AN INVENTORY OF CURRENT SOIL FERTILITY STATUS OF MAHOTTARY DISTRICT, NEPAL.

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KEY WORDS
Soil fertility status of the district, showing
p^H level
Organic Matter level
Nitrogen level
Phosphorus level
Potash level

ABSTRACT

Nepal has complex topography and diversified agricultural practices. By analyzing the situation, it is known that soil fertility decline is due to uncontrollable soil erosion and improper soil management. It has an overwhelmingly subsistence agricultural economy where modern science and technology practices are of very recent origin. In light of the limited land resources of Nepal, improve soil fertility is one of the key factors to increase agricultural production of the nation. It is the best way to diagnose the sub-optimal of soil fertility for plant growth and its further improvement. Soil analysis and determination of N, P, K, OM and soil p^H generated meaningful relationship to drive a technological package utilize for increase crop production. Soil analysis of samples for 365 different sites of Mahottary district was done during May- June 2002 for its fertility assessment. Sampling sites range from 61 to 808 m's above sea level. Soil samples collected from all dominant land system of the district were use to assess the current soil fertility status addressing soil P^H and soil Texture, and also OM, N, P and K content of soil.

INTRODUCTION

Nepal has complex topography and diversified agricultural practices. By analyzing the situation, it is known that soil fertility decline is due to uncontrollable Soil erosion and improper soil management. The problem of soil fertility deterioration may aggravate in future with increasing cropping intensity, use of high yielding crop varieties low and unbalanced application of chemical fertilizers and decreasing use of organic manure. It has an overwhelmingly subsistence agricultural economy where modern science and technology practices are of very recent origin. In light of the limited land resources of Nepal, improve soil fertility is one of the key factors to increase agricultural production of the nation. It is the best way to diagnose the sub-optimal of soil fertility for plant growth and its further improvement. Soil analysis and determination of N, P, K, OM and soil P^H generated meaningful relationship to drive a technological package utilize for increase crop production.

The study was conducted in FY 2001/2002 in order to assess the current soil fertility status of Mahottary district. Soil analysis of samples for 365 different sites of the district was done during May- June 2002 for its fertility assessment. Sampling sites ranges from 61 to 808 m above sea level. Soil samples collected from all dominant land system of the district were use to assess the current soil fertility status addressing soil $P^{H \text{ and}}$ soil Texture, and also OM, N, P and K content of soil.

PRESENT LAND USE AND AGRICULTURE OF STUDY AREA

Mahottary district is located between $26^0$36' to $28^0$10' N latitude and $85^0$41' to $85^0$57' E longitude and belongs to two topography regions, Siwalik and Terai, the district is bounded in the east by Dhanusha district, in the west by Sarlahi district, in the north by Sindhuli district and south by Bihar State of India. The total area of the district is 1002 Sq. km among those 75000 ha of cultivated land including 60633 ha having irrigation facilities ranges from 61 to 808 meter from mean sea level and influenced by diverse climatic condition warm subtropical to cool subtropical. The district receives an annual rainfall about 272 mm to 2200 mm. June- July are the months when district received maximum rain fall. This is highly populated district population density is more than 500 per square kilometer.

Rice, Wheat, maize, millet, Potato, Vegetable, oilseed, lentil, chick pea, black grams, are major crops growing in the district under rice based cropping system like Rice- Wheat-Fallow, Rice – Vegetables, Rice- Wheat-Mug, Rice –Fallow, Rice- Wheat- Rice, Rice-Wheat-Maize and Rice – Pulses etc. Productivity of the major crop rice, wheat and maize is 2.1, 1.7 and 2 Mt/ha respectively, which is low compare to neighboring districts. Mahottary has two crops combination with low Index of Agricultural Development Potentiality (ADP). Among 20 Terai districts of Nepal which are often known as breadbasket of the country, only Mahottary has low agricultural potential. Geologically this district is quaternary alluvial river deposits plain area.

JUSTIFICATION OF THE STUDY

- Intensively cultivated soil of the district has lower ADP[1] (1.86) compare to adjoining district of Sarlahi (2.48) and Dhanusha (2.039). Degradation of soil fertility in the district is a challenge and needs to proper soil management for plant growth and better crop production.

OBJECTIVE

The main objective of the study is to assess the chemical characteristics of the soils of Mahottary district and prepare soil fertility map. The specific objectives are to:

- Conduct soil survey and collect soil samples from different representative locations.
- Prepare soil fertility maps showing occurrence and distribution of soil reaction and major plant nutrient statuses in the district.
- Help to recommend sound and sustainable soil management practices in the district.

