nawalparasi, Palpa, Rupandehi, Kapilbastu, Arghakhanchi
Dhaulagiri	Mustang, Myagdi, Parbat, Baglung.

IV. MWDR

Rapti	Salyan, Rukum, Dangdeuhkuri.	Pyuthan, Rolpa
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Karnali	Jumla	Kalikot
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Bheri	Banke, Bardia, Surkhet, Jajarkot	Dailikh
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V. FWDR

Seti	Achham	Doti, Bajhang, Bajura, Kailali
Mahakali	Baitadi, Kanchanpur	
To	5 (8.6%)	47 (67.1%) —47 (24.3%)

Fertility status of Western Development Region

Jaishy 1991, reported the following fertility status of western development region .

Table 5. Soil reaction

Acidic	Alkaline
Mygdi, Baglung, Parbat, Kaski, Shyanja	
Gulmi, Arghakhanchi.	Mustang, Rupandehi, Kapilbastu, Manang,

Table 6. Nitrogen status of western development region

Low	Medium	High
Baglung, Kaski, Shyanja Rupandehi, Kapilbastu, Manang Tanahu, Gorkha, Nawalparasi, Palpa, Gulmi, Arghakhanchi, Mustang	Parbat, Lamjung, Myagdi,	-

Table 7. Available Phosphorus status of western development region

Low	Medium	High
Baglung, Kaski, Shyanja, Parbat, Lamjung, Rupandehi, Kapilbastu, Tanahu, Gorkha, Nawalparasi, Palpa, Arghakhanchi, Mustang	Gulmi, Myagdi	Manang

Source: Jaishy, *Impact of Soil analysis recommendation to farmers by Soil Lab WRATC, July 1991*

Note Phosphorus content of western development region is low to medium

Micronutrient status of soils in Nepal

Micronutrient status of soil a global study report published by FAO

According to that study the fertility status of the study area is as below

Table 8 Micro nutrient status of soil of Nepal.

Micro nutrients	Nepal	International
Boron Mg/l	0.19	0.73
Manganese Mg/l	22.7	34.7
Molybdenum Mg/l	0.063	0.210
Zinc Mg/l	0.38	197

Source: (FAO Soil bulletin 48 By Mikko Sillanpaa)

The most evident Micronutrients deficiencies in Nepal are those of B & Zn (FAO report)

According to Carson (1992) Zinc, Boron, Manganese, Molybdenum, Copper and iron deficiency have been found in some cereals, vegetable and fruits crops.

Current fertility status of Nepal: Jaishy et al. compiled the soil analysis data from all regional soil testing laboratories and provide the current fertility status of Nepal. These data's are very few so it can generalized the fertility trend of the country.

Table : 10. Current fertility status of Nepal

<u>Nutrients</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>
Nitrogen	69%	28%	3%
Phosphorus	30%	65.7%	16%
Potash	12%	46%	42%

Note : Range of phosphorus is very wide 1kg /ha to 2000kg /ha

pH	42% acidic	40% Neutral	18% Alkaline
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If we compare the past and present soil fertility status. Nitrogen content of soil is declining order.

Traditional Soil fertility management Practices which are being practicing

Terracing , slicing the bond and the walls of the terrace riser, leaf and in situ green manuring, bringing first flood water into the field, use of FYM, compost , oil cake, etc. Shifting herds for in- situ terrace manuring. Use of legume as a sole crop, or as a mixed crops, use of weeding weeds in the same field or as a animal bed for composting, use of crops residues, crop rotation , mulching, mobile herds etc are the traditional soil fertility management practices.

Concept of soil management services in IXth Plan

- Improve the System of manure and fertilizer used
- Capacity building of Soil labs as per the needs.
- Tied-up soil management program with Agri- extension activities, and compulsory soil testing and fertilizer recommendation has given priority in implementation of package production program

The programs being conducted by STSS are:

The Soil Testing and Service Section, for the sake of effective launching of its diversified activities, has formed following three service units.

- Soil Chemistry and Plant Nutrition Unit
- Soil Survey and Land Evaluation Unit
- Soil Fertility and Microbiology Unit

Program and Activities

Supervision, monitoring and follow up of

- Soil analysis and management activities conducted by the regional labs.
- Green manuring and biofertilizer activities conducted at district level.
- Soil campaign activities.

Study and report making on

- Use of compost at farmers level :-
- Micronutrients deficiencies Survey

Soil survey and land evaluation Programs

- Soil survey and study of local resource bases.
- Contribute to the bottom-up approach of agriculture planning by providing land resource information and necessary soil database.
- Creation and preservation of soil database based on survey, resource monitoring and land evaluation studies.
- Fertility mapping and its use for soil services.

Soil fertility and Microbiology Programs

- Technology transfer and demonstrations regarding macro and micronutrient fertilizers, green manure, compost, agriculture lime and new fertilizer materials in IPNS concept.
- Development & execution of program for optimum use of slurry from bio-gas plant
- Initiation of bio-fertilizer program in the feasible pockets
- Monitoring soil fertility situation in the country.

Soil Test and Recommendation Programs

- Soil analysis in the laboratories, based on systematic sampling techniques and recommendation of fertilizer based on test results.
- Help soil analytical work in the District Agriculture Development Offices by using soil testing kit.
- Soil analysis for Soil problem identification and recommendation for correction
- Promote soil SIBIR (campaign) and MATO SAPTAH in quantitative and qualitative basis to provide field level soil services.

Programs being launched by the Regional Soil labs:

- Soil analysis and fertilizer recommendation in lab.
- Monitoring and supervision of
 - Soil fertility related activities conducted by District Agriculture Development Offices (DADOs)
 - Soil analysis and manure recommendation conducted by DADOs.
- Demonstration on
 - Micronutrient use
 - Green manure use
- Study on micronutrient deficiency problems.
- Preparation of soil fertility maps in co-ordination with STSS.
- Conduct soil campaign
- Services on soil management.
- One-day training to farmers in co-ordination with DADOs.
- Publication of annual report and Study reports.

Achievement:

- Central Lab have build up capacity for fertilizers and micronutrients analysis in addition to routine analysis of N.P.K.OM, pH, Texture etc.
- GIS is in way of establishment.
- Officer's training for Soil analysis, Soil management, Soil survey and mapping and Fertilizers analysis have conducted.
- Soil Fertility Maps of 6 districts(north -eastern part of Jhapa, Bhaktapur, Nuwakot, Bardia, Kailali and Kanchanpur) have produced.
- Soil campaign have conducted.
- A workshop on Soil Fertility Management has conducted.

- Publications :
 - Annual reports with finding of studies
 - Working procedure of workshop' Soil Fertility Management program'.
 - Use of compost at farmers level in different four districts
 - Soil campaign why and how (in co-operation with JICA)
 - Integrated Plant Nutrient System (in co-operation with JICA)
 - Use of manure and fertilizers for soil fertility increment (in co-operation with JICA)
 - Soil sampling technique (in co-operation with JICA)
 - Azolla leaf-let (in co-operation with JICA)
 - Hand book of soil fertility management (in co-operation with JICA)

Study findings:

In study areas (Dhankuta, Kathmandu, Nawalparasi, Chitwan, Tanahu, Kaski and Parbat) farmers were using organic as well as Chemical fertilizer but application rate of organic manure was too low (<10 doko ropani or 250 kg/ ropani), no potassium fertilizer was in use, proper composting technique was not in practice, no used of starter in composting, compost turning practice was found rare and use of compost was not found in proper way.

Zinc and Boron deficiencies were found the major problem in paddy and vegetable fields. Micronutrients fertilizers used by the farmers are:

Multiplex, Agromin, Suryazinc, Microplex, Graphicon, Zinc chelate, Vegimax, FertiminZ, FertiminB, Zinc sulphate, Borax, boric acid etc. It is realized that the use of micro nutrients, without knowing its quality is not very convincing. So research finding and recommendation of some familiar micronutrients were collected and advised to use the reliable micro nutrients fertilizers for the correction of deficiencies.

Future Strategy

It is important to let the farmer to decide what he wants to do for his soil management and let him integrate it within his own system. Based on the research works, experience gained in the past and country's need, following strategy is formulated:

- Identification and introduction of soil fertility management program in the production package that are interesting for the farmer and which have long term beneficial effects.

- Formulation of location specific soil management programs to enhance agricultural productivity and tied-up with package production program.
 - Separate soil management strategies for subsistence and commercial agriculture as APP is dictated.
- (i) 'Demand driven' Production system of less accessible hills and mountainous is supported by use of available fertilizer and the improvement of their traditional integrated system of agriculture, livestock and forest.
- (ii) "Technology driven" green revolution has been emphasized on the Terai and in the easily accessible valley of Nepal by supporting increasing chemical fertilization and mass scale of green manuring along with bio-fertilizer use.
- Soil management program need to focus on the small farmers, which contribute more in Nepalese agriculture. In this connection, special programs need to be run for sustainable soil fertility management based on the study of location specific needs and opportunities.
 - Promote *Integrated Plant Nutrient System (IPNS)* technologies to the farmers on sound environmental ground and maximum use local resources on sustainable basis. This includes the activities on green manuring, compost/ FYM management, use of micronutrients, use of fertilizers and development of alternative source of fertilizer as cultivation of fertilizer crops and management of slurry comes from biogas plants.
 - Carry out necessary surveys for soil inventory creation, fertility evaluation, land use monitoring and feasibility analysis to help program planning, execution, monitoring and identification of location specific soil service needs.

Constraints and Opportunity

Constraints

OM depletion

Opportunities

- Increase biomass
- Inclusion of legumes
- Adopts suitable cropping pattern according soil
- Use biogas for fuel and slurry for plant nutrition
- Use green manure
- Use plant residue as a manure
- Mulching the fruit plants
- Encourage the integrated plant nutrient system (IPNS)
- Follow crop diversification
- Emphasise on quality compost.
- Launch dung save programs
- Aware the farmers for night-soil use in their field

Acidification

- Ameliorate the soil with lime
- Discourage acidic fertilizer

Erosion/
vulnerability

- Agro forestry
- Promotion of forestation
- Hedge grow
- Alley cropping
- Contour planting
- Cropping pattern according to land suitability
- Agronomy practices (minimum tillage)

Siltation

- Use quality water
- Construction of desilting basin

Degradation of
forest and Marginal
land

- Reforestation
- Use of high value crops e.g. horticultural plantations, medicinal herb plantation.
- Develop legume pasture

Crop Intensification

- Use of azolla in paddy field
- Use green manuring as a relay crops in maize.
- Use mixed crops with legumes.
- Follow IPNS
- Use balance dose of manure and fertilizer
- Use micro nutrients especially Zinc in paddy and boron in vegetable

Mono-cropping for long period	<ul style="list-style-type: none"> - Create crop rotation with suitable legume
Unbalance and inadequate use of manure and fertilizer	<ul style="list-style-type: none"> - Use balanced and recommended dose of manure and fertilizer. - Use quality fertilizer - Create suitable fertilizer rating for various crops
Quality fertilizer	<ul style="list-style-type: none"> - Regular monitoring - Law enforcement - Aware the farmers about the quality fertilizer - Develop mechanism for quality fertilizer and making the lab strong and adequate manpower to analyse the quality fertilizer
Desertification	<ul style="list-style-type: none"> - Use Cover crops - Check the soil erosion - Aforestation - Create Irrigation facilities - Plantation of fodder trees and fruit plants - Medicinal herbs - Pasture development
Environmental protection	<ul style="list-style-type: none"> - Use recommended dose of fertilizer - Proper recycling of city waste - Efficient use of fertilizer to reduce the leaching and volatilization losses
Swampy land Management	<ul style="list-style-type: none"> - Drainage management - Plantation of highly water demanded plants
Red soil management	<ul style="list-style-type: none"> - Manage the soil providing high dose of organic manure - Correction of pH

Recommendations:

The above mentioned programs in future strategy are mandatory as per the national needs and the directives of APP. Expansion of these programs is justifiable so as to increase the area coverage of soil services.

Organizational Setup and Manpower Development Soil Testing Service Section under DOA has to be strengthened and made responsible to promote IPNS technologies to the farmers. however full capacity of this section is yet to develop.

On the basis of analysis and discussion done by the experts working in Soil fertility, it is strongly felt the need of correction of present unbalanced manpower structure and the section need to be uplifted into *Land and Soil Service Division* with provision of optimum number of trained manpower and adequate lab facilities.

Provision for lab allowance:

There should be provision for lab allowance to encourage the lab technicians to work effectively.

Conclusion:

Soil Fertility decline is one of the major problem in agricultural production system in Nepal. which need to be improved in order to increase productivity of land resources by using opportunities stated above. To tackle the mentioned constraints the regular conducted program of HMG/N may not be enough. because of the fact HMG has many more national prioritized programs in other fields. So. external assistance is urgently needed to cope with these problems.

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workshop of Soil Fertility Management Activities in Eastern Development Region (Nepal)

Past, Present and Future

Friday, 11 June, 1999

MR. N. L. URAC.

CHIEF

RESTL, THUMKA

1. Introduction :

Agriculture is the main stay of economy in Nepal providing livelihood for more than 80 % of the population. Population growth rate is 2.5 % while growth rate on food grain is 2.3 % over the period 1980/81 to 1990/91. The additional food production achieved so far is attributed mainly to the expansion in the agricultural land rather than increase in yield/unit of land. More and more of marginal land have been brought under cultivation and there is very little chance to increase cultivable land so the food crisis must be resorted by raising the productivity of existing arable land. Among the different means of increasing productivity, soil fertility management is one of the key factors. Therefore improvement of soil fertility and increased plant nutrient supply through all possible means like organic and inorganic resources and biological sources must be enhanced for increased food production and farmers income.

