Soil Fertility Survey And Mapping Of Parsa District

His Majesty's Government

Department of Agriculture

Soil Management Directorate

2061 Jestha (2004)

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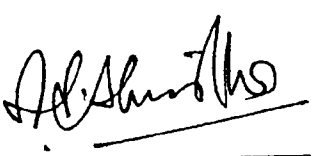
Foreword

Soil is the storehouse of plant nutrients and soil fertility is the key factor for Crop production. It is most essential to know the soil fertility status of a field for the recommendation of manure, fertilizer and soil amendment for the betterment of soil health. Healthy soil produces healthy crops. So to achieve the healthy crops in a sustained way, it is advisable to know the soil fertility status and mange the soil accordingly. For this purpose, the soil analysis is most essential. Soil Management Directorate (SMD) has started the fertility survey and fertility mapping programs. This fiscal year Parsa district was in target. SMD has completed the survey work and has prepared Soil fertility maps of this district.

I hope this map will be useful for the planner, extension workers, farmers and other stakeholders as well.

Lastly I thank Mr. S.N. Jaishy and all his staffs of the SMD, DADO, and farmers for their valuable contribution.

Thanks.



(S.S. Shrestha)
Director General
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Content

Soil Fertility Survey and Mapping of Parsa District

1. Soil Fertility Survey

1.1. Location

Parsa occupies two topographical regions, Siwalik and Terai. The total area of Parsa is 1353 Sq. kms. Elevation of the district is 122 to 925 meters, which is located between 26^0 60" to 27^0 13" North latitude and $84^0$22" to $85^0$13" East longitude. This district is situated within Narayani zone of Central Development Region. Birgunja is the district head quarter.

1.2. Boundary of the district

East:	Bara
West:	Chitawan District and Bihar state of India
North:	Makawanpur and Chitawan
South:	Bihar state of India

1.3. Climate

The climate of Parsa district is not so much influenced by diverse topography and elevation. The district has diverse tropical and sub tropical climate. The district receives an average annual rainfall of about 2145 mm and temperature 20.5 to 36^0 c.

1.4. Land Distribution

Table 1. Topographical distribution of land (Area in ha.)

Physical condition	Agriculture		Pasture	Forest	Others	Total
	Cultivated	Non cultivated				
Siwalik	1119	167	66	45127	2043	48522
Terai	48927	4519	2790	31997	2188	90421
Total	50046	4686	2856	77124	4231	138943

Source: District Development Profile of Nepal 2001

1.5. Political Distribution

Table 2. Political distribution

Electorate region	Ilaka	Sub metropolitan	VDC
4	15	1	82

Source: District Development Profile of Nepal 2001

1.6. Demography

Table 3. Demography

Household Number	Average HH size	Population		
		Total	Male	Female
79456	6.26	497219	260411	236808

Source: Statistical Information on Nepali Agriculture (2001/2002)

1.7. Land Classification

Table 4 Land classification according to landholding

S. N	Classification	Total house hold
1	Land less	1234
2	<1 hector	23348
3	1-5 hector	17211
4	5-10 hector	904
5	>10 hector	169

Source: Annual report of DADO (2003-2004)

1.8. Land use pattern

Table 5. Major crops, area, production and productivity

Crops	Areas (ha.)	Production (Mt)	Yield (Kg / ha.)	Remarks
Paddy	44735	165650	3703	
Maize	4150	11329	2730	
Millet	103	103	1000	
Wheat	22000	55000	2500	
Barley	75	105	1400	
Oil seed	6510	3971	610	
Potato	892	11910	13352	
Tobacco	200	107	535	
Sugarcane	1475	51625	35000	
Lentil	7132	7900	1109	
Chick pea	20	24	1200	
Pigeon pea	260	280	1077	
Black gram	75	61	813	
Grass pea	700	560	800	
Horse gram	-	-	-	
Soybean	25	15	600	
Others	320	300	938	

Area under tropical summer fruits				
Crops	Area Ha	Crops	Area Ha	
Mango	556.5	Jackfruit	66.78	
Banana	194.37	Pineapple	29.45	
Guava	86.0	Litchi	133.36	
Papaya	107.3	Areca nut	2.10	
Coconut	2.15			