METHODOLOGY

Table work

Land System maps published by Land Resources Mapping Project (LRMP) in 1986 at the scale of 1:50000 have used as the base maps for conducting the field survey works. Prior to the actual fieldwork, tentative sampling sites were fixed on the base maps. These sampling sites were set and distributed in such a way that all the agriculturally important land system units are proportionately represented.

Fieldwork

Following the sampling sites fixed in the base map, field works were conducted with the help of District Agriculture Office, Mahottary and surface soil samples from 20 cm depth were collected using soil auger and local spade with proper labels.

Laboratory work:

Soil samples received from the field were used for the determination of soil pH, organic matter and major plant nutrient content of soil using the standard laboratory methods.

Soil reaction (p^H):

[1] Dahal, H., Regional Planning and Agricultural Regionalization, Paper to be presented to the national seminar on National Agricultural Extension Situation in Nepal, Kathmandu, 2002.

Soil reaction was determined by measuring 1: 1 Soil: Water suspension with the calibrated p^H meter.

Organic Matter:

Organic matter content was determined by following Walkley- Black method.

Total Nitrogen:

Total nitrogen was determined by micro Kjeldhal digestion method.

Available Phosphorus:

Available phosphorus was determined by modified Olsen's bicarbonate method and available phosphorus is expressed in P_2O_5 by using conversion factor.

Available Potash:

Available potash was determined by extracting the sample with neutral ammonium acetate and the K content was determined by flame photometer. The available potassium is expressed in K_2O by using the conversion factor.

DATA COMPILATION AND MAPPING:

Physiography and land systems within each of the physiographic region were considered as the major basis for conducting field survey and assessment of the current soil fertility status of the district. The laboratory data were linked with the corresponding auger points in the digitised land systems maps and soil reaction and nutrient status maps were prepared using GIS techniques (Annex). While assessing the soil reaction and nutrient status the following standard rating chart were followed (Table 1). The distribution and status of soil reaction and plant nutrient of district soils were shown respectively in Table 2 and Table 3.

Soil Reaction	**p^H**
Acidic	<5.5
Slightly acidic	5.5-6.5
Nearly neutral	6.5-7.5
Alkaline	7.5<

Table 1

Nutrient Rating

Nutrient status	**OM %**	**Total N %**	**Avail. Phosphorus (P_2O_5 Kg/ha)**	**Avail. Potash (K_2O kg/ha)**
Very low	<0.75	<0.03	<11.2	<56
Lows	0.75-1.5	0.03-0.07	11.2-28	56-112
Medium	1.5-3.0	.0.07-0.15	28-56	112-280
High	3.0-5.0	0.15-0.25	56-112	280-504
Very high			>112	>504

CURRENT SOIL REACTION AND NUTRIENT STATUS OF THE DISTRICT SOIL

Table 2

Soil reaction and area coverage

Soil reaction	**Area covered (ha)**
Acidic	8718.44 (15 %)
Slightly Acidic	23666.57 (40 %)
Nearly Neutral	18504 (30 %)
Alkaline	8798.42 (15 %)

Table 3

Nutrient status and area coverage

Nutrient class	Nutrient level and area covered (ha)			
	Organic Matter	Nitrogen	Phosphorus	Potash
Very Low	20800 (29 %)	20800 (29 %)	500 (1 %)	19500 (26 %)
Low	42800 (58 %)	42800 (58 %)	28000 (37 %)	34100 (46 %)
Medium	7800 (11 %)	7800 (11 %)	16800 (22 %)	16000 (21 %)
High	1500 (2 %)	1500 (2 %)	15000 (20 %)	1400 (2 %)
Very High			14700 (20 %)	4000 (5 %)

CONCLUSION AND RECOMMENDATION

About 9000 ha cultivated land of Mahottary district is acidic having pH less than 5.5 which must be corrected with suitable doses of lime for better plant growth and higher production. Similarly 63600 ha cultivated district soil is low to very low in organic matter content. This problem is more serious in Terai part of the district. In general the soil organic matter is the key indicator of soil fertility, which controls the physical, chemical and biological properties of soil. Therefore, serious attention must be paid in improving the organic matter content of soil. Nitrogen, phosphorus and potash status of district is also poor, about 63600 ha land is low to very low in nitrogen, 28500 ha land is low to very low in phosphorus and 53600 land is low to very low in potash content. Since farmers are using mainly urea and DAP, so the management of nitrogen and phosphorus is not very difficult but potash management where its use is almost negligible, is really a matter of great concern. Depending up on the nutrient status of soil the fertilizer dose should be adjusted scientifically.