REGIONAL SOIL TESTING LABORATORY - HUMAN VILLAGE
SOIL FERTILITY MANAGEMENT IN EASTERN DEVT REGION

Dr. P. Hema Chitra

PGD, Tumkur

Fertility status of Eastern Devt. Region

pH (1107)

Total sample: 1107

Acidic: 65.67%

Neutral : 11.38 %

Alkaline : 22.95%

Organic Matter (1107)

High : 1.15 %

Medium: 21.39 %

Low : 71.16 %

Nitrogen (1107)

High : 6.86 %

Medium: 28.54 %

Low : 64.60 %

Phosphorus (1107)

High : 52.03 %

Medium: 23.53 %

Low : 21.39 %

Potash (1107)

High : 28.10 %

Medium: 33.66 %

Low: 33.24 %

Fertility Status of Hill of Eastern Devt Region.

pH (194)

Acidic= 86.60 %

Neutral = 10.30 %

Alkaline = 3.10 %

Organic matter (169)

High : 9.17 %

Medium : 53.84 %

Low : 36.69 %

Nitrogen (194)

High: 22.70 %

Medium: 54.60%

Low: 22.70 %

Phosphorus (194)

High : 73.20 %

Medium : 15.98 %

Low: 10.82 %

Potash (194)

High: 62.37 %

Medium: 24.74 %

Low: 12.89 %

Soil Fertility status of Terai of Eastern Devt. Region

pH (913)

Acidic= 61.23 %

Neutral = 11.61 %

Alkaline = 27.16 %

Organic matter (651)

High =2.76 %

Medium= 16.74 %

Low= 80.50 %

Nitrogen (913)

High = 3.50

Medium =23.00 %

Low = 73.50 %

Phosphorus (913)

High = 47.53 %

Medium = 25.20 %

Low = 27.27 %

Potash (913)

High = 20.81 %

Medium = 41.62 %

Low = 37.57 %

Regional Soil Testing Laboratory, Trishuli, Nuwakot

Soil Fertility Management in Central Development Region

Introduction

Regional Soil Testing Laboratory, Nuwakot has been providing services on soil fertility management in 19 districts of central development region since 1994. In the beginning, few tests such as P.H. OM, Nitrogen were done due to lack of machinery. After that, analysis such as PH, OM, Nitrogen, Phosphorous, Potash, texture have been done by laboratory method.

Fertility Status of Central Development Region

PH : (1005)

Total sample :- 1003
 Acidic: 73%
 Neutral: 23%
 Alkaline: 4%

Nitrogen(1002) Potash(

Low:	38%	Low:	31%
Medium:	55%	Medium:	41%
High:	7%	High:	28%

Organic Matter(1003)

Phosphorus:

Low: 51%
 Medium: 45%
 High: 4%

Low: 25%
 Medium: 28%
 High: 47%

Fertility Status of Hill of Central Development Region

PH(748)

Acidic: 87%
 Neutral: 12%
 Alkaline: <1%

Organic Matter(748)

Low: 54%
 Medium: 42%
 High: 4%

Nitrogen(748)

Low: 39%
 Medium: 52%
 High: 9%

Phosphorus(534)

Low: 24%
 Medium: 25%
 High: 51%

Potash(502)

Low: 24%
 Medium: 39%
 High: 37%

Fertility Status of Terai

PH(255)

Acidic: 31%
Neutral: 53%
Alkaline: 16%

Organic Matter(255)

Low: 44%
Medium: 55%
High: 1%

Nitrogen(255)

Low: 33%
Medium: 65%
High: 2%

Phosphorus(249)

Low: 27%
Medium: 34%
High: 39%

Potash(245)

Low: 47%
Medium: 42%
High: 11%

Soil Campaign

This programme has been conducted in all district except Citwan since last year. Forty compaign have been completed and 2855 samples have been analyzed in which 1948(68%) acidic, 769(27%) Neutral and 138(5%) alkaline soil have been found.

- Most of the hill district soil are acidic.
- Terai district have Neutral to Alkaline soil

Study of Micro Nutrient Deficiency

It has been conducted in ail districts of the region and following conclusion has made

- Most of the rice growing areas found deficient in Zn.
- Boron deficiency has found in crops like cauliflower,radish,tomato, ~~cabbage~~ and some variety of wheat.
- Molybdenum deficiency has also found in cauliflower.

Zn demonstration in rice

It was conducted in Nuwakot ,Dhading, and Sarlahi districts. It has been found better crop i.e. not showing deficiency compare to adjacent field.

Green Manuring Demonstration(Block)

Conducted area: Bara, Sarlahi, Bhaktpur, Nuwakot,Sindhupalchowk,Chitwan,Parsa

There is positive result in yield and properties of soil..According to DADoffice, on an average 20 to 25 percent yield increment.

Lime Demonstration (F/Y052/053 & F/Y 053/54)

This programme was conducted in various area of districts having acidic soil in Nuwakot, Dhading and Kathmandu with close cooperation of DADO office. Farmers are positive on crop growth and cultivation practices.

Boron demonstration on vegetable and wheat

Boron demonstration was conducted in vegetable (cole crops) in Nuwakot, Dhading, Lalitpur, Dolkha and Kathmandu. Positive result on correcting deficiency. Similarly, It was demonstrated on wheat with recommended dose of fertilizer (100-50-25)

Better result was found with 0.5% foliar application in wheat variety such as UP262, NL251, and NL297.

Fertility Map of Nuwakot District

In F Y 2054/55 Fertility Map of Nuwakot was prepared with close cooperation of Soil Testing and Service Section. The map shows the fertility status of the district.

Training to Junior Technician

Training on Soil Fertility Management to the Junior Technician of all DADO office has been conducted and they are trained

Others:

- Technical services on soil fertility management has been provided to farmers of different districts of this region.
- In F. Y 2052/53, seed production of Dhaicha in 10 ha was conducted and distributed to the farmers of different districts.

Problems:

- Lack of both technical (chemistry & Management) and administration (accountant, Kharidar, typist/computer operator and Peon/guard).
- Though programme has to carry in various districts of the region; it is necessary to have vehicle in order to accelerate the programme.
- We have problem of water supply. We have already bought water meter but due to lack of fund we could not able to connect water supply.
- Due to interruption in current supply a lot of problem have been raised in soil analysis. Therefore, provision of generator in all laboratory should be made in order to tackle the problem

Soil Fertility Management Activities in Western Development Region

Friday, 11 June 1999
Padam Prasad Adihikari
Asst. Soil Scientists
RSTL, Khairanitar.

INTRODUCTION:

This laboratory is situated in (Khairanitar) Tahahun district of western development region of Nepal . It is situated 22 Km. west from the district head quarter Damauli and 27 Km. east from the Regional headquarter Pokhara. This laboratory covers 16 district of Gandaki, Lumbini, and Dhaulagiri zones.

It has established under the department of Agriculture in 2049 B.S. It is working under the technical supervision of soil testing and service section of department of agriculture and administrative direction of regional directorate of Pokhara .

OBJECTIVES

The main objectives of this laboratory are :

1. Recommendation of agriculture lime on the basis of soil testing results.
2. Recommendation of chemical as well as organic manure on the basis of soil testing results.
3. To conduct soil campaign on different districts.
4. Technology transfer to the farmers and extension workers recently generated by the research.
5. To conduct field related programs like soil fertility for conservation of crop nutrients, lime demonstration, green manure demonstration etc.
6. Micronutrient problem survey.
7. Making soil fertility map with collaboration with central office (STSC)
8. Technical supervision of problematic areas and recommendations.

Main functions performed by this laboratory.

(a) soil test:

This laboratory has tested about 2100 soil samples. Soil testing report justify that the majority of the soil of this region is acidic (about 65%), 34% neutral and 1% basic reaction . This result says that there is great need of agricultural lime. Nitrogen content of the soil is medium to low and the content of phosphorus and potassium is good. But the organic matter content of the soil is very poor. The soil test data are presented in the following table.

pH			N content			P ₂ O ₅			K ₂ O			Organicmatter		
Acidic	Neutral	Basic	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	medium	High
65%	34%	1%	33%	55%	12%	34%	22%	44%	6%	31%	61%	43%	50%	7%

(b) Micronutrient Survey:

Study on micronutrient survey reveals that the micro-nutrient content of the soil is very poor, in Terai as well as hilly region. Zinc deficiency is prominent in rice, boron and molybdenum in cole crops as well as radish. Micronutrient study results convey that there is great need of application of micro-fertilizers in the land. The test were conducted in Magdi Parbat, Baglung, Rupendehi and Nawalparasi districts of this region.

(c) Green manure demonstration:

This laboratory has conducted green manure demonstration in different districts. Green manure demonstration program become very popular and farmers are convinced for the use of green manuring .Among green manuring crops Dhaincha and Moongbean become very popular in farmer's field From the results given by the farmers reveals that the production of rice was increased about 20% by applying green manure.

(d) **Agriculture lime demonstration:**

It was found that the production of crops was increased by 25% in different crops by the use of agriculture lime. The result was taken from six demonstration conducted in the Tanahun and Baglung districts in accordance with the soil test results.

(c) **Rhizobium culture demonstration:**

This was tested in the lentil crops and found that the production of lentil was increased by 8 Kg/Ropani in comparison with lentil crops having no rhizobium culture. The data was taken from 10 demonstration conducted in the Tanahun and Kaski districts.

(f) **Follow up soil testing program:**

Regular follow up of the programme reveals that the farmers are suffering from unavailability of agriculture lime and chemical fertilizers. They are convinced for the use of green manuring crops and compost. Farmers are benefited from the soil campaign and the perception of farmers towards the use of lime is positive. Due to quick soil test result from soil campaign this programme become very popular.

REGULAR PROGRAM

(a) **Soil testing:**

This is the regular program of this laboratory. This laboratory is testing pH, N, P, K, o.m. and texture. The target program of testing soil is 500 samples. Samples are collected from DADO office, direct from farmers and the staff of RSTL.

(b) **Soil campaign :**

This is the very important program. Farmers are very interested to check soil in soil campaign. pH and o.m. are testing in soil campaign and results are directly distributed to the farmers. Soil campaign are conducted with joint co-ordination of DADO office and RSTL.

(c) **Micro-nutrient deficiency study program:**

RSTL staff goes to the different and survey the micro-nutrient deficiency symptoms of different crops. They suggest the farmers for applying micro-nutrient fertilizer, if they found the deficient symptoms. From this study it was found that Boron, zinc and molybdenum deficiency symptoms are prominent in different districts.

(d) **Fertilizer quality test:**

This test is recently started in this laboratory. This is very important function of RSTL. For quality control aspect this step is very important. But when we check samples and found less quality, there is no authority to arrest fault Businessman. Soil scientists give authority and should make them powerful, so that the quality control of chemical fertilizer program could run efficiently.

(e) **Follow up of program:**

RSTL. regular follow the ongoing and past soil management activities.

FUTURE PROGRAMME:

- (i) Soil test (pH, N, P, K, o.m. & micronutrients)
- (ii) Fertilizer quality test.
- (iii) District soil map preparation in co-ordination with central lab.
- (iv) Soil campaign
- (v) Monitoring of soil related programs conducted by DADO.
- (vi) Technical supervision of problematic areas and recommendations.
- (vii) Technology transfer and demonstrations regarding macro and micronutrient fertilizers, green manure, compost, agriculture lime and new fertilizers materials in IPNS concept.
- (viii) Conduct various soil based training for manpower development.

CONSTRAINTS:

- (i) Defective organizational set up and manpower.

GAZ III	(2)
Non GAZ I	(3)
Non GAZ III	(1)
Peon (1)	
Total	(7)

- (ii) **Dual responsibility of RSTL:**
RSTL is under the administrative control of Regional Agriculture Directorate and technically under the STSC. This dual responsibility often causes problems in launching the programs.
- (iii) **Limited physical facilities:**
a) Mobility: RSTL has not any vehicle facilities to support the programs in districts and at the field level.
b) Residence: It is under RATC.
- (iv) **Provision of allowance:**
There is no separate allowance for working in the lab. Working in lab is risky and hazardous to the health.

RECOMMENDATIONS:

- (a) **Organizational set up and manpower:**
The present organization is unscientific. There should be provision of soil scientists, sub-accountant, typist and watch man.
- (b) **Single line of command:**
Regional soil testing laboratories, technically and administratively should be under one line of command that is STSC.
- (c) **Physical facilities:**
i) Residence: The quarters should be handed over to RSTL. Khairanagar from RATC.
ii) Mobility facility: Mobility facilities are essential to improve the quality of an ongoing program and to increase the service area coverage. So soil lab should have at least one vehicle to launch the program effectively.
- (d) **Provision of lab allowance:**
There should be at least 25% lab allowance to encourage the lab technicians to work effectively.

CONCLUSION:

Soil fertility management is the important aspects for increasing agriculture production. The fertility status of our soil is declining day by day. We should manage our soil in such a way that the fertility status goes up. For this purpose organic matter plays a vital role. For increasing organic matter content green manure, compost, Azolla and night soil should be used properly. Unavailability of Dhaincha seed is a major problem for green manuring. So the seed multiplication area of Dhaincha seed should increase. Farmers should be encouraged for the use of Biogas so that the night soil is properly utilized. Rhizobium culture should be available in all districts. Unavailability of agricultural lime is a major problem for pH correction. So the distribution system of agricultural lime should be changed. Chemical fertilizer should be easily available in the market, so that farmers purchase when they want. If we manage the above mentioned things, the fertility status of soil will go up.



Soil Fertility Management Activities in Mid-Western Region

Bharat Mani Adhikari^{*}
Asst. Soil Scientist

Introduction:

Many Scientists, Planners and farmers themselves experience and believe that the Soils of Nepalese arable lands are not as fertile as they were before. Declining Soil fertility is natural Phenomena when we grow food and fiber crops and depleted amount plant nutrient are unless replenished by any means. The soil that produces food and fiber crops, is formed so slowly that it is considered to be non-renewable resource. Soil fertility includes all the physical, chemical and biological properties of the soil that influence the productivity of land resource. The soil fertility management objectives include both using the soil for human welfare and maintaining its productive capacity. The long-term soil fertility maintenance is of great concern than the short term increase in productivity.

Mid- Western Development Region covers 15 Districts of Bheri, Rapthi and Karnali Zones. These are: (i) Terai and Inner-terai- Banke, Bardiya, Dang (ii) Mid-Hills- Dairekh, Jajarkot, Rukum, Rolpa, Pyuthan, Sulvan, Surkhet (iii) High Hills- Jumla, Humla, Mugu, Kalikot, Dotpa. The total cultivated land in the region is 427995 ha. (Bout 10 percentage land area in the region). Only 112333 ha. (About 26 percentage of cultivated land) is irrigated. More than 90 percentage population is engaged agriculture.

The high hills are potential for deciduous fruits- apple, walnut, peach and plum, apricot etc. And maize, wheat, barley, millets, potato and some beans are important agronomic crops grown in high hills maize, wheat, rice, millets, Barley, rape seed, pulses are major food grain crops and orange, pear, lemon, vegetables and vegetable seeds are important horticultural crops grown in the mid hills in this region. Rice, wheat, maize, pulses, grain legumes, potato, cotton, vegetable's, Mango, Litchi, banana are important agricultural crops in the plains of Terai and Inner-terai.