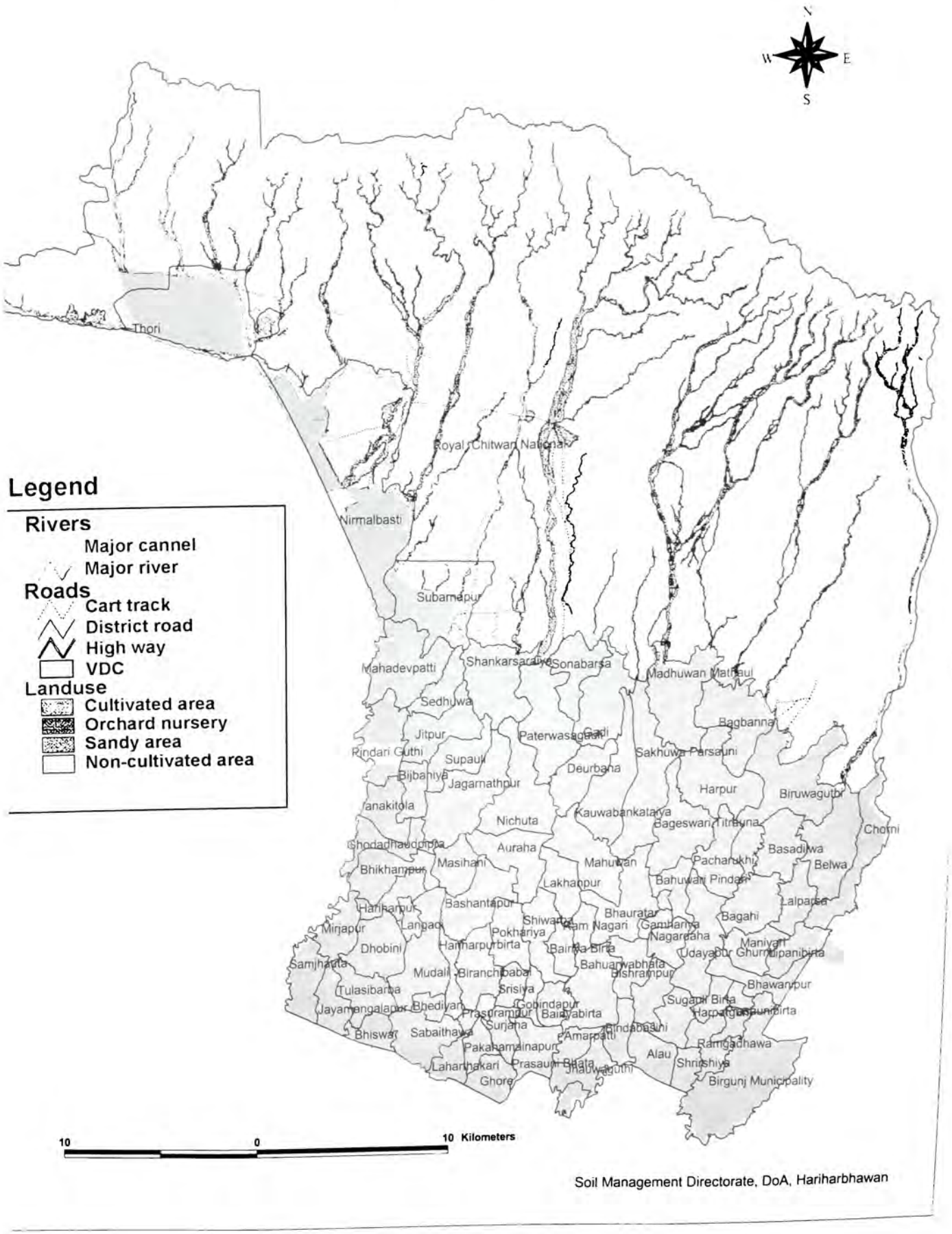
Source: Statistical Information on Nepali Agriculture (2002/2003)

Productive area and production of tropical (Summer) fruits

	Area (ha)	Production (Mt)		Area (ha)	Production (Mt)
Mango	397	3859	Pineapple	24	350
Banana	165	2409	Litchi	89	730
Guava	63	737	Arecanut	1	2
Papaya	86	1290	Coconut	1	2
Jackfruit	44	537	Total	870	9916

Source: Statistical Information on Nepali Agriculture (2002/2003)

Parsa District Cultivated Area



Legend

Rivers
- Major cannel
- Major river

Roads
- Cart track
- District road
- High way
- VDC

Landuse
- Cultivated area
- Orchard nursery
- Sandy area
- Non-cultivated area

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1.9. Major Cropping Patterns of the District

Irrigated land	Un irrigated land
Rice- Rice -Wheat-	Rice -Wheat
Rice-Rice – Oil seed	Rice - Legume
Rice-Rice –Vegetable	Rice-Legume-Maize
Rice-Rice –Pulses	Rice - Oil seed
Rice- Wheat	Rice - Vegetable
Rice - Maize	Maize - oil seed
Rice- Wheat -Mung	Sugarcane
Rice-tobacco	

1.10. Irrigation facilities

Statistical Information on Nepalese Agriculture has reported that 45203.5 ha of land of Parsa district are irrigated.

2. Objective

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

Conduct soil survey and collect soil samples from different representative land system locations

Analyse the collected soil samples for soil reaction (pH), organic matter, total nitrogen, available phosphorus and potassium.

Based on the soil reaction and nutrient status recommend sound and sustainable soil management practices

Prepare soil fertility maps showing occurrence and distribution of soil reaction and major nutrient statuses in the district.

3. Methodology

3.1. Table work

Kenting earth science ltd. Canada under Land Resources Mapping Project (LRMP) in 1986 has prepared Land Systems Maps of the whole country. These maps show extent and distribution of different land systems and land types. These maps with physiographic details published at the scale of 1:50000 have been 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.

3.2. Fieldwork

Following the sampling sites fixed in the base map, field works were conducted and surface soil samples were collected by using soil auger and packed in plastic sample bags with proper labels. The samples were collected only from the presently cultivated areas. Soil samples were collected from DADO and SMD staffs.

3.3. Laboratory work

Soil samples received from the field were air dried first by spreading in shade. These air-dried samples were then crushed with a wooden pestle and mortar and sieved through 2-mm sieve. Part of the soil samples less than 2 mm diameters were again sieved through 0.2 mm sieve, which were used for the determination of organic matter and other nutrient content. Following chemical properties were assessed using the standard laboratory methods

3.4. Soil reaction (pH)

Soil reaction was determined by measuring 1: 1 Soil: Water suspension with the calibrated pH meter.

3.5. Organic matter

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

3.6. Available Phosphorus

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

3.7. 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.

4. Data compilation and Mapping

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. While assessing the soil reaction and nutrient status the following standard rating chart for general information & lime use.

Soil Reaction class	pH Acidic
Acidic	<4.5
Strongly acid	4.5-5.2
Moderately acid	5.3-5.9
Slightly acid	6.0-6.5
Nearly neutral	6.6-7.0
Slightly alkaline	7.1-7.5
Moderately alkaline	7.6-8.3
Strongly alkaline	8.4-9.0
Extremely alkaline	>9.0

Note: Although this rating chart is widely accepted and used for interpreting the soil reaction status, in our project considering the soil analysis report and limited number of sample the following category have been made viz.