Application of recommended dose of different fertilizer elements on the basis of soil test value, soil type and irrigation facility:

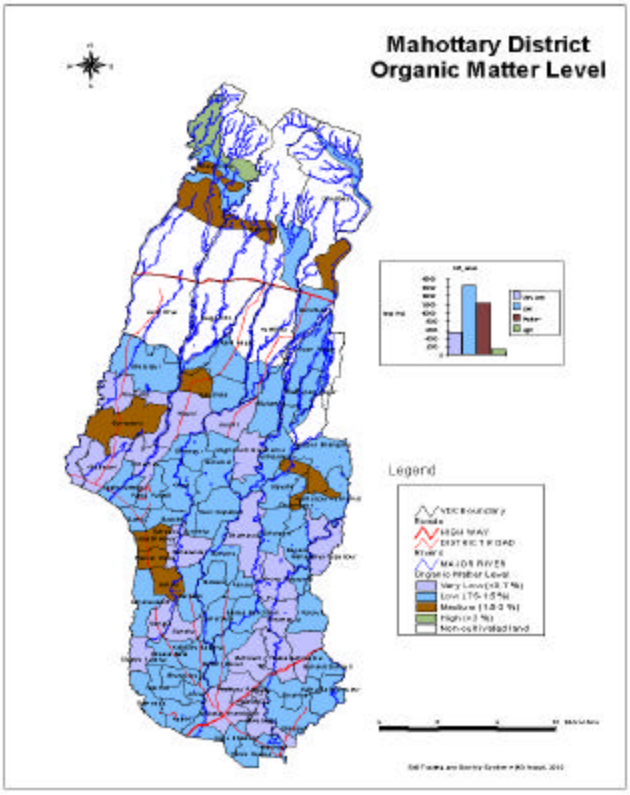
Percent of recommended dose of fertilizer to be applied	Nutrient status found from soil test
100% of N, P and K	LOW
75% OF N and 60% P and K	Medium (Medium-fine texture)
80% of N and 70% P and K	Medium (Light texture)
50% of N and 40% P and K	High