Soil fertility status in Mid-Western Region

After the establishment of Regional Soil Testing Laboratory at Nepalgunj in 1981 BS it has provided soil test service and Soil fertility and fertilizer management recommendations for the farmers in the region.

Total of 1232 Soil samples were analyzed in the laboratory. Out of 1232 samples, 252 samples were from hills and 980 samples were from plains. The results of soil analysis are presented in table-1.

^{*} Regional Soil Testing Laboratory

Table-1
Soil fertility status in Mid- Western Region

Physiographic Region	No. Of Samples Analyzed	Soil Reaction (pH)			O.M. Content			Nitrogen			P ₂ O ₅			K ₂ O		
		Acidic	Neutral	Alkaline	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Plains	980	304 (31%)	372 (38%)	304 (31%)	780 (80%)	171 (17%)	29 (3%)	770 (79%)	181 (18%)	29 (3%)	489 (50%)	210 (21%)	251 (26%)	609 (62%)	181 (18%)	190 (20%)
Hills	252	102 (40%)	92 (36%)	58 (21%)	160 (63%)	70 (28%)	22 (9%)	132 (52%)	95 (38%)	25 (10%)	154 (61%)	54 (21%)	44 (18%)	137 (54%)	67 (27%)	48 (19%)
Total	1232	406 (33%)	464 (38%)	362 (29%)	940 (76%)	245 (20%)	51 (4%)	902 (73%)	276 (22%)	54 (5%)	643 (52%)	294 (24%)	295 (24%)	746 (61%)	243 (20%)	233 (19%)

Source :- RSTL, Nepalgunj

33 percentage were acidic 38 percentage soil were neutral and 29 percentage soil were alkaline reaction. The range of Soil pH was from 4-10. 76 percentage soil were low in organic matter content. 73 percentage soil were low in nitrogen content. 52 percentage soil samples were low in available phosphorus content. 61 percentage soil contained low level of available iron above results the fertility status in the Mid-Western Region is low.

Besides, rapid soil test services are being provided by Regional Soil Testing laboratory. Soil test campaigns are conducted in the fields in collaboration with District Agriculture Development Offices and Soil samples are tested by soil testing kit. The soil test results and recommendations are given to the farmers in the field. The results of soil test campaign are presented in table -2

Table 2
Results of Soil test campaign

No. Of Samples	Soil Reaction			Nitrogen			Low	P ₂ O ₅		K ₂ O		
	Acidic	Neutral	Alkaline	Low	Medium	High		Medium	High	Low	Medium	High
2330	608	964	748	1577	615	128	1277	832	211	1632	397	241
Percentage	26%	42%	32%	68%	27%	5%	55%	36%	9%	73%	17%	10%

Source: RSII, Nepalgunj

✓

Similar results were obtained by kit method in the field about 28 percentage Soil samples were to be acidic. Most of the analyzed soil samples contained low level of nitrogen phosphorus and potassium.

From above results it is obvious that the fertility status of the cultivated soils in Mid- Western Region is low soil were found deficient in major nutrient elements i.e. Nitrogen, Phosphorus and potassium. Such poor soils can not support the increased agricultural productivity.

Soil fertility Management Activities

Soil fertility management is give and take system Because without nutrient supply yields of crop plants can not be expected. Soils are the medium for plant growth. Natural fertility of the Soil can not produce much to fulfill the present demand. Therefore, we must apply required amount of plant nutrient and soil amendments to the soil to achieve satisfactory yield.

Major nutrient elements like nitrogen, phosphorus and potassium are deficient in most soils and are responsible for decreased yield. Besides, Some micro nutrient are also deficient zinc deficiency in rice and maize and citrus in senous and Boron and Molybdenum deficiency are common in vegetables. Application of zinc in rice as fertilizer is advisable.

The application rate of organic matter in the field is decreasing. Green manuring is done in limited scale. Farmers apply very low levels of chemical fertilizers.

We have not returned to the soil whatever the amount we harvest from the soil. Unless equilibrium is maintained in between harvesting form and incorporating into the soil the soil fertility of the soil and productivity of the crops can not be increased.

Suggested Soil/Fertility Management Strategies

1 Soil Reaction

Most of hill soils are acidic. Acid. Soils are to be limed. Liming of acidic Soils is essential as it affects nutrient availability. Problems of unavailability of agricultural lime in the hills must be solved.

2 Soil Organic Matter

Most of the cultivated soils contain low organic matter. Organic matter plays vital role in soil fertility management and crop productivity. Increase in Soil organic matter is necessary. For this-

- Stop burning of farm yard manure by making dung cake
- Green manuring with *Sesbania* s.p and *Crotolaria juncea* can add huge bio-mass to the soil relatively in short period wherever there is irrigation facility. Seed production of green manuring crops should be accelerated.
- Crop diversification and crop rotations with legumes are helpful to sustain soil fertility.
- Use of appropriate strain of microbial fertilizer help increase crop growth.

3 Use of chemical fertilizer:

Farmers do not apply balanced dose of chemical fertilizer for satisfactory crop yield, balanced dose of chemical fertilizer is necessary

Soil fertility management activities in Far Western Development Regional of Nepal¹

Kunwar M. N.²

Introduction:-

Nepal is being a country of farmers, whom, main occupation is agriculture. No doubt, without improving the Agriculture productivity, the promotion of economic & nutritional status of Nepalese people is seems to be impossible.

There are many components in increment of Agriculture production with limited land resources. Among those, soil and its fertility is one of the valuable and basic components of Agriculture production. Previously soil services sector had been neglected in our country, while there were many organizational rearrangement in DOA had been done, but no one had taken interest about the soil service sector.

Some of the soil program had been conducted by the soil units of Farm & stations, but they were mainly concentrated in research, not directly involved in soil services for farmers.

In the latest organizational rearrangement of DOA, And separation of NARC provides the circumstances to create soil service program in DOA

So that soil testing service program and it's sub-ordinate institutions e.i. RSTL are born in BS 2051

First 2 years were used as years of establishment. Our real soil testing services has been started from BS 2053/54.

Therefore it is one of the newly born institution, that is why, it has few field & lab activities, which were lunched with its limited physical & human resources and they are presented here in brief.

Discussion

1. Agri-lime demonstration:-

This program was conducted in three districts of this region as given in table No. 2 The increment in grain yield has found 17.4-23.9% and its mean was 20% only over control plot.

2. Green manuring demonstration

It was conducted in different forms in last four years and different districts as shown in table No.3. Besides it the green manuring minikit was also distributed in Tarai districts (kailali & kanchanpur) and it's no was 24 & 20 respectively. It was a special program fully supported by soil testing service program during 2052/53

The effect of green manuring was found better than non G.M. plots in terms of crop growth, yield and some positive effect on soil physical condition.

3. Technical services (training)

This program was conducted in various districts in different years by RSTL to field technicians of D.A.D.O. to improve their analysis and other soil management actives. It might have promoted their knowledge and skills in implementation of soil service activities specially soil testing kit operation and identification visual soil problems.

¹ Paper presented in "Soil Fertility Management Workshop" held on 28 Jestha 2056

² Asst. Soil Scientist, Regional Soil Testing Lab Dhangadhi, Kailali.

4. **Model compost- demonstration**

It was conducted in previous years in different districts of this region, which is given in table no.5

In this program it was demonstrated how to make better use of Farm refuses and focus on its importance in making clean environment. To prepare composts by local materials in rural area to promote the soil fertility by using compost materials without losing plant nutrients.

5. **Bio-fertilizer demonstration**

This program was conducted in two districts as given in table No 6.

In this program, it was demonstrated that how to use the Rhizobium in legume crops like lentil & Chickpea. It showed good response in grain yield, which was found 21.9 & 19.6 respectively over control. The residual effect on succeeding crops was also found better.

6. **Micronutrients demonstration**

This program was conducted in rice & vegetable in two districts as shown in table No 7.

(a) The zinc sulphate @1kg/ katha was applied as basal dose. It showed very good response in growth as well production of rice..

(b) The foliar application of ammonium molybdate was done after the occurrence of Mo. deficiency in vegetable crops (cauliflower). It was applied twice at one-week interval and response was found positive in correction of deficiency and promotion of yield, which was obtained around 20% more over control.

7. **Study of micronutrient problems**

This program has been conducted in previous years in different districts which is as given in table No.8.

This program was conducted to clarify to the farmers about the problem whether it is due to disease (Rog) or deficiency of nutrients e.i. (Bhok).

It was observed that the kailali & kanchanpur are the highly zinc deficit districts in case of rice. Same way they are also deficit in other micronutrients like MO, B, in vegetable crops (Cauli, Radish, Cabbage) in some pocket areas like Tikapur, Dhangadhi, Malakheta, Lamki in Kailali and Majhgawn. Mahendranagar in Kanchanpur district.

Above micronutrients were observed and demonstrations were done in those districts in rice & vegetable crops and found good results. (Tomato & Cauli)

8. **Soil testing service campaign: -**

This program was conducted in Darchula district to provide on spot soil testing services to the farmers. The No of samples analyzed was given in table No. 9 the required advises have been given to the farmers.

9. **Monitoring of soil programs**

The program conducted in three district of this region and visited spots are as given in the label No.10

10. **soil analysis services**

It has been started since FY 2053/54 and are as given in table No.9 and its findings are shown in table No.11&12

The district & regional basis soil reaction O.M.N, P. & K status are shown in fig No1-8

11. **Laboratory strengthening activities**

In this program the purchasing of Laboratory equipment and furniture were done.

Table No.1
soil activities conducted by RSTL in F. W. Dev. Region

S.N.	Activities	Unit	205//52	2052/53	2053/54	2054/55	1055/56
1.	Agri-line demonstration	No.	4	6	5	-	-
2.	Green manuring demonstration	"	10	10	20	6ha.	-
3.	study of problems related to micronutrients.	"	1	1	2	2	3
4.	technical services in command area	times	3	3		-	-
5.	Model compost pit demonstration	No.	-	7	5	-	
6.	Soil sample analysis	No.	-	150	500	500	500
7.	Bio-fertilizer demonstration	"	-	-	10	-	-
8.	Soil testing kit handling training	"	-	3	3	-	1
9.	preparation of soil fertility map.	"	-	-	1	1	-
10.	Monitoring of soil Activities conducted by DADO	Times	-	-	-	3	1
11.	soil testing service campaign	do	-	-	-	1	3
12.	Micro nutrients Demo.inRice	No	-	-	-	9	-
13.	Miero-nutrients Demo.inVeg.	"	-	-	-	9	-
14.	soil testing service week	Times	-	-	-	-	1
15.	Lab strengthening Activities	"	100	100	100	100	100

Table No.2

Agri-line demonstrations

S No.	Districts	units	Quantities in No.			Remarks
			051/52	052/53	053/54	
1.	Kailali	No.	2	-	-	
2.	Kanchanpur	"	2	1	2	
3.	Dadeldhura	"	-	2	2	
4.	Doti	"	-	3	1	
	Total		4	6	5	

Impact:-The increased average grain yield obtained was 20% more over control.

Table No.3
Green manuring demonstration

S No	District	unit	Quantity in No			
			051/52	052/53	053/54	054/55
1.	Kailali	No.	4	5	10	3.5ha
2.	Kanchanpur	"	2	2	10	2.5ha
3.	Doti	"	4	3	-	-
	Total		10	10	20	6ha

Note :- The additional green manuring minikit (24&20) had been distributed among the farmers of Kailali & Kanchanpur during 20252/53.

Table No. 4
Technical services (Training)

S No	Districts	units	Quantity in No	
			2052/53	2053/54
1.	Kailali	No.	2	1(18)
2.	Kanchanpur	"	1	1(17)
3.	Doti	"	-	1(9)
	Total		3	3(34)

Note:- figures in bracket denotes the No of Trainees.

Table No 5
Model compost demonstration

S no.	Districts	units	Quantity in No		Remarks
			2052/53	2053/54	
1.	Kailali	No	3	2	
2.	Kanchanpur	"	4	2	
3.	Doti	"	-	1	
	Total		7	5	

Table no.6
Bio-Fertilizer demonstration.

S NO	Districts	crops	units	Quantity in No	Remarks
				2053/54	
1.	Kanchanpur	Lentil	No	2	19.6%more grain yd over control 21.9%more grain yd over control
2.	Kailali	"	"	4	
3.	kailali	gram	"	4	
	Total			10	

Table No. 7
Micronutrients demonstrations

S No.	Districts	crops	unit	Quantity in No 2053/54	Remarks
1.	kailali	Rice	No	6	zinc sulphate
2.	Kanchanpur	"	"	3	"
3.	Kailali	vegetable	"	8	Ammonium
4.	Kanchanpur	cauliflower	"	1	molybdate in cauliflower

Note:- A :- $znso_4$ @ 1Kg/ Kattha as basal application

B:- Ammonium molybdate @ 0.10% .Foliar applications two times at one week interval.

Table 8

soil testing service campaign

S No.	Districts	units	Quantity in No:- 2054/55	Remarks
1	Darchula	<u>Times</u>	1(22)	A-6,N-16
2	Baitadi		(2)	N-1,AK-1.
Total			24	

Note:- A= Article, N= Neutral, AK= Alkaline

Table No. 9
Soil analysis service

S No.	Districts	Units	Quantity in No.		Total	Remarks
			2053/54	2054/55		
1	Kailali	No.	88	206	294	
2	Kanchanpur	"	320	187	507	
3	Dadeldhura	"	43	66	109	
4	Doti	"	33	5	38	
5	Achham	"	5	26	31	
6	Bajhang	"	11	-	11	
7	Bajura	"	-	10	10	
	Total		500	500	1000	

Table no. 10
Monitoring of soil activities in DADO of command area

s no	Name of District offices	Spots	Activities
1.	DADO Kanchanpr	Tilachor Badaipur Majhgawn Mahendranagar Jhalary Krishnapur Sundarpur	Green manuring Compost pit demonstration Green manuring Agri-veg farm Green manuring Green manuring Agronomy, Horti, veg. nursery
2.	DADO Kailali	Malakheti Munuwa Geta Geta Tikapur	Rhizobium lentil Rhizobium lentil Rhizobium lentil Micro nutrients Demo.veg Micro nutrients Demo.veg
3.	DADO Doti	Dipayal Silgadhi Mudbhara Kalika	Compost pit demonstration Fertilizer situation & their use Fertilizer program in rice & maize Compost pit demonstration

Table .No11
Soil reaction of Districts & Region.