Soil Reaction	***pH***
Acidic	<5.5
Slightly acidic	5.5-6.5
Nearly neutral	6.5-7.5
Alkaline	>7.5

Parsa District Soil Sample Sites

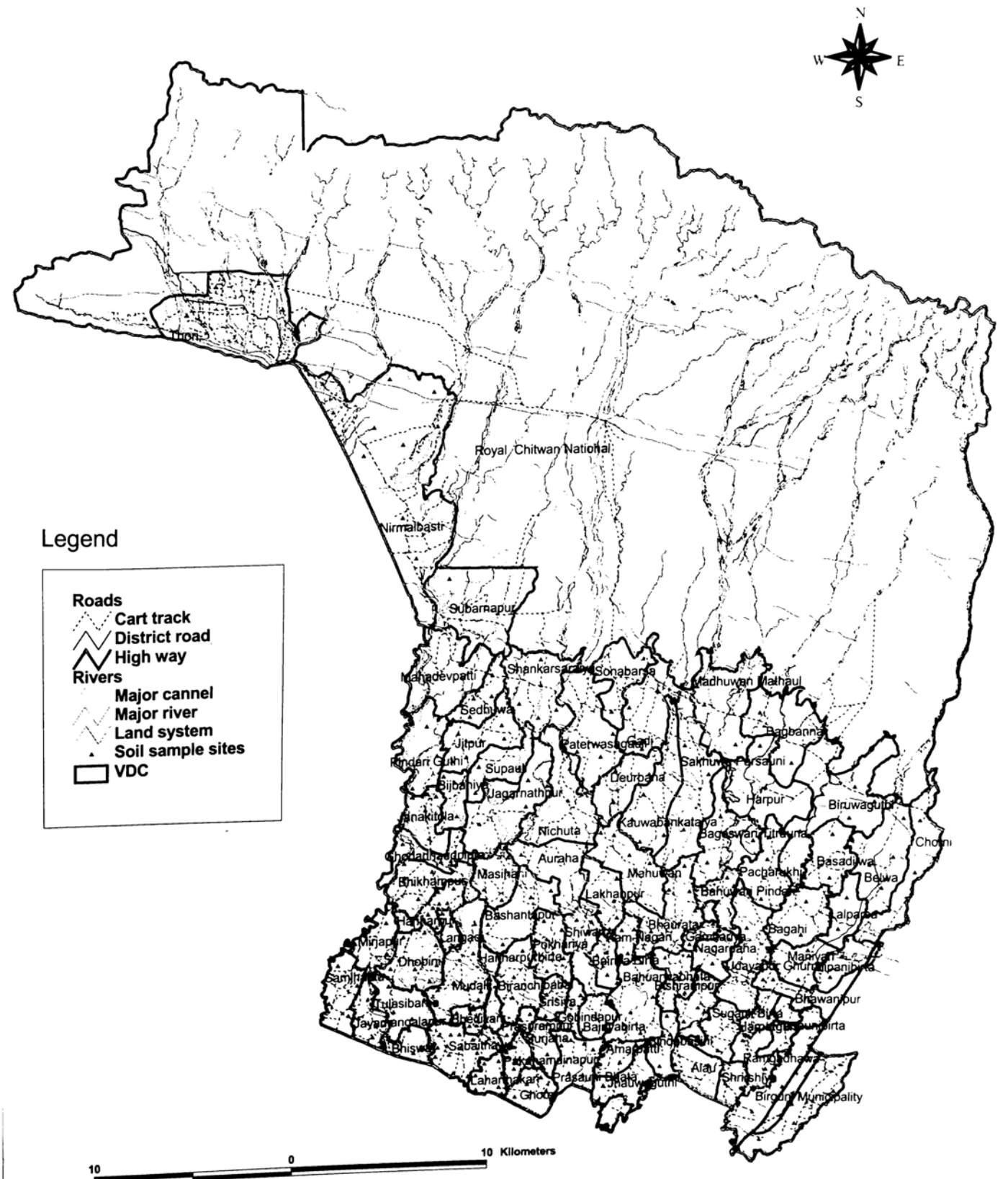

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Table 6 Nutrient rating

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
Low	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	>5	>.25	>112	>504

As stated earlier, physiography and land systems within each of this physiography were considered as the major basis for conducting field survey and assessment of the present soil fertility status of the district. The brief descriptions and characteristic features of these land types occurring in the district are as follows:

5. Descriptions of Physiography and Land Systems

LRMP (1986) have identified five physiographic regions in the country based on the repeating patterns of landforms. Of these five physiographic regions Parsa district falls within two regions Siwalik and Terai.

5.1. Land System Legend

Table 7. Mapping Approach

Category:	Differentiation Criteria
Region	Physiography, Geology and Geomorphology
Land system	Recurrent Patterns of landform, geological materials, slope and Arable Agriculture limits
Land unit:	Land scope feature, Position, slope, degree of dissection, flooding frequency soil characteristic, drainage, depth, texture, profile development, pH.