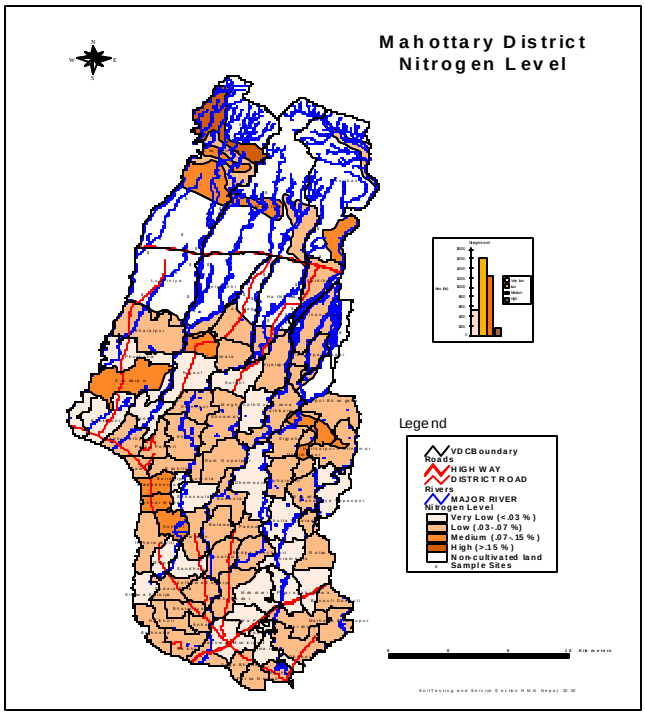
* Joshy and Deo 1976

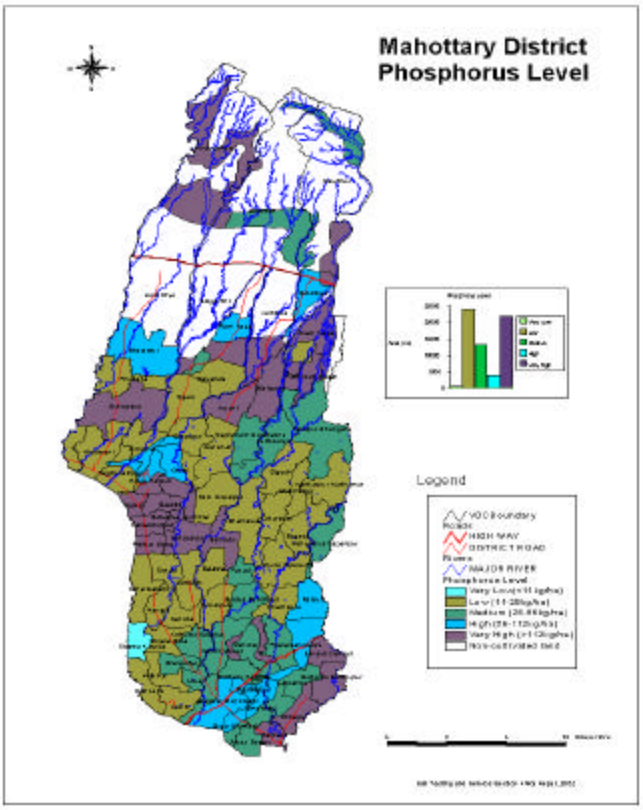
*** *** This recommendation is for irrigated agriculture. In case of rainfed condition the recommended dose should be reduced down to 60%.

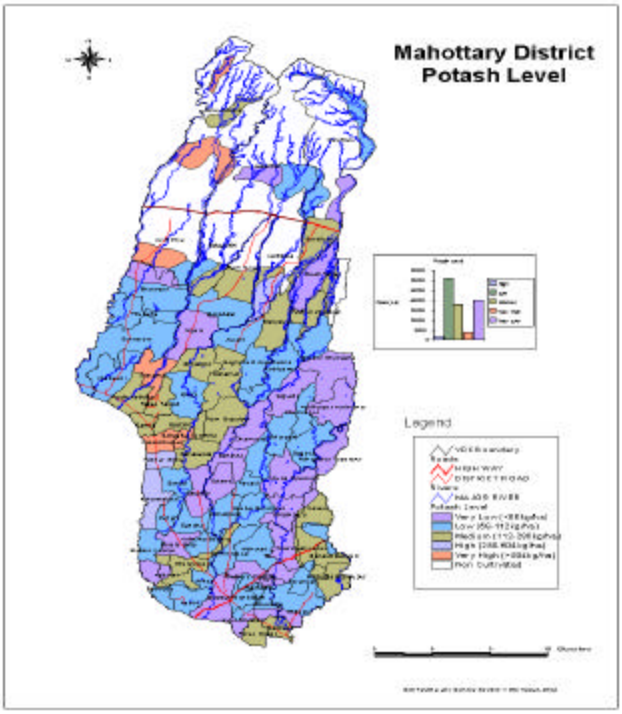
The deficiency of micronutrient in vegetables and other cereals like zinc in rice and boron in wheat has been reported. Farmers, during the survey, reported similar experience. The limit of the study did not include the micronutrient status of the district. Therefore, micronutrient status could not be studied, however attention should also be paid in micronutrient along with major nutrients to increase the efficiency of applied fertilizers and to get maximum yield.