2053/54/55

S No.	Districts	unite	No.	No of sample distribution			Total percentage
				A	N	AK	
1.	Kailali	No %	294	67 22.79	96 32.65	131 44.56	100
2.	Kanchanpur	No %	507	156 30.77	205 40.43	146 28.8	100
3.	Dadeldhura	No %	109	86 78.90	22 20.18	1 0.92	100
4.	Doti	No %	38	23 60.53	15 39.47	0	100
5.	Bajhang	No %	11	8 72.73	1 9.09	2 18.18	100
6.	Achham	No %	31	24 77.42	7 22.58	0	100
7.	Bajura	No %	10	8 80	2 20	0	100
	G. T.	No	1000	372	348	280	
	G	%		37.2	34.8	28.0	100

Note: A=Acidic, N=Neutral, AK=Alkaline

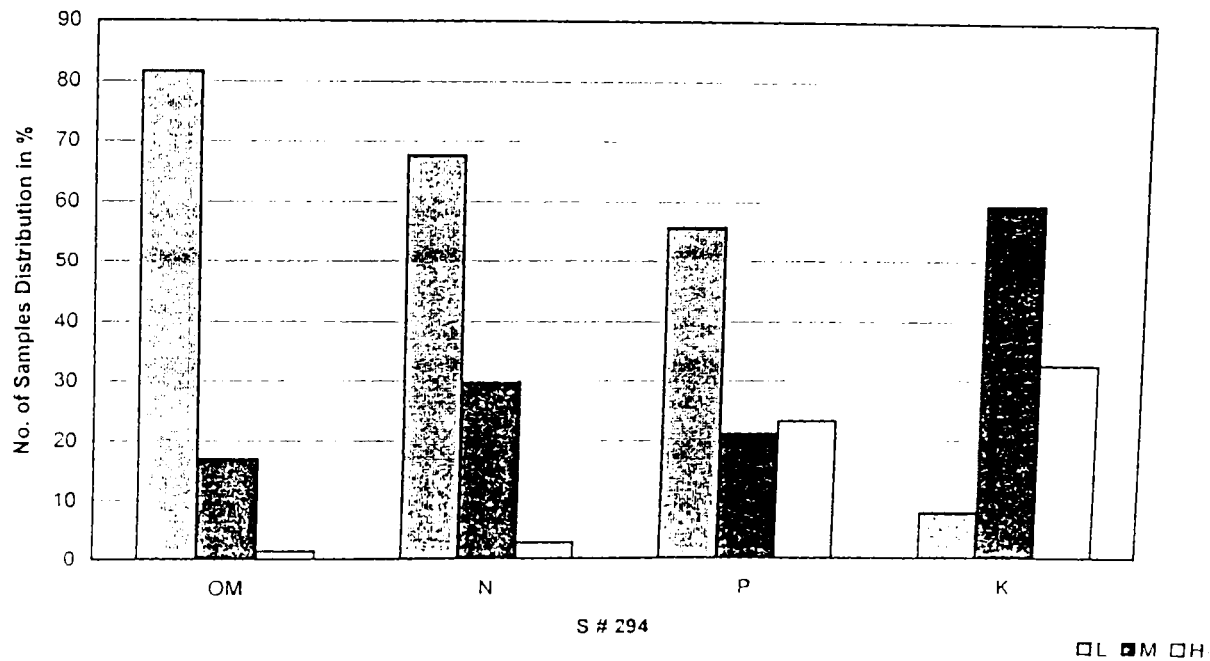
Table :-12
Soil fertility status of various districts and F. W. Region

S No.	Districts	Unit	No/S	OM			N			P			K		
				L	M	II	L	M	II	L	M	II	L	M	II
1	Kailali	No.	294	240	50	4	199	87	8	132	50	55	23	175	96
		%		81.63	17.0	1.36	67.69	29.59	2.72	55.70	21.10	23.21	7.82	59.52	32.65
2	Kanchanpur	No.	507	436	69	2	366	130	11	175	97	124	15	269	223
		%		86	13.61	0.39	72.19	25.64	2.17	44.29	24.50	31.30	2.96	53.06	43.98
3	Dadeldhura	No.	109	49	58	2	33	62	14	63	20	25	0	12	97
		%		44.95	53.21	1.83	30.27	56.88	12.84	58.33	18.52	23.15	0	11.01	88.99
4	Doti	No.	38	25	13	0	16	19	3	15	9	9	6	27	5
		%		65.79	34.21	0	42.10	50.0	7.89	45.45	27.27	27.27	15.79	71.05	13.16
5	Bajhang	No.	11	4	5	2	3	3	5	5	5	1	0	2	9
		%		36.36	45.45	18.18	27.27	27.27	45.45	45.45	45.45	9.09	0	18.18	81.82
6	Achham	No.	31	22	9	0	15	15	1	3	2	0	0	17	14
		%		70.97	29.03	0	48.39	48.39	3.22	60	40	0	0	54.84	45.16
7	Bajura	No.	10	2	8	0	0	10	0	4	2	4	0	0	10
		%		20	80	0	0	100	0	40	20	40	0	0	100
	G. T No.	No.	1000	778	212	10	632	326	42	397	185	218	14	502	154
	G. Percentage	%		77.8	21.2	1.0	63.2	32.6	4.2	39.7	18.5	21.8	1.4	50.2	15.4

Note: L= Low, M=Medium, II=High

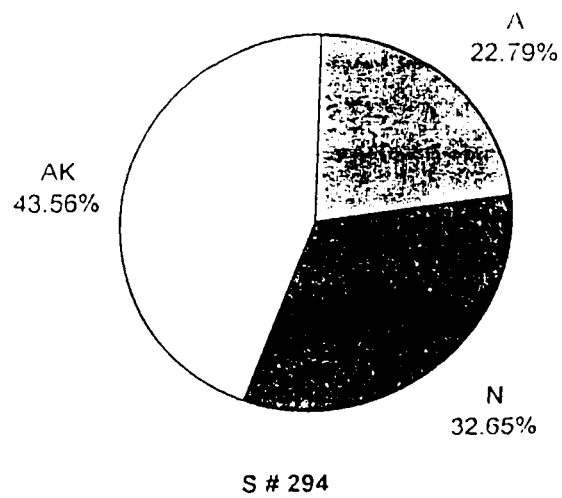
Fig. No. 1

Soil Fertility Status of Kailali District Year : 053/54/55



Note : L = Low, M = Medium, H = High.

Soil Reaction

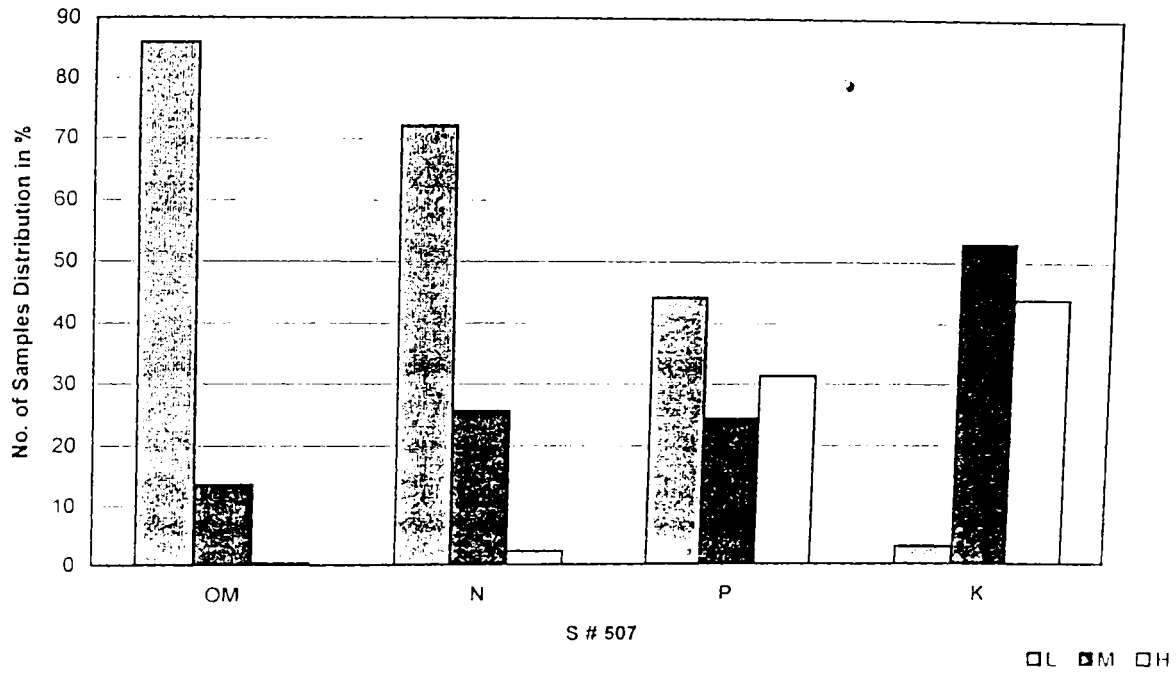


Note : A = Acidic, N = Neutral, AK = Alkaline.
Regional Soil Lab, Dhangadhi - Kailali

Fig. No. 2

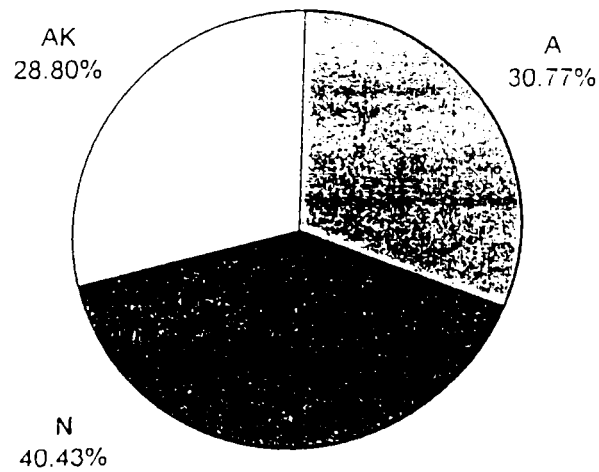
Soil Fertility Status of Kanchanpur District

Year : 053/54/55



Note : L = Low, M = Medium, H = High.

Soil Reaction

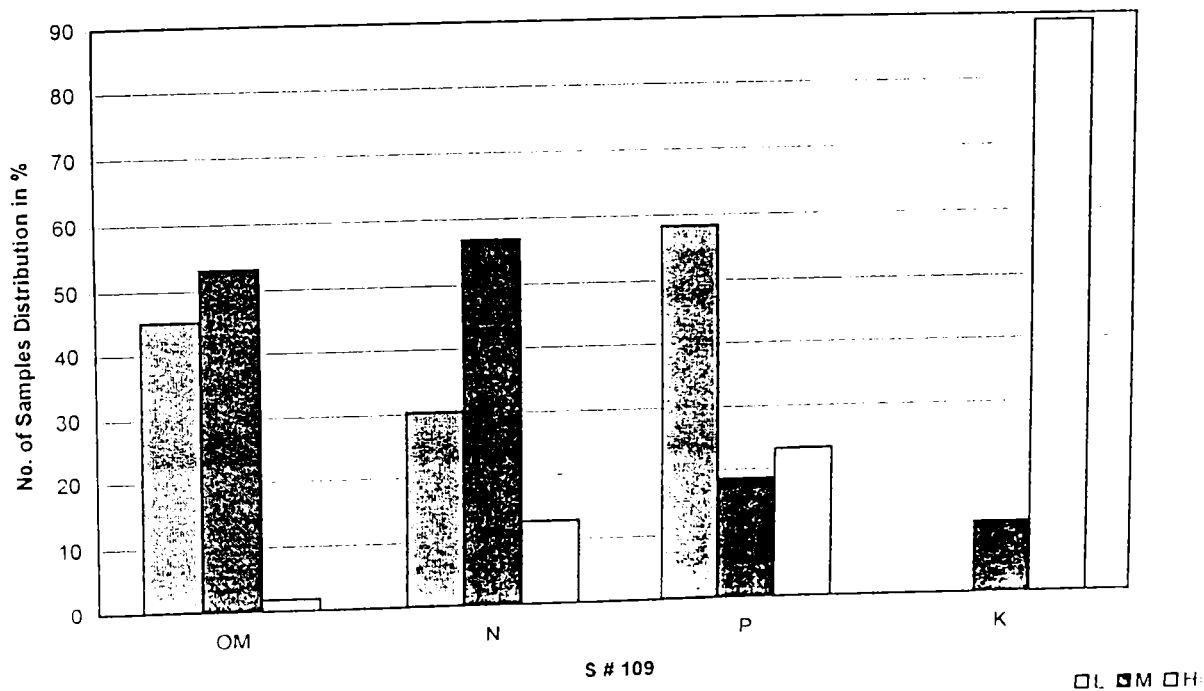


Note : A = Acidic, N = Neutral, AK= Alkaline.
Regional Soil Lab, Dhangadhi - Kailali

Fig. No. 3

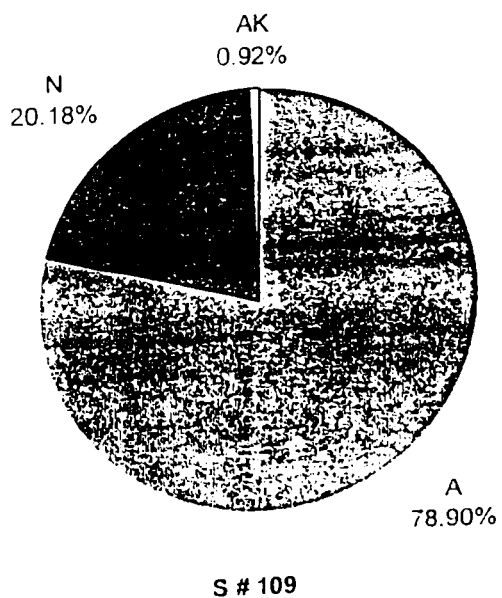
Soil Fertility Status of Dadeldhura District

Year : 053/54/55



Note : L = Low, M = Medium, H = High.