Terai Region: Quaternary alluvium, Subtropical							
Land system	Land form	Land unit	Dominant soils	Dominant slopes	Dominant texture	Seasonal Range of depth to water table	Drainage
I	Active alluvial plain (Depositional)	Ia Present river channel	-	-	-	-	-
		Ib sand and gravel bar	Ustrothents Psamments	$<1^0$	Sandy/ cobby	0-2m	Subject severe river flooding
		Ic low terraces	Ustifluvents Fluvaquents	$<1^0$	Sandy	0-2m	Variable; severe river flooding

		1d higher terraces	Ustrocrepts Haplaquepts	<1^0	Loamy	0-4 m	Variable subject to occasional river flooding
2	Recent alluvial plain "lower piedmont " (depositional and erosional)	2a depressional	Ustrocrepts Haplaquepts	<1/2^0	Fine loamy	0-2 m	Poor
		2bInter mediate positional; level	Haplaquepts Aeric	<1/2^0	Loamy	0-6m	Imperfect
		2c Inter mediate positional; undulating	Haplaquepts Ustrocrepts	<1^0	Variable	Dependent on position	Variable; low areas; subjected to flooding
		2d high positional	Haplaquepts Ustochrepts	<1^0	Loamy	1-10m	Moderately well
3	Alluvial Fan Apron complex "upper piedmont" (erosion)	3 very gentle slope	Haplustolls Dystrochrepts Ustochrepts	<1^0	Loamy	1-10m	Moderately well
		3b gentle slope	Haplustolls	1-5^0	Loamy/ Bouldery	2-10m	Rapid
		3 undulating	Haplustolls	1-3^0	Loamy	2-10m	Well
		3d highly dissected	Ustrochrepts	0-20^0	Loamy	>2m	Rapid

Table 8 Siwalik regions

SIWALIK REGION: Tertiary inter bedded sand stone, shale, conglomerate and quaternary alluvium;

Subtropical

Land system	Land form	Land unit	Dominant soils	Dominant slopes	Dominant texture	Seasonal Range of depth to water table	Drainage
4	Active recent alluvial plain	4a sand and gravel bars	Ustrothents Psamments	<1^0	Sandy / cobby	0-2m	Subject to severe river flooding
		4b Low terrace	Ustifluvents Fluvaquents	<1^0	Sandy	0-2m	Variable; subject to severe river flooding
		4c Higher terrace	Ustrocrepts Haplaquepts	<1^0	Variable	Dependent on position	Variable; low areas subjected to flooding
5	Fans, Aprons, and Ancient river Terraces (Tars)	5a very gentle slope	Haplustolls Dystrocrepts Ustrochrepts	<1^0	Loamy	0 ->15m	Moderately well

Parsa District Soil Textural Distribution

		5b gentle Slope	,,	1-5^0	Loamy/ Bouldery	2->15m	Rapid
		5c undulating	,,	1-5^0	Loamy	2->15m	Well
		5d rolling	,,	0-20^0	Loamy	2->15m	Rapid
6	Depositional Basin (Duns)	6a Depressional	Haplaquepts	<1/2 ^{0}	Fine loamy	0-2m (perched)	Poor
		6b Non-dissected high position	Ustochrepts Haplaquepts	<2 ^{0}	Fine loamy	0-6m (perched)	Imperfect
		6c gently rolling	,,	1-5 ^{0}	Fine loamy	2-15m (perched)	Variable
		6d highly dissected	Ustochrepts	0-30 ^{0}	Fine loamy	>15m (perched)	rapid
7	Moderately to steeply sloping hilly and mountainous Terrain		Paralithic, Lithic, and Anthropic Subgroups of Dystrochrepts Ustochrepts	<20^0	Loamy Skeletal	no water table , < 1m to bedrock	Well to rapid
8	Steeply to Very Steeply Sloping Hilly and Mountainous Terrain		Lithic Subgroups of 7 and Ustorthents	<20^0	Loamy Skeletal	No water table, < 50 cm to bedrock	Rapid

6. Nutrients status of soil

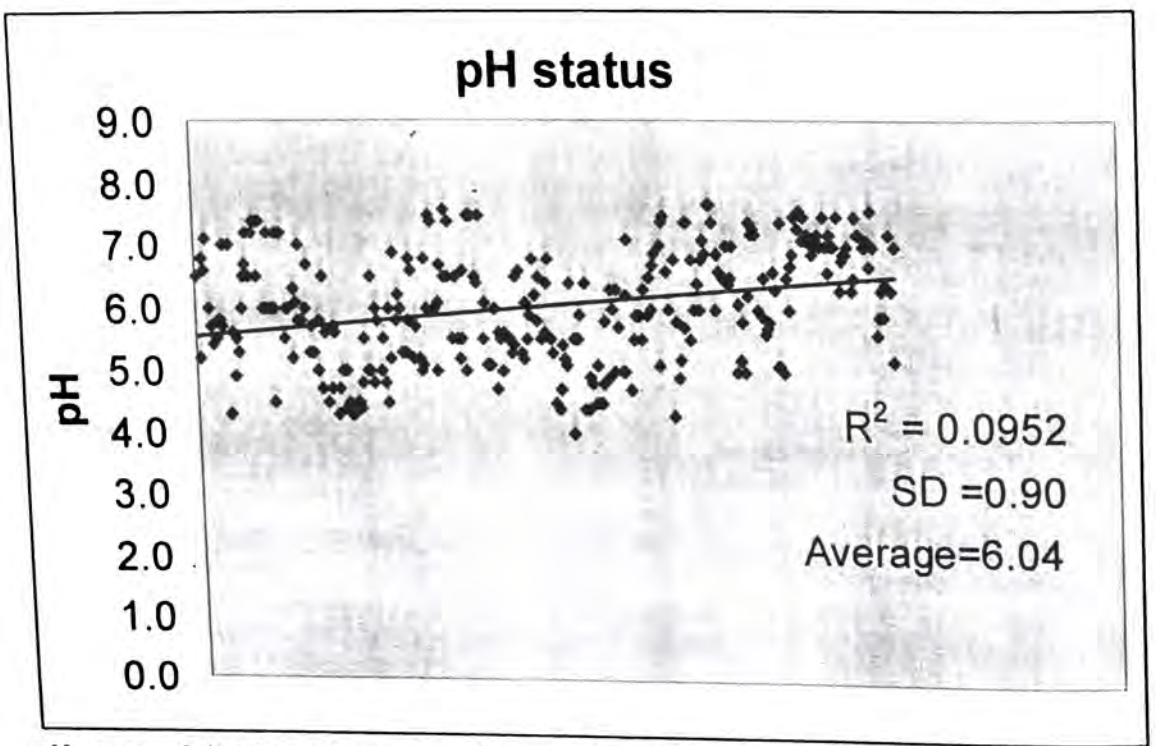
Plant needs 16 elements to complete their life cycle. Carbon oxygen and hydrogen are basic nutrients, major constituents of plant part (96 % in dry matter basis). Nitrogen phosphorus and potassium are primary, nutrients, which need large amount. They are deficient in almost all soil. Ca, Mg, S are the secondary nutrients, require less amount. Fe, Zn, Mn, B, Mo, Cu and Cl are trace or micronutrients, which need very small amount but equally important as macro elements. Less than requirement, they show deficiency and more than required causes toxicity. These micronutrients are catalyser and activators. K, Ca, and Mg act as regulators and carriers. N, S and P are structural elements useful in energy storage, transfer and binding. In Nepali cases N, P, K, S, Zn, B, Mo are creating problems due to deficiency.