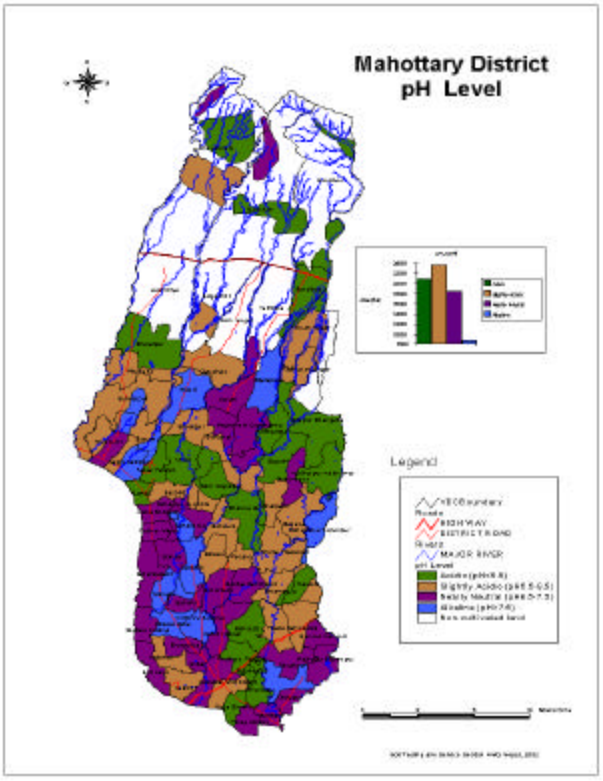
ANNEX

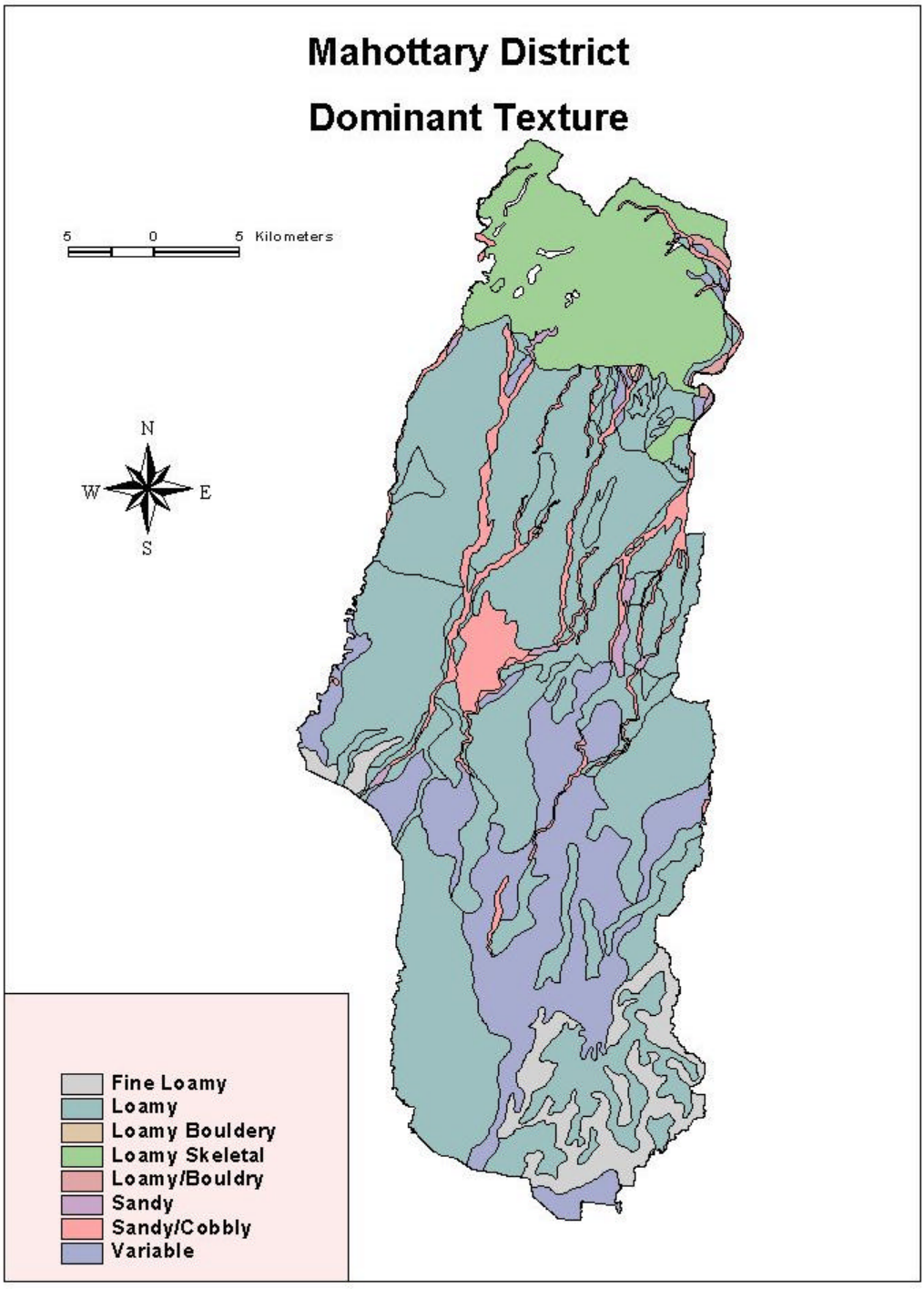



Mahottary District
Nitrogen Level
Legend
VDC Boundary
Roads
HIGH WAY
DISTRICT ROAD
Rivers
MAJOR RIVER
Nitrogen Level
Very Low (<.03 %)
Low (.03-.07 %)
Medium (.07-.15 %)
High (>.15 %)
Non-cultivated land
Sample Sites


Mahottary District
Phosphorus Level
Legend
VDC Boundary
HIGH WAY
DISTRICT ROAD
MAJOR RIVER


Mahottary District
Potash Level
Legend


Mahottary District
pH Level
Legend


Mahottary District
Dominant Texture
5 0 5 Kilometers
N
W
E
S
Fine Loamy
Loamy
Loamy Bouldery
Loamy Skeletal
Loamy/Bouldry
Sandy
Sandy/Cobbly
Variable