Soil Reaction

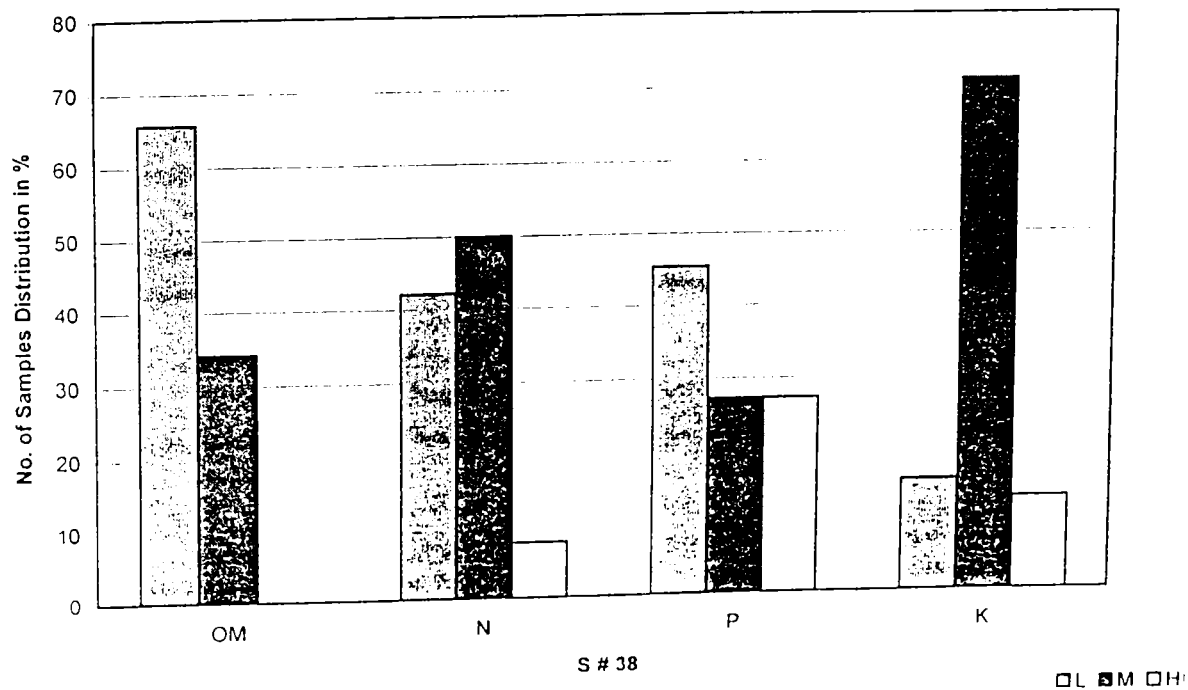


Note : A = Acidic, N = Neutral, AK = Alkaline.
Regional Soil Lab, Dhangadhi - Kailali.

Fig. No. 4

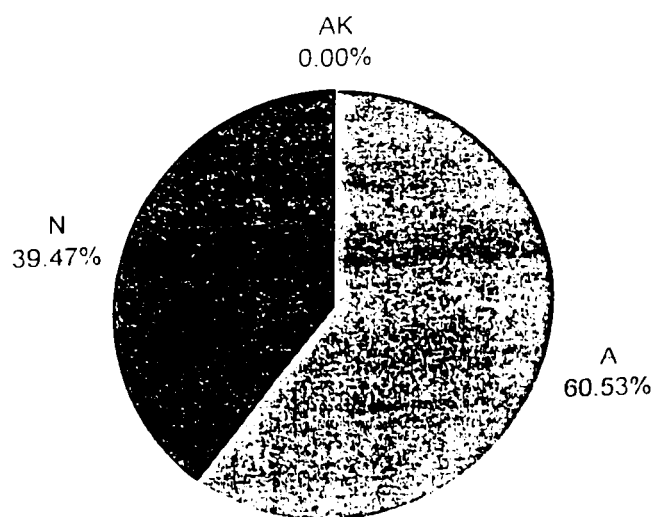
Soil Fertility Status of Doti District

Year : 053/54/55



Note : L = Low, M = Medium, H = High.

Soil Reaction



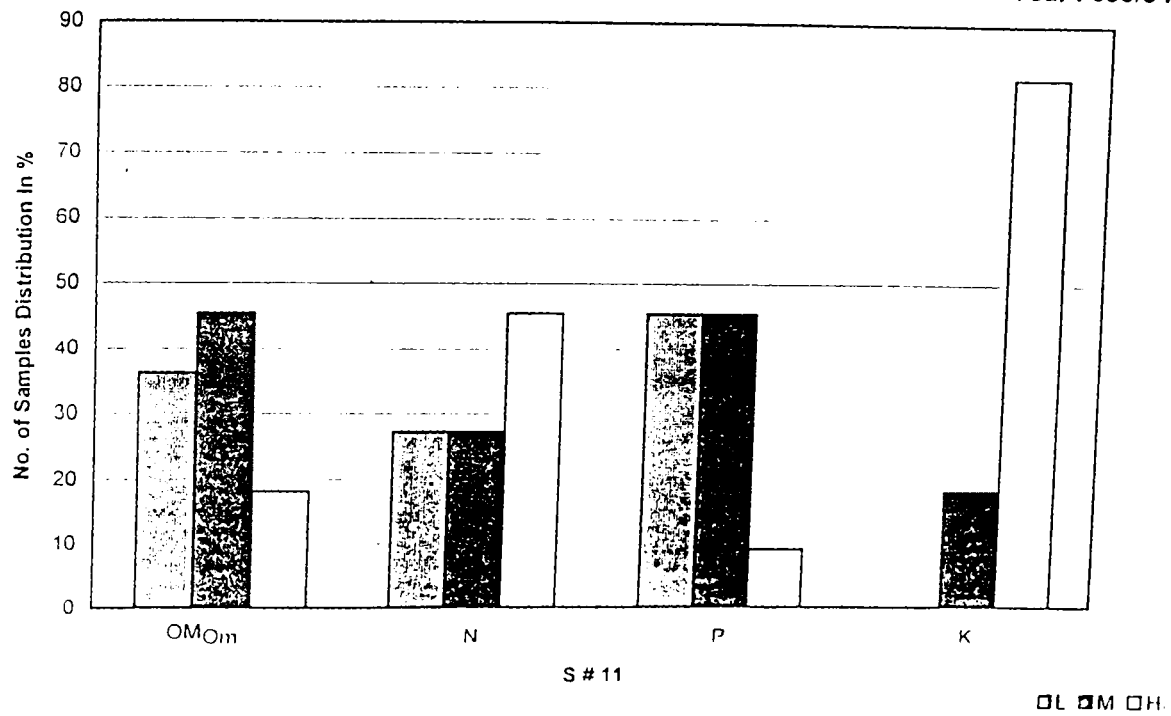
S # 38

Note : A = Acidic, N = Neutral, AK = Alkaline.
Regional Soil Lab, Dhangadhi - Kailali.

Fig. No. 5

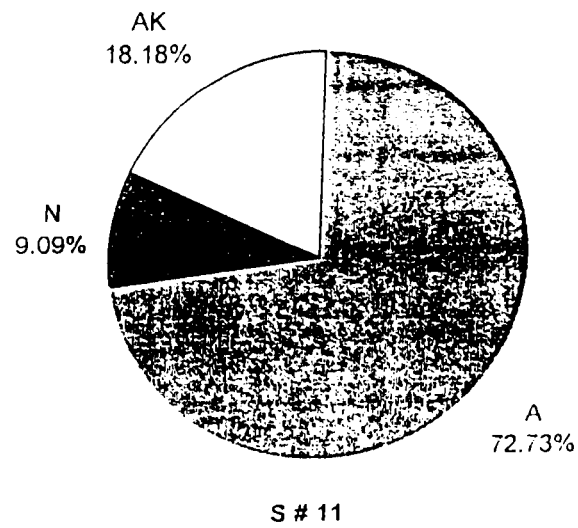
Soil Fertility Status of Bajhang District

Year : 053/54



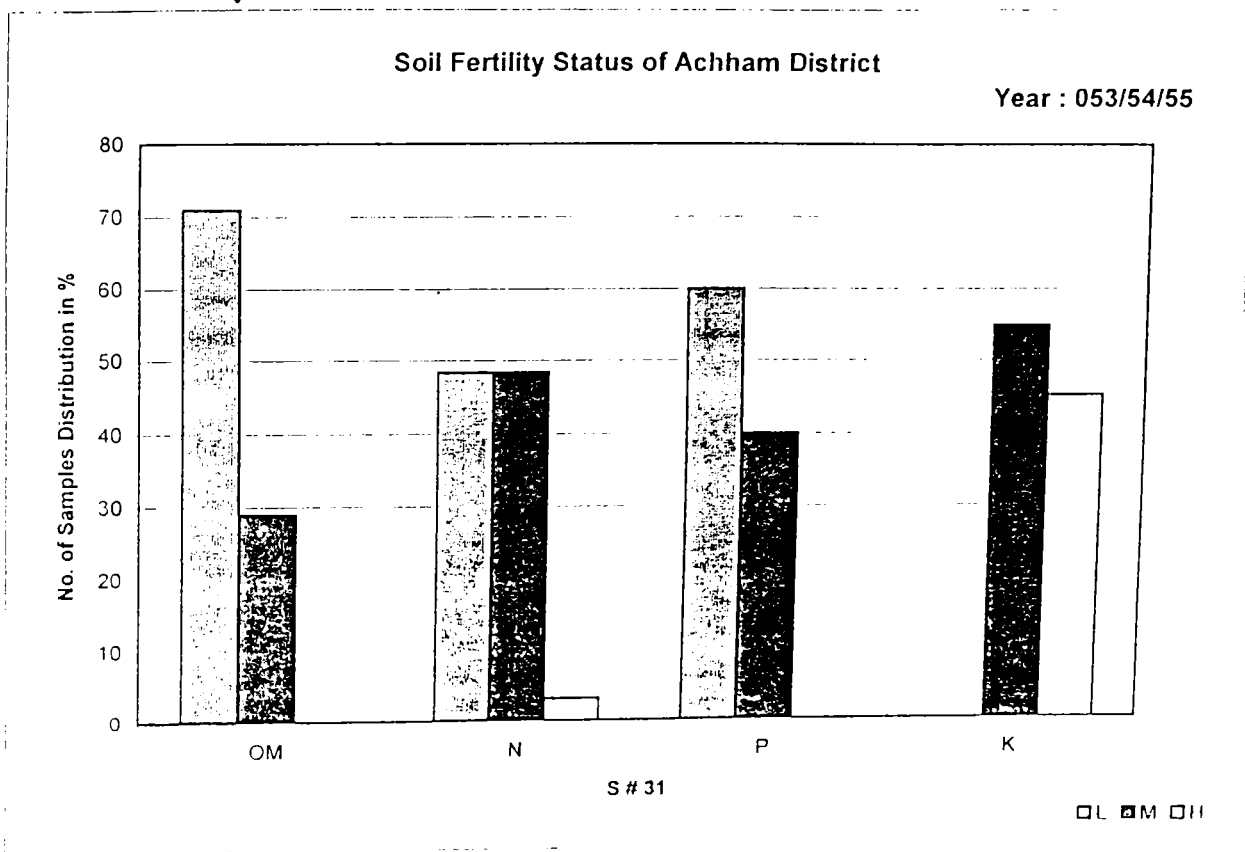
Note : L = Low, M = Medium, H = High.

Soil Reaction

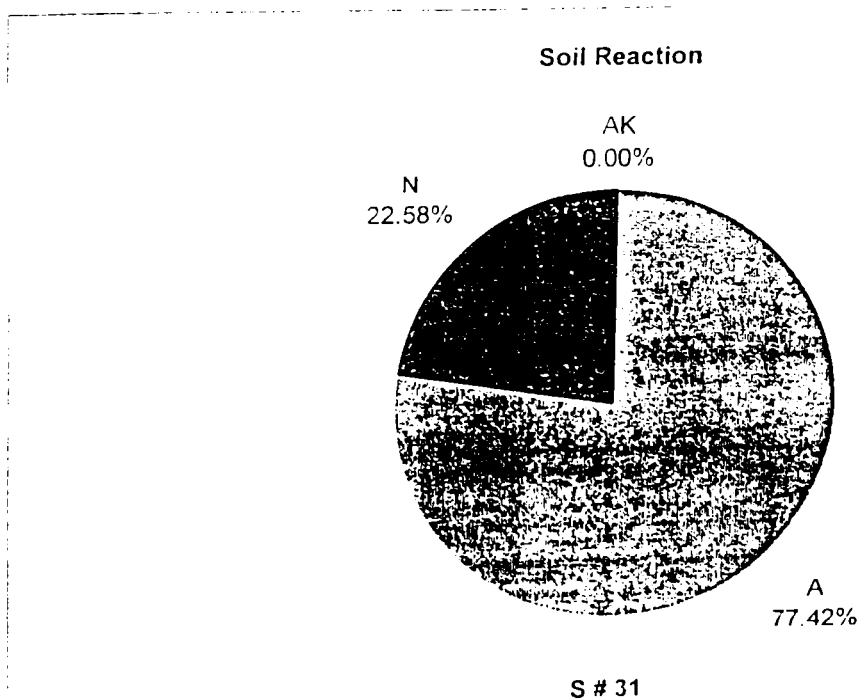


Note : A = Acidic, N = Neutral, AK = Alkaline.
Regional Soil Lab, Dhangadhi - Kailali.