6.1. Soil reaction (pH)

The meaning of pH is pouvoir hydro gene, which means hydrogen power. pH indicates the nutrients availability situation, microbial activities, nitrification / denitrification situation, deficiency / sufficiency of plant nutrients etc.

Table 9. Soil reaction situation of Parsa

Soil reaction	pH value	No. of samples	%
Acidic	<5.5	83	27
Slightly acidic	5.5-6.5	107	35
Nearly neutral	6.5-7.5	100	33
Alkaline	7.5<	16	5
Average	6.04		
Range	4 - 7.7		
Total		306	100



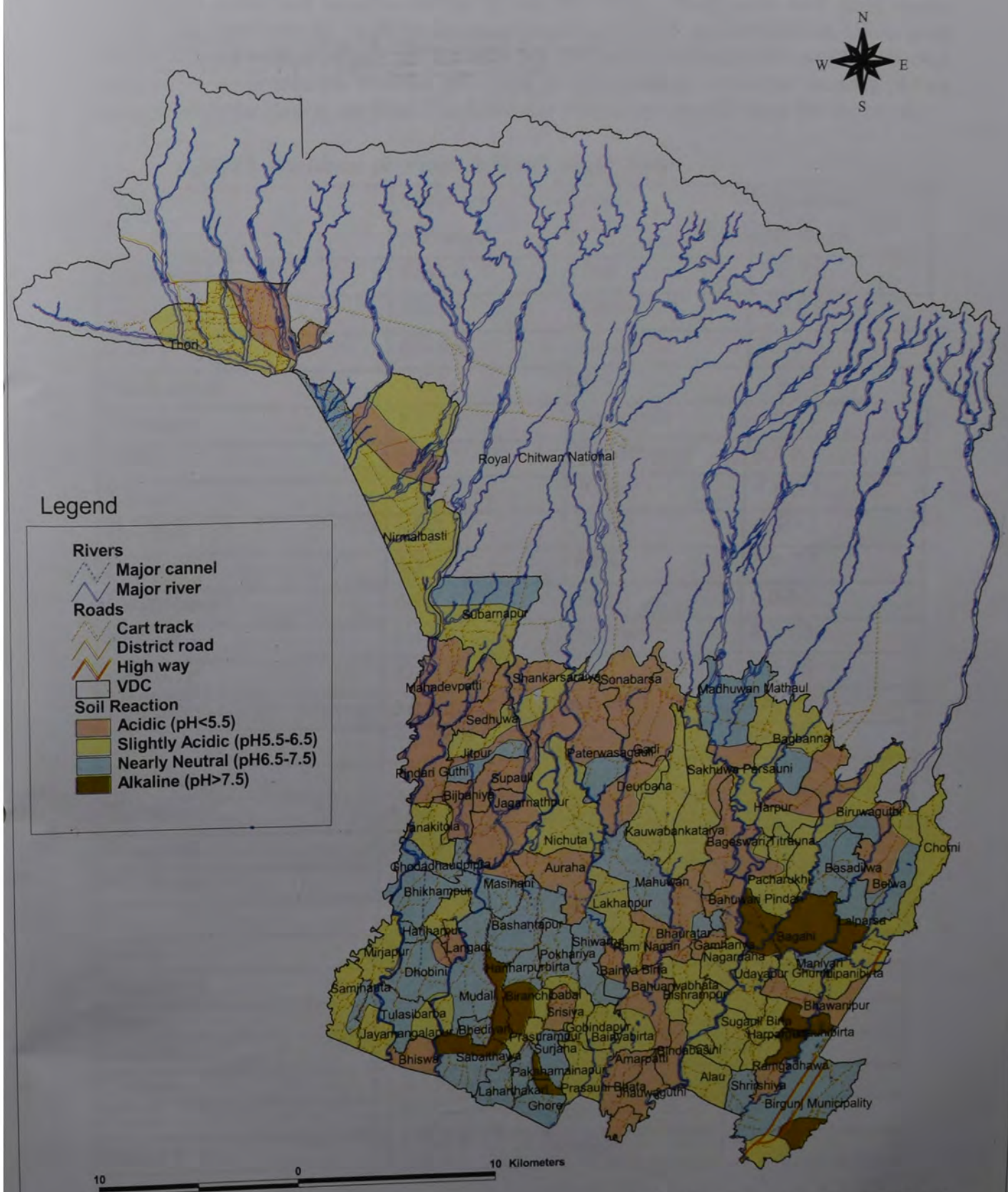
pH range of district soil was found from 4.0 to 7.7, which is a quite wide range of soil reaction indicating strongly acidic to slightly alkaline nature of the district soil. 27 % of soil of Parsa district is acidic and needs to reclamation by applying lime.

6.2. Acid soil management

6.2.1. Crop management

The pH requirement of different crop is different. Therefore, it is difficult to say anything about correction of soil pH unless we know about the crop that is growing by the farmers. However extreme soil pH, either acidic or alkaline, limits the crop growth in various ways. For example in highly weathered acid soil with high iron (Fe) and aluminium (Al) oxides, crops may suffer due to unavailability of phosphorus due to high rate of fixation of soil phosphorus and applied phosphoric fertilizer too. Under such condition rice crops may suffer due to toxicity of iron and aluminium because of high solubility. In highly acidic condition crops also suffer due to deficiency and unavailability of calcium and magnesium. Similarly in highly alkaline soil with pH more than 8, crops may suffer due to deficiency of micronutrient like Fe, Mn, Zn and Cu. In highly alkaline soil phosphorus availability is also reduced due to fixation by calcium compounds in soil. In general a soil

Parsa District Soil Reaction Level



Legend

Rivers
- Major cannel
- Major river

Roads
- Cart track
- District road
- High way
- VDC

Soil Reaction
- Acidic (pH<5.5)
- Slightly Acidic (pH5.5-6.5)
- Nearly Neutral (pH6.5-7.5)
- Alkaline (pH>7.5)

10 0 10 Kilometers

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having pH from 6.5 to 7.5 (nearly neutral) is considered best for growing almost all of the crops. The soil with pH 5.5 to 6.5 although categorized slightly acidic are safe for growing most of the crops except a few high calcium requiring plants. The soil with pH < 5.5 are considered acidic and requires liming. At this pH range liming gives very good result. Under such condition pH might be the major limiting factor of crop production. Under such condition amelioration of soil pH is a must for soil fertility management and higher crop production. Crop requires desiring pH. If the crop is growing within the desiring pH no need to apply the lime to the field. The following table shows the pH range for the crops.

Table 10 Optimum pH range for some major crops

Crop	Optimum pH range	Crop	Optimum pH range
Asparagus	5.5-7.0	Oat	5.0-7.5
Banana	6.0-7.5	Olive	6.0-8.0
Barley	6.5-8.0	Onion	5.5-6.5
Buck wheat	5.5-7.0	Pea	6.0-7.5
Cabbage	6.0-7.0	Pine apple	5.0-6.5
Chilly	5.5-6.5	Pomefruit	6.0-8.0
Citrus	5.5-6.5	Potato	4.8-6.5
Coconut	6.0-7.5	Radish	6.5-7.5
Coffee	4.5-7.0	Rape	6.0-7.5
Cauliflower	6.5-7.5	Rice	5.0-6.5
Coriander	6.0-7.0	Rubber	4.5-7.5
Cotton	5.0-6.0	Rye	5.0-7.0
Cow pea	5.0-6.5	Soybean	6.0-7.0
Cowpea	5.0-6.5	Stone fruit	6.5-8.0
Cardamom	4.5-5.5	Sugar beat	6.5-8.0
Cucumber	6.0-7.3	Sugar can	6.0-8.0
Fenugreek	6.0-7.0	Sun flower	6.0-7.5
Field beans	6.0--7.5	Sweet potato	5.8-6.0
Flax	5.0-7.0	Tea	4.0-5.5
Garlic	6.5-7.0	Tobacco	5.5-7.5
Ground nut	5.3-6.6	Tomato	5.5-7.0
Hemp	6.0-7.0	Turmeric	5.5-6.5
Lima bean	6.0-7.0	Turnip	5.5-6.8
Lucerne	6.2-7.8	Velvet bean	5.5-7.0
Maize	5.5-7.5	Wheat	5.5-7.5
Mango	5.5-7.0	Zinger	6.8-7.0

Amelioration of acidic soil, although pays with higher crop production, is a costly process. Under resource poor farming condition and in remote areas lime recommendation may not be very much practicable because of inability of farmers to buy it and difficulty in transportation. Therefore, low cost alternative solution is required to such condition. In recent years, the concept of "fitting the soil as per crop requirement" has been changed to " fitting the crop as the soil" to solve this problem.

The pH requirement of different crop is different. With proper crop management practice liming may not be necessary, as there are some acid loving plants, which grow well on acid soils. So it would be desirable to manage crops according to pH. However soil pH from 6.0 to 7.5 is considered to be suitable for most of the crops. Acid soils can be used for tea, coffee, pineapple, and blue berry. Black berry, cabbage, corn, peanut, sweet potato, tobacco, wheat are medium lime desiring plants. Incas of lowland irrigated rice the field is flooded, hence the soil chemistry is different than that of upland crops. Rice can tolerate wide range of soil pH but in highly acidic soil the crop may suffer due to iron and aluminium toxicity and unavailability of phosphorus and other plant nutrients. Classification of crops according to soil pH is given in table 11.

Table 12 Classification of crops according to lime requirement.

High	Medium	Low	Very low
Alfalfa, barley, asparagus, bean pea, soybean, spinach, sugar beet, Sun flower,	Black berry, cabbage, peanut, maize, lettuce, gram, sweet potato, tobacco, wheat,	Buckwheat, oat, rice, potato, and strawberry.	Tea, coffee, pineapple, Napier grass, crane berry, rhododendrons, azalea, several conifer,

In acid soil management the type of nitrogenous fertiliser that farmers use is also very important. In general the ammoniacal and urea nitrogen aggravate the soil acidity. Therefore, use of nitrate nitrogen instead of these ones, if available, will help to reduce the problem. Organic manures have high buffering capacity and help to maintain the soil reaction. They always keep the soil reaction near neutral range. Therefore, both in acidic and alkaline soil use of high dose of organic manure help to ameliorate the problem.