Fig. No. 6

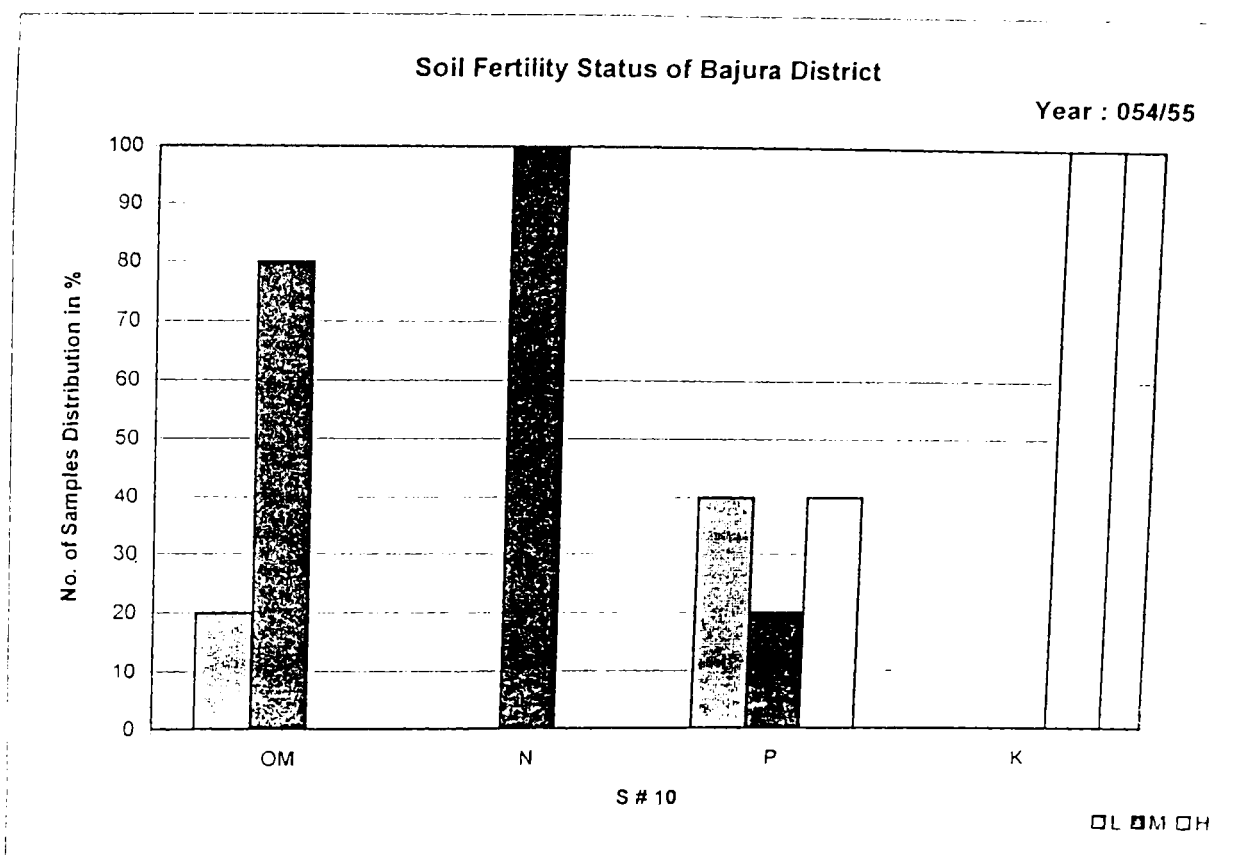


Note : L = Low, M = Medium, H = High.

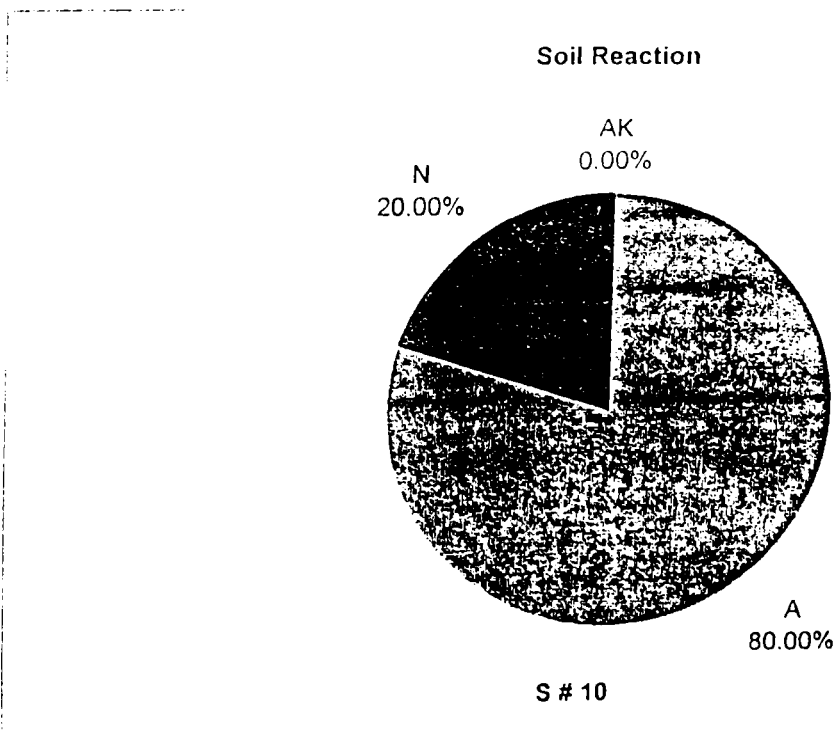


Note : A = Acidic, N = Neutral, AK = Alkaline.
Regional Soil Lab, Dhangadhi - Kailali.

Fig. No. 7



Note : L = Low, M = Medium, H = High.

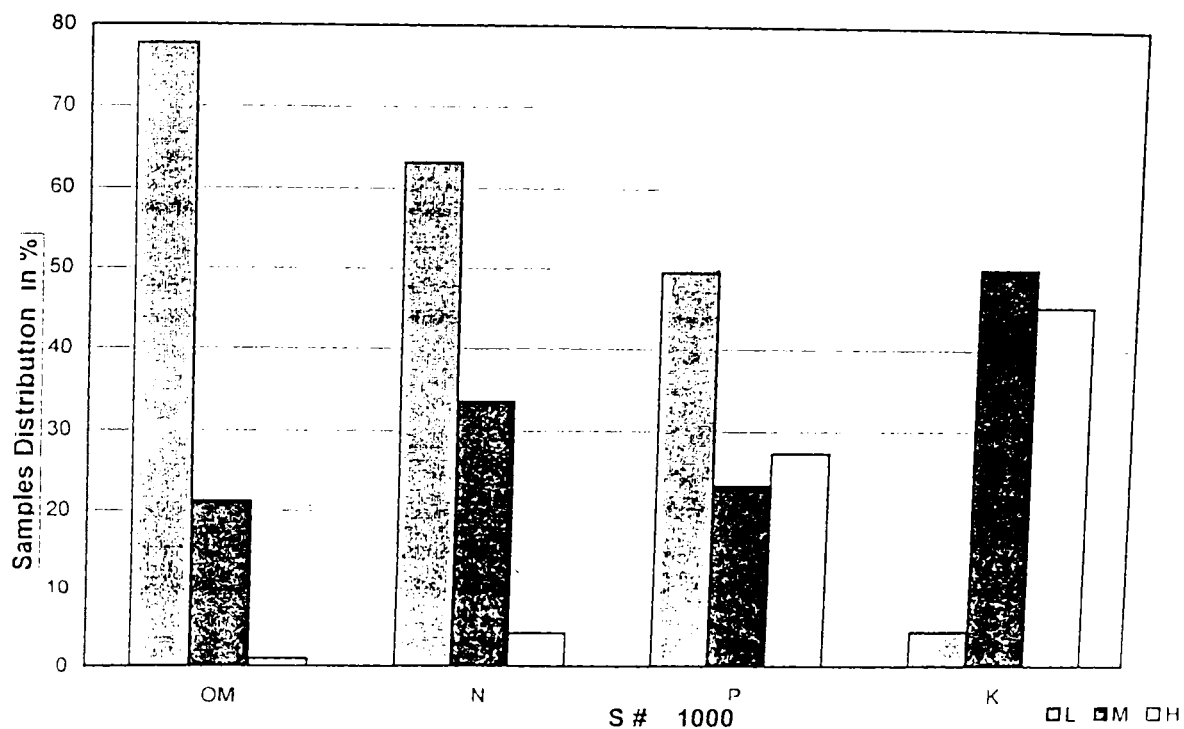


Note : A = Acidic, N = Neutral, AK = Alkaline.
Regional Soil Lab, Dhangadhi - Kailali.

Fig. No. 8

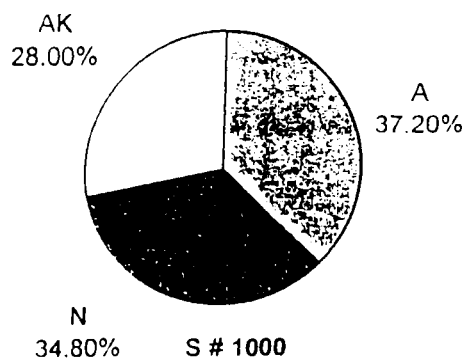
Reginal Soil Fertility Status of Far-Western Region

F/Y : 2053/54
: 2054/55



Note : OM = Organic Matter, N = Nitrogen, P = Phosphorus
: L = Low, M = Medium, H = High

Soil Reaction of F.W. Region



Note : A = Acidic, N = Neutral, AK = Alkaline.
Samples taken from : Kailali, Kanchanpur, Dadeldhura, Doti, Bajhang, Achham & Bajura Districts.
Regional Soil Lab, Dhangadhi - Kailali

Present problems faced by RSTL Dhangadhi

- 1:- **Lack of Laboratory & Office building.**
A. Due to lack of its own building, we are doing Lab. and office work in two separate buildings. Owing to very limited human resources it is very difficult to manage it.
B:- As we have got only two rooms in D.A.DO. for lab purpose. We installed some of the lab equipments and working with them in very congested condition.
C:- Due to very limited lab space we are unable to install all the equipments which we have at present.
- 2:- **Lack of man power**
It has very limited technical and no administrative staffs. While its work load is 4-5 times more than other Labs of DOA and its nature is also highly sensitive, health hazardous and risky.
- 3:- **Lab equipments**
This lab is still lacking some equipments for complete routine soil analysis.
- 4:- **Lack of Transportation**
As it is named as regional lab, so that it is working in all districts of this region. Its field is not limited only in lab but it is launching programs in the farmer's field also. To increase the effectiveness of the field activities it needs a means transportation.

Suggestions

The deterioration of soil fertility enhancing occurrence of field problems related to soil fertility & plant nutrition. Increasing demand of soil problems for their solution, the quality control of water, fertilizer shows needs to strengthen the lab facilities and the expansions of soil service activities in future programs.

Keeping them in mind some suggestions have been made as listed below.

Office cum Lab building: The required size of office cum lab building should be constructed as soon as possible.

- 1:- **Analysis services strengthen-** In future following analysis services should be strengthened.
A:- Soil Analysis
 [I] Macro- Nutrients
 [II] Micro- Nutrients
B:- Plant analysis
C:- Water analysis
D:- Fertilizer analysis
E:- Production & evaluation of Bio- Fertilizers.
2. **Field activities**
 - ☐ Study of micro nutrients problems in command area.
 - ☐ Soil analysis service campaign in command area
 - ☐ To provide technical services to the field technicians regarding the soil analysis, fertilizer recommendation, nutritional problems identification & soil fertility management.
 - ☐ Monitoring of soil activities conducted by RSTL and DADO.
 - ☐ Monitoring for Fertilizers quality control and judicious use.
 - ☐ To conduct the fertility management in command area.
 - ☐ O.M. enrichment program in Pocket area

Lab equipment :

The following equipments should be made available.

N - Block digester	one set
A.A.S. with recorder	" "
Generator 10 Kb.	" "
Precision Oven	" "
Magnetic Stirrer	" "
Stereo Microscope including light and photographic system	One set
Gas Chromatography	One set

Man Power :

In the strengthening of soil Lab some administrative staffs & some technical man power should be added.

The list of purposed man power is as given below.

(1) soil Scientist G II	1
(2) Asst. " G III	1
(3) JTA Non Gazetted II	2
(4) Field Asst. No. G II	2
(5) Computer Operator No. G II	1
(7) Asst. No. GII	1
(8) Lab Worker Lower Level	1
(9) Watchman " "	1
(10) Peon " "	1

4. Transportation

(1) Motorbike	2
(2) Pick Up Double Cabin	1

5. Carrier development :

To encourage the lab workers it is necessary to improve the present organizational structure of soil science group and create scientific structure & better opportunity of personal development & promotion in posts.

6. Man Power mobilization :

As we know that lab workers are playing with highly health hazardous chemicals. Owing pure scientific highly precised and laborious nature of work. To increase the lab workers efficiency in work it is felt that it seems to essential to provide some risk allowances to them

Acknowledgement

I would like to give special thanks to our D.G. Mrs. R.B. Pradhan, D.D.G. Mr. A. Jha, D.D.G. Mr. S.B. Aryal, Divisional Chief G.P. Pandey, R.D. Dr. B.S. K.C. has given me chance to present this paper in this workshop.

I would like to give cordial thanks to sectional chief Mr. S. N Jaishy & JICA Soil Expert Mr. T. Fujimoto for arranging this program and their valuable technical & other supports provided by them to labs.

I can't be silence without extending our thanks to all of our previous & present lab workers Mr. M.B. Chaudhary, Mr. U. Pd. Ghimire, Mr. R.N. Kalwar & other Subordinate staff Mr. B.D. Paneru, Mr. N.A. Khan, Mr. A.K. Sharma, Mr. G.B. Singh & Mr. C.L. Chaudhary for their valuable role played by them in achieving the target during the past and present.

I would like to thank Mr. P.R. Bhatta for computer setting support in preparing this paper.

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4. " " " " " 2054/55

Fertility status of horticultural land (fruit orchard) and common nutrient disorders

Janardan Khadka ¹

Fruit Development Division, Kirtipur, Nepal.

ABSTRACT

Horticulture Development Project is taking its momentum since 1985. This article focus on HDP targeted fruit crops with regard to soil, fruit variety, common nutrient disorders and suggestion to improve the production and productivity of fruit crop in the future.

Additional key words: Soil nutrient, deficiency, toxic, citrus, pear, persimmon, grapes, chestnut.

Introduction

Horticulture Development Project (HDP) has been carrying out various activities among which, Soil and Plant nutrient management is a major activity which contributes in better fruit production. HDP has set eyes on five major crops i.e. Citrus, Pear, Persimmon, Grapes and Chestnut, considering them as the targeted fruit crops for the upliftment of the economic status of the farmers. Citrus is a major fruit of Nepal and It is cultivated from ancient time. Most of the Citrus like Suntala, Junar, Lime, Pummelo and Citron are grown in mid hills of Nepal ranging from 900 m to 1400 m in elevation. The HDP has been contributing major role in the development and promotion of Citrus fruits. Many kinds of Pear like European pear (high chilling), Oriental pear (low chilling) and indigenous pear (mayal) are well adapted and are available in Nepal. Low chilling pear is well adapted to the mid hills of Nepal. Persimmon is mostly cultivated in the Katmandu valley and warm temperate regions of Nepal. Two types of persimmon astringent and non-astringent type (raw eaten type) is popular now a days. Grape cultivation has been tried in many districts of Nepal but its cultivation has not yet been commercialized.