6.2.2 Liming:

Agriculture lime application is highly recommended for the soils with acidic reaction. Lime application dose is recommended based on the pH reading, Organic matter content and texture condition of soil. By addition of soil the proportion of calcium on exchange complex and can immobilize by precipitation certain element such as iron, manganese and aluminium, which may be, present a soil to excess. The recommendation chart is given in table 10.b. Careful attention should be paid about the time and dose of lime application. Standing crops should never be limed, as land should be left fallow for at least about 2-3 weeks after liming. In case of higher dose split application is recommended.

Increasing the pH by more than one unit at a time is not desirable because sudden increase in soil pH may affect the soil environment affecting the growth of soil microorganisms and availability of plant nutrients.

Table 13 Recommendation of agricultural lime for different pH level, for different soils texture

pH	Recommended dose of Agri lime (kg / ropani_					
	Hills			Terai		
	Sandy loam	Loam	Clay loam	Sandy loam	Loam	Clay loam
6.5	15	20	24	8	14	22
6.3	29	40	48	15	24	44
6.2	43	60	72	23	34	64
6.1	58	78	98	30	44	86
6.0	71	92	120	38	52	106
5.9	85	110	146	45	62	128
5.8	97	128	166	52	72	146
5.7	108	142	188	58	82	166
5.6	119	158	208	64	90	184
5.5	130	170	230	70	100	200
5.4	140	188	252	76	110	220
5.3	150	204	274	81	118	238
5.2	160	218	294	86	126	254
5.1	169	228	314	91	136	270
5.0	176	240	334	96	142	286
4.9	184	252	354	101	150	302
4.8	191	262	374	106	158	316
4.7	199	272	390	111	166	330
4.6	205	280	406	115	174	340
4.5	210	290	420	120	180	350

Note:

- Test your soil before applying lime.
- Use agricultural lime 2-3 weeks before plantation or sowing the seed.
- If high dose of lime is recommended, use in split dose of twice.
- If pH is less than 4.5, apply agricultural lime according to recommendation for pH 4.5 and application should be repeated as required after checking the soil pH.
- It is not advised to raise the soil pH by more than one unit at a time or a season.

7. Organic matter status of the District

Soil organic matter is a residue of plant, animal and microbial stage of decaying. It serves as a storehouse of reserve nitrogen, which is in organic form and mineralized slowly. Organic matter is the soul of soil, which has multifunctional behaviour. The table below summarizes organic matter status.

Table13 organic matter status of Parsa

Rating	Samples	%
Very low	96	31
Low	185	60
Medium	23	8
High	2	1
Range	0.051-3.9	
Average	0.97	
Total	306	100

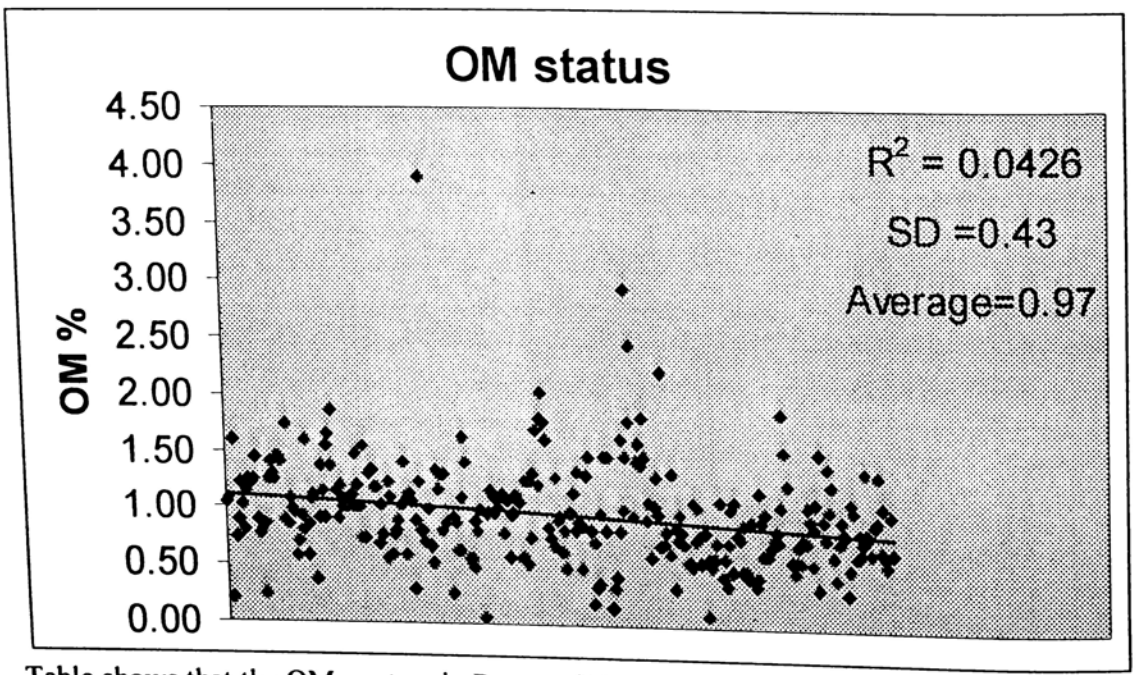


Table shows that the OM content in Parsa soil is very deprived. So to mange for betterment is essential. The range of OM content is 0.051-3.9. Majority of samples are below than 1.5 a great effort should be paid for improvement. The following practices are recommended for improvement.