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Fruit varieties under study

Pear	Grapes	Citrus	Chestnut	Persimmon
1. Kikusui 2. Yakumo 3. Waseaka 4. Kosui 5. Hosui 6. Chajuro 7. Golden Nijisseiki 8. Shinko 9. Okusankichi 10. Hawana 11. Bartlett 12. Meigetsu 13. Anjow 14. Ya-li 15. Pharping	1. Himrod 2. Black Olympia 3. Steuben 4. Neo Muscat 5. Kyoho 6. Muscat Bailey-A	Mandarin 1. Yoshida Ponkan 2. Ohta Ponkan 3. Nepalese Suntala 4. Murkot Orange 1. Aoshima Unshu 2. Imamura Unshu 3. Yoshida Navel Orange 4. New Taracco	1. Japanese 2. Chinese	i) Jiro ii) Fuyu iii) Hiratanenashi iv) Zenjimaruru v) Hachiya vi) Hanagasho vii) Teku viii) Dhaula

SOIL

Physical characteristics

Profitable citrus orchards must have sandy loam, sandy gravelly loam and loam soils. Normal growth does not occur in soils having impervious sub-soil or exceedingly shallow soil with sandy or gravelly sub-soil or having very little moisture retaining capacity. Soils underlain with hard pan or impervious clay layer, which create improper drainage and water infiltration during the rainy season are not satisfactory. Improper drainage conditions lead to accumulation of free water in the root zone, resulting in poor aeration and injury to roots. Shallow soils less than 50 cm in depth for orchard plantation, citrus may grow and crop well for a few years but later show symptoms of decline. Dieback is predominant in clay and sticky soils. It is caused by soil conditions such as deficiency of aeration, hard substratum and waterlogged conditions.

Soils with uniform profile, within the normal root zone are most satisfactory for proper citrus cultivation, because water movement is not impeded by variations in texture.

Chemical Characteristics

Some of the soil properties which are considered important for successful citrus cultivation are: soil reaction, nutrient deficiencies and excess soil fertility. The most common commercial rootstock for citrus is Poncirus trifoliata and it does not perform well where the soil pH exceeds 6.5. Under these conditions the uptake of Fe, Mn and Zn is seriously impaired.

Sample address	Depth	pH	Total (N%)	P ₂ O ₅ (Kg/ha)	K ₂ O(Kg/ha)	OM(%)
Kathmandu	0-15	5.2	0.11	82	423	2.3
Kathmandu	0-15	5.3	0.1	82	877	2
Kathmandu	0-15	5.5	0.14	71	1161	3
Kathmandu	0-15	5.1	0.09	156	297	
Bhaktapur	0-15	5.5	0.1	139	522	
Bhaktapur	0-15	6	0.16	38	39	
Dhankuta Farm	0-15	5	0.17	366	95	
Dhankuta Farm	0-15	5.7	0.04	38	426	
Dhankuta Farm	0-15	5.7	0.19	37	230	
Illam	0-15	5.9	0.13	21	170	2.08
Lalitpur	0-30	6	0.12	34	200	
Lalitpur	0-30	6.4	0.18	36	300	

Kavre	0-30	4.8	0.01	37	220	1.62
Kavre	0-30	5	0.06	21	228	1.86
Ramechhap	0-30	5.8	0.14	37	136	2.02
Ramechhap	0-30	5.6	0.1	18	136	0.86
Ramechhap	0-30	6.1	0.13	53	400	1.7
Sindhuli	0-30	6.8	0.03	41	216	0.36
Sindhuli	0-30	6.1	0.1	92	240	1.41
H. F. Palpa	0-30	5.2	0.14	10	97	
H. F. Palpa	0-30	5.5	0.15	24	105	
H. F. Palpa	0-30	5.7	0.15	2	97	
H. F. Palpa	0-30	6	0.17	32	312	
H. F. Palpa	0-30	6.7	0.22	112	792	
Kathmandu	15-30	5.4	0.07	9	206	1.9
Kathmandu	15-30	5.3	0.06	7	297	1.2
Kathmandu	15-30	5.5	0.09	85	413	1.9
Kathmandu	15-30	5.4	0.07	22	174	
Bhaktapur	15-30	5.9	0.1	75	302	
Bhaktapur	15-30	6.6	0.1	36	16	
Dhankuta Farm	15-30	5	0.11	127	50	
Dhankuta Farm	15-30	5.6	0.09	9	84	
Dhankuta Farm	15-30	5.8	0.17	92	488	
Illam	15-30	6	0.12	174	120	2.05
Kathmandu	30-60	5.3	0.05	3	120	1.7
Kathmandu	30-60	5.5	0.03	3	101	
Bhaktapur	30-60	6.8	0.05	38	634	
Ramechhap	30-60	6.2	0.1	30	152	1.89
Ramechhap	30-60	5.9	0.08	16	112	0.48
Ramechhap	30-60	6.1	0.12	44	184	1.36
Sindhuli	30-60	6.5	0.01	9	224	0.14
Sindhuli	30-60	6.2	0.07	50	136	1.41

Common nutrient disorders

CITRUS

Nitrogen deficiency	- Critical time for N deficiency: Prior to and during flowering fruit set and December leaf drop.
Excess Nitrogen	- Poor fruit quality, fruit colour, delays maturity, reduce juice content and reselect in thick skins.
Phosphorus deficiency	- Low juice content, thick skins and acid juice.
Magnesium deficiency	- Yellowing of leaves with an inverted V of green tissue at the base of the leaf.
Manganese deficiency	- Interveinal yellowing with a band of darker green along the midrib and veins.
Zinc deficiency	- Produces symptoms which are similar to Mn deficiency but

the interveinal yellowing is less blotchy and more clearly defined. In extreme cases leaves can be small and narrow. Manganese and Zinc deficiency often occur together and can be corrected together on singly.

PEAR

Boron deficiency

-Boron deficiency shows up in many different ways depending on the crop and the extent of the deficiency. Symptoms usually appear on the fruit before vegetative parts are affected. Fruit symptoms in apples and pears are quite similar. In Pharping pear fruit is malformed and hardly misshaped.

PERSIMMON

Magnesium deficiency

- Necrotic tissue appearing in the interveinal regions of the young summer growth.

GRAPE

Nitrogen deficiency

- Typically young leaves near the shoot tips are yellow, internodes are short and yields are greatly reduced.

Magnesium deficiency

- Chlorosis of margins of basal leaves in mid season. The chlorosis moves inward between primary and secondary veins.

Boron deficiency

- Fruit set is much reduced and small seedless berries are commonly found along with normal sized ones.

Water stress

- Fruit Cracking

CHESTNUT

Manganese toxicity

- Chlorosis of Chinese chestnut.

Problems of commercial orchard establishment

- * Gestation period long.
- * Big investment.
- * Lack of availability of quality planting materials.
- * Lack of proper agrotechniques and research supports.
- * Lack of post harvest handling techniques and infrastructures.
- * Lack of organized marketing channels and monitoring system.

Suggestions

- * Quality planting materials should be grown and supplied to the growers.
- * Proper agrotechniques and research for the fruit crop, specially in major problems is essential.
- * Post harvest handling technology should be developed.

Conclusion

Commercial fruit orchard establishment has tremendous potential throughout mid hills and high hills of Nepal. Especially citrus is the main fruit crop for the mid hills and that is the good way for upliftment of economic status of farmers. For the Katmandu valley Japanese pear, raw eaten persimmon and grapes are the best fruit crops.

Improvement of soil fertility management activities in Nepal

T. Fujimoto
JICA Expert

The Soil Testing & Service Section(ST&SS) was established in 1992 in order to promote agricultural development in Nepal. Five Regional Soil Testing Laboratories(RSTL) were established under ST&SS in each development region.

Fundamental activities of ST&SS and RSTL are as follows.

1. Soil sample analysis and recommendation on soil fertility management based on soil testing results.
2. Management of demonstration farm on utilization of various new fertilizers, micro-nutrient fertilizers, green manure, compost and farm yard manure, and agricultural lime.
3. Follow up and monitoring of soil analysis and recommendation activities.
4. Implementation of soil testing campaign at village level.
5. Provision of soil related services to farmers.
6. Training for officers, JT and JTA as well as for farmers.

As ST&SS is a recently established organization, it has many problems which should be solved urgently to accelerate smooth accomplishment of their duties.

Followings are proposals for improving activities of soil fertility management which I realized during my stay for three years.

Improvement of soil testing system

The proposed soil testing system is shown in Fig.1. As shown in the figure, the application of computer plays very important role for the smooth achievement of soil fertility management activities. The data processing to

analyze the general trend of soil fertility status and the prescription of recommendation to farmers will be done efficiently through the introduction of computer system.

Accumulation of data file is very important. The nation-wide data must be accumulated at ST&SS, and the district wise data should be accumulated at each Regional Agriculture Directorate(RAD) and RSTL.

The soil sampling is the first step and very important process in soil testing. The soil sample must be collected so as to reflect the nature of field soil accurately. As for the method of soil sampling, we published a pamphlet.

The second process is chemical analysis of soil in the laboratory. At present, chemical analysis of pH, organic matter, available phosphorus and available potassium are done according to the method described in "Soil Science Manual".

Construction of computer network

The application of personal computer is essential, at least one computer should be installed to each RSTL. Furthermore, it is desirable to introduce it to every Agriculture Service Center(ASC) in near future. At ASC, the computer is used not only for soil fertility management. It plays important role in the management of crop production and provides statistical information in village level.

At RSTL, the personal computer is very useful for the calculation of analytical results, prescription of recommendation sheet and compilation of district wise data.

In near future it will come true that once the data in fertilizer recommendation sheet are put into equations, the fertilizer recommendations are generated by personal computer. Information regarding properties of soil, crop, yield goal, and other critical factors are entered, then the computer generates the recommendations and provides a print out of soil test results and recommendations.

In the more advanced recommendation, it is desired that following information is included in the recommendation sheet: the kind of fertilizer best fitted to soil type and crop, the methods of fertilizer placement and time of application etc. to raise the fertilizer efficiency and to avoid environmental pollution.

Increase in the number of soil analysis (Promotion of efficiency)

Currently, the number of soil samples analyzed by RSTL is 300-500 samples per year. About two to three thousand soil samples are analyzed in the whole country. As the cultivated land area is 2.6 million ha, the number of soil analysis corresponds to one farm soil in every one thousand ha per year. It is desired to increase the number of soil analysis at least several times more in order to prevail the soil testing at the rate of two or three samples in every village. It seems that it is not so difficult to increase the number of soil analysis to several times under existing manpower.

Increase of items of soil testing

The current soil testing ratings include pH, organic matter, phosphorus and potassium regardless of soil type, kind of crop and climatic condition. The items of ideal soil testing ratings are shown in Table 1. Information on chemical, physical and biological properties of representative soil type is indispensable in considering advanced soil fertility management. It is to be desired that NARC provides these basic information on soil properties of representative soil types. It is desirable that ST&SS is closely connected with NARC. To build up the item of soil testing, it is essential to increase number and quality of manpower, budget to purchase equipment and chemicals.

Revision of soil testing ratings

From the compilation of data provided by RSTLs, it was recognized

that the soil classified as low in potassium was only 12%, and 42% of soil belonged to high level. Bajracharya et al(1985) also reported the same tendency that the percentage distribution of available potassium fertility in low, medium and high categories was 9, 67 and 24 %, respectively.

The medium range of soil testing ratings of available potassium is between 110 and 280 kg/ha as K_2O . This is equal to 73 and 187 mg K_2O per kg of soil on weight basis. It seems that this range is rather low compared to the ratings in other countries. For example, the medium range of exchangeable potassium in Japan which is enacted by prefecture considering soil type, land use and climate is in most cases between 150 and 300mg per kg of soil which corresponds to 225 and 450 kg/ha. In this case, the yield goal is higher than Nepal. It is considered that Nepal soil is not rich at all in potassium. If we apply this criteria to Nepal soil, the fertility status of Nepal shows quite different aspect as shown in Fig. 3. The percentage distribution of low, medium and high is 46, 37 and 17 %, respectively. As long as the yield level remains under very low level, there exist no problem in rating under current situation.

Regarding phosphorus, the medium range is between 31 and 55 kg/ha which is equal to 21 and 37 mg P_2O_5 per kg of soil. Japanese standard is in most cases between 100 and 300 mg per kg of soil namely between 150 and 450 kg/ha.. Again there exists a big difference. If this criteria is applied to Nepal soil, the results becomes quite different. The percentage distribution of low, medium and high becomes 86, 11 and 2 %, respectively.

In near future, it is needed to reconsider the current ratings when the yield goal is raised.

Training

As the soil fertility management program is newly launched, staff are not accustomed well how to accomplish their duties. Intensive theoretical and practical training on soil fertility management is

indispensable for technical staff of ST&SS, RSTL and ASC. Studying abroad will contribute to the development and strengthening of the activities of ST&SS.

It is necessary to convene short-term training courses periodically for JT and JTA on ① soil analysis, ② fertility management, ③ land use planning, ④ interpretation and recommendation work based on soil testing and ⑤ application of computer system. Continuous improvement of technique is essential for all staff concerned.

As there is no reference book on soil fertility management written in Nepalese, we published "Handbook of Soil Fertility Management" and distributed to all Agricultural Service Center and Sub-center under the Department of Agriculture, hoping that this handbook helps JT and JTA better understand their daily activities on soil fertility management.

Strengthening of manpower

Two assistant soil scientists, three junior technicians and a field assistant are posted to each RSTL. Currently the posts for assistant soil scientists and junior technicians are not filled. It is necessary to increase the number of technical and administrative staff in order to increase the number of soil analysis. In the "Ninth Plan", ST&SS proposes to increase the number of staff from 10 to 34 at central level and from 6 to 20 at RSTL. The proposal of ST&SS is as follows: one chief soil scientist(Class 1), three soil scientists(Class 2), four assistant soil scientists(Class 3), four JTs and six JTAs. It is desirable that half of this target is realized during the "Ninth Plan" period by 2002.

Data processing

The data is precious property. However, these data are not accumulated systematically by ST&SS. The Central laboratory should collect and input all the data into personal computer for further statistical analysis. These data should be utilized for the trend analysis of soil fertility

status, mapping of fertility distribution, statistical analysis related to crop production etc. For data processing and communication between Central laboratory and RSTLs, the introduction of personal computer is indispensable. If available, e-mail serves as a very convenient tool for data communication.

Simplified soil analysis (Soil test kit)

Soil test kit method is sometimes used in Soil Testing Campaign. It is said that the results obtained by this method are frequently unreliable. Application of this method is not recommended unless utmost care is taken during the process of handling and interpretation of the data obtained by this method. It is necessary to check the accuracy of this method. It is essential to compare the data with the analytical results by laboratory analysis. Needless to say, the use of fresh reagent is essential.

Accuracy and reliability of chemical analysis

The chemical analysis must be carried out carefully so as to get accurate and reliable data. It is required for each technician to check the extent of accuracy and understand his own confidence limit of analysis. The technical staff must be conscious of his ability and technical level of chemical analysis. It is inevitable that error arises from each analytical procedure, from weighing out of sample through reading of the measuring instrument. The following is the recommendation on how to check the accuracy and confidence limit of analysis.

One recommendation is to carry out "Cross check" among RSTLs using the same soil samples. The other is to use "Standard soil sample" with the known analytical value. To check the accuracy and confidence limit of the chemical analysis, several kinds of standard soil samples should be prepared and provided to each RSTL. It is recommended to analyze the standard sample soil occasionally during the process of routine soil analysis

to check the extent of accuracy. The Central laboratory must be responsible for the standard sample preparation and provision to RSTLs.

Sometimes we notice that unusually high or low values of analytical results are recorded. When a questionable value is obtained, it is recommended to repeat the analysis. As for pH, it ranges 4.5 and 8 in most cases. When pH value beyond this range is found, it is required to repeat the analysis. The analyst must have the concept of reasonable value.

Expression

With regard to the expression style of the analytical results, it is recommended to express data principally in three-digit numbers. For example, phosphorus content was recorded as 51.392 kg/ha, this should have been expressed as 51.4 kg/ha. The second and third decimal places are unreliable and meaningless. In another case, potassium content was written as 674.562 kg/ha, this should have been written 675 kg/ha. Likewise, in case of pH, it should be written to the first decimal place like 6.8 instead of 6.82. It is important to understand the limit of confidence of chemical analysis.

The application of radar chart is very helpful to understand the results of soil testing.

Prescription of recommendation sheet

The recommendation sheet plays very important role for the improvement of soil fertility. It is needed to consider many factors at the time of its preparation. To provide better recommendation, knowledge on the followings is indispensable: ① behavior of nutrient element in the soil-plant system, ② efficiency of fertilizer element, namely uptake ratio, ③ nutrient content of organic mater like FYM, compost and green manure ④ soil type, ⑤ balance of element in the soil. in other words relationship between input and output etc. In near future, it is desired to recommend how to apply fertilizer which includes fertilizer placement, fertilizer form

and time of application in addition to the rate of fertilizer application.

Demonstration farm

RSTL manages various kinds of demonstration farms such as fertilizer, green manure, agricultural lime, micro-nutrient etc. at farmer's fields. The demonstration is useful as a means of introducing new technology to farmers.

Followings are recommended to improve the management of demonstration farm.

Site selection: The demonstration site must be selected carefully in accordance with its purpose. It is essential that the chemical properties of the soil is known beforehand. In case of the micro-nutrient fertilizer application, the micro-nutrient content of the soil must be checked in advance.

Mobility: The staff of RSTL, DADO and ASC must go to demonstration sites frequently for the management and observation of crop growth. As they don't have motorbike, it is difficult to go and observe the crop growth frequently as required. Provision of motorbike is essential as a means of transportation. At least one motorbike should be provided to each organization concerned.

Advertising: The demonstration farm plays an important role in introducing new technology to farmers. However, as there is no signboard at the demonstration site, it is very difficult for farmers to get information about the demonstration. It is recommended to hang a signboard showing the outline of the demonstration.

Publication: It is important to record the characteristics of crop growth and measure yield to show the effectiveness of the material used for demonstration. Although they organize so many demonstration farms, their results and effectiveness have not been made public so far.

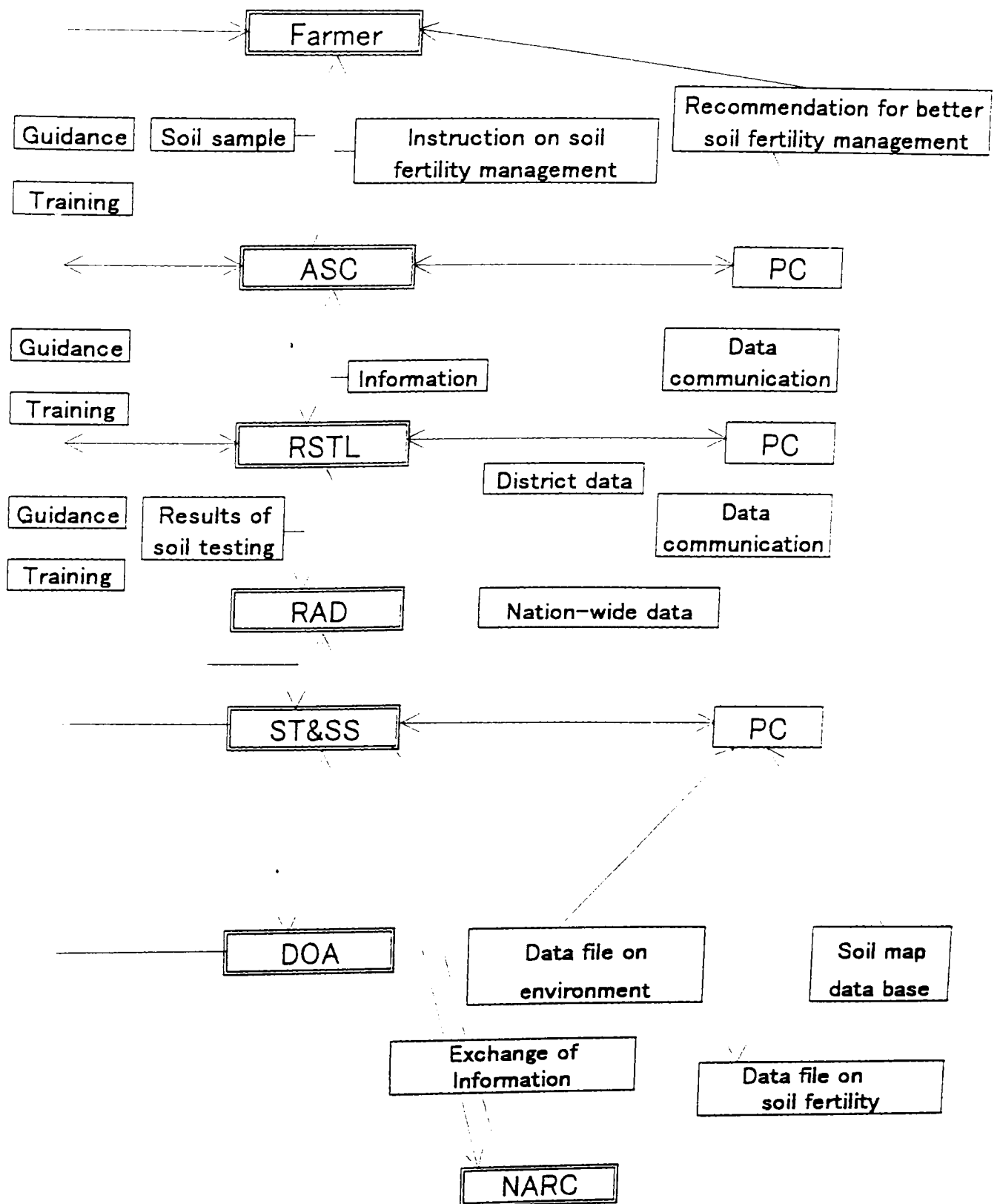


Fig. 1. Proposed soil testing system in Nepal

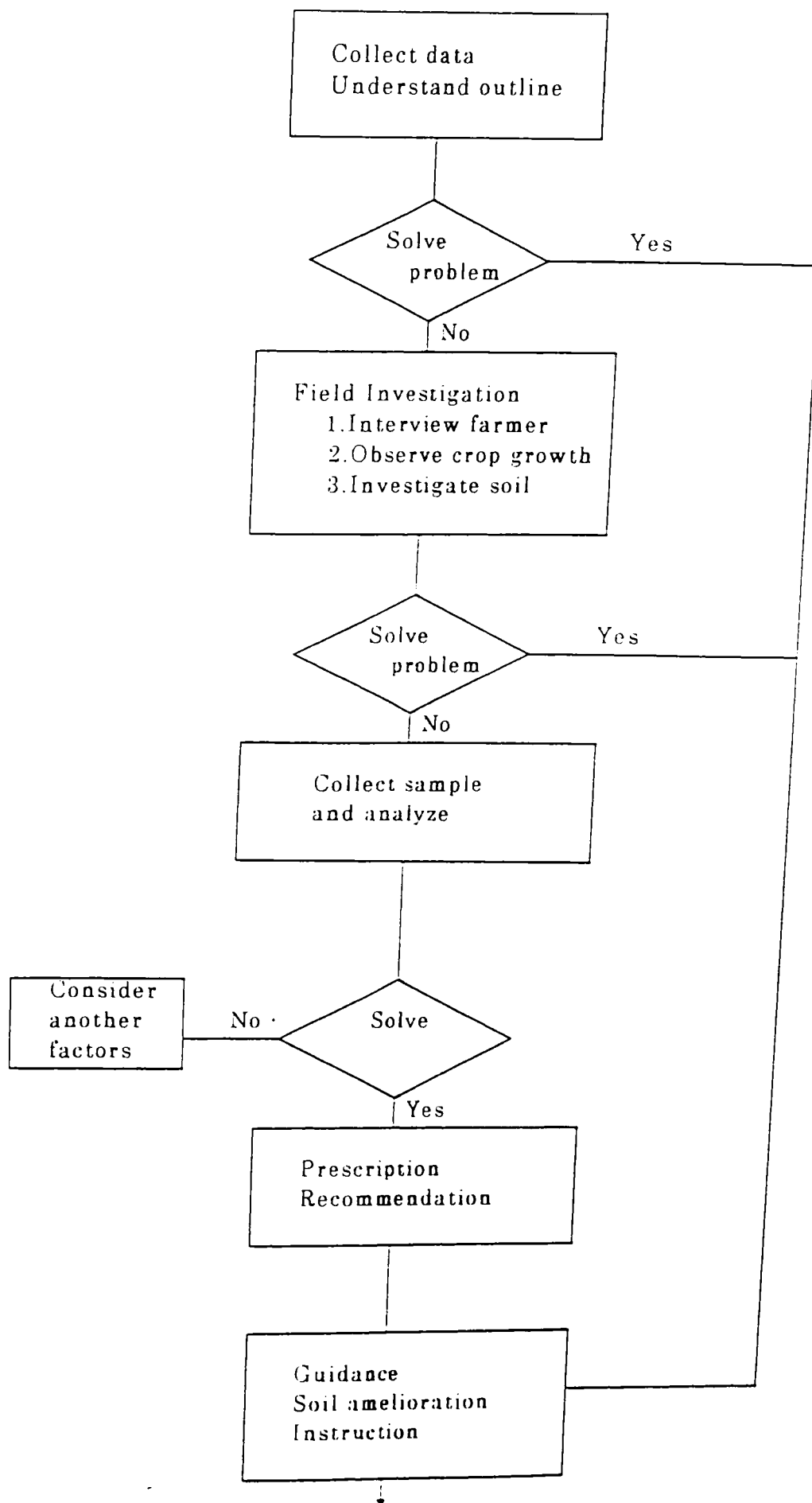


Fig. 2 Process of soil testing

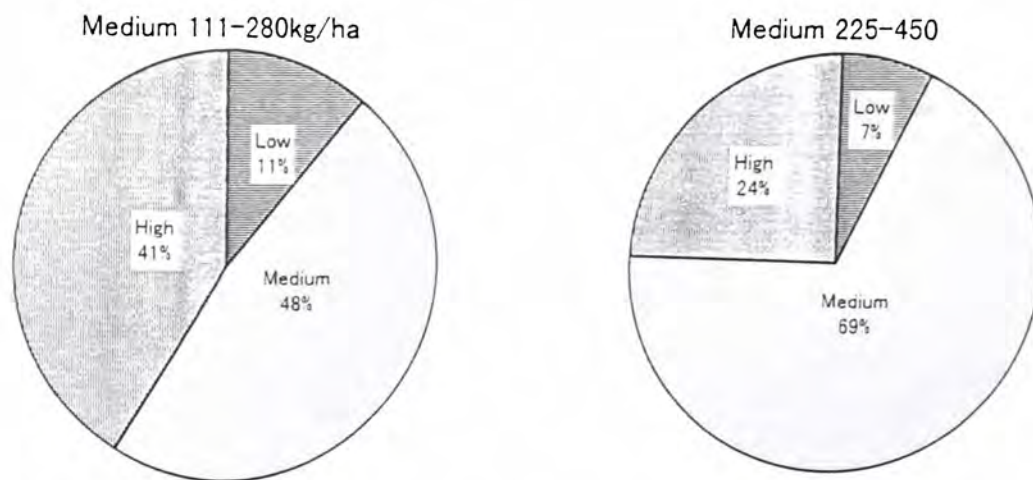


Fig. 3 Percentage distribution of potassium ratings

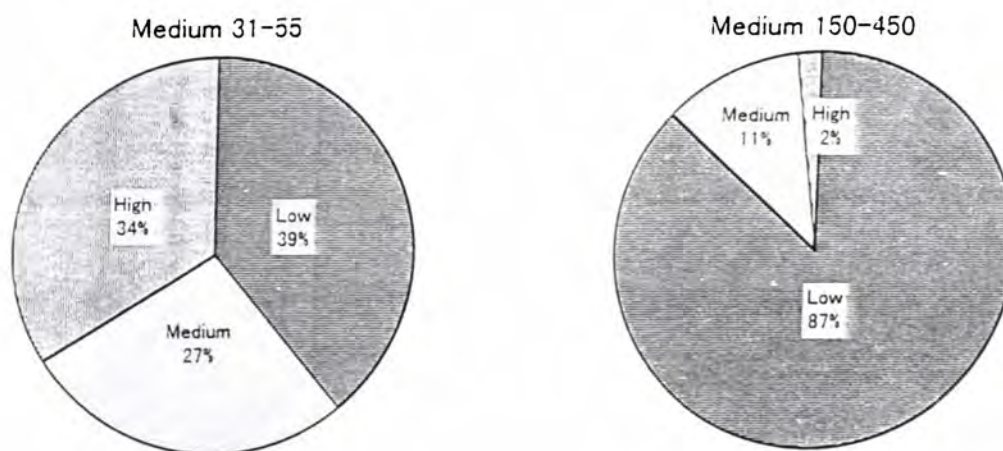


Fig. 4 Percentage distribution of phosphorus ratings

3.4.5 - current extension programs for soil fertility, problems & prospects.