7.1. Function of OM

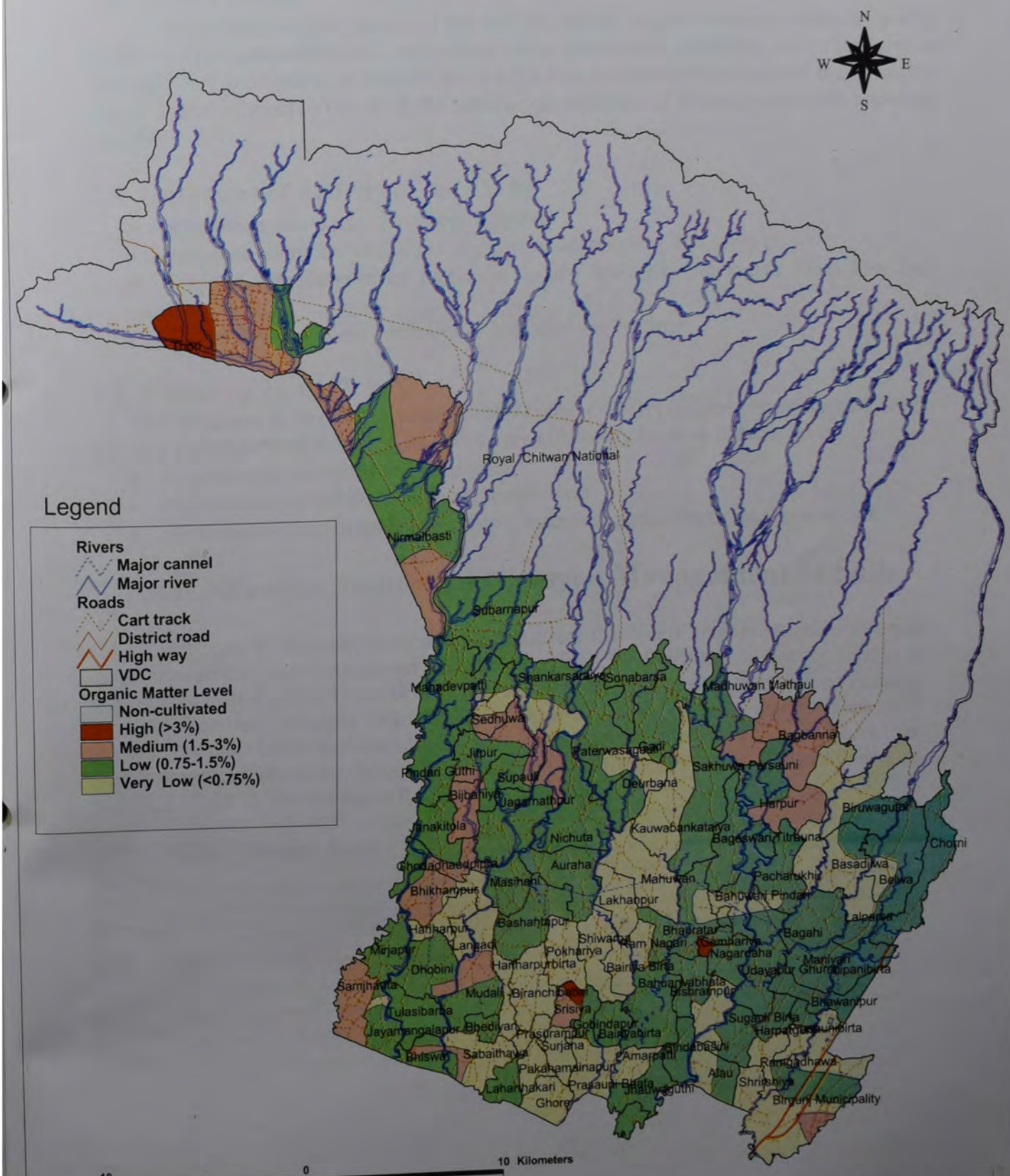
The major function of OM in soils are warming the soil, improve water holding capacity (about 20 times of weight), having good cementing action, forms stable complex with metallic and other polyvalent cat ions, buffering action, increases CEC, Source plants nutrients of elements.

7.2. Organic matter management

Organic matter is a key factor for soil health improvement. Soil organic matter can be improved by improving the quality of manure being used and in sufficient quantity. From IPNS guideline, it is advised to use sufficient manure to maintain organic matter in soil. Soil OM can be maintained as follow although SSMP is suggesting for at least 3% organic matter in soil required for sustainability.

- 1% Soil organic matter can be maintained by using 18 dokos (450 kg) FYM / Ropane
- 2% Soil organic matter can be maintained by using 34 dokos (850 kg) FYM / Ropani

Parsa District Organic Matter Level



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- 3% Soil organic matter can be maintained by using 50 dokos (1250 kg) FYM / Ropani

7.3. Source of OM

Increasing Organic matter in the soil by adding organic manure, improve quality FYM/ compost preparation and application, use green manure, mulching, aware the farmers for night soil application on biogas, etc are the way to increase the organic matter in the soil. It is also advised to use of all the possible combination of organic recyclable materials into the soil.

7.4. Increment of Activity of soil life by

- Integrate legumes into the cropping system
- Introduce additional soil micro organisms (Mycorrhiza, Rhizobia etc)
- Avoid the application of pesticides to the soil (e.g. carbonate fungicides and insecticides)
- If needed, use organic pesticides or localized applications

7.5. Follow up on IPNS FFS

This program is launching both by NGO and GO. IPNS demonstration and IPNS Farmers Field's School should be launched very effectively because it essential for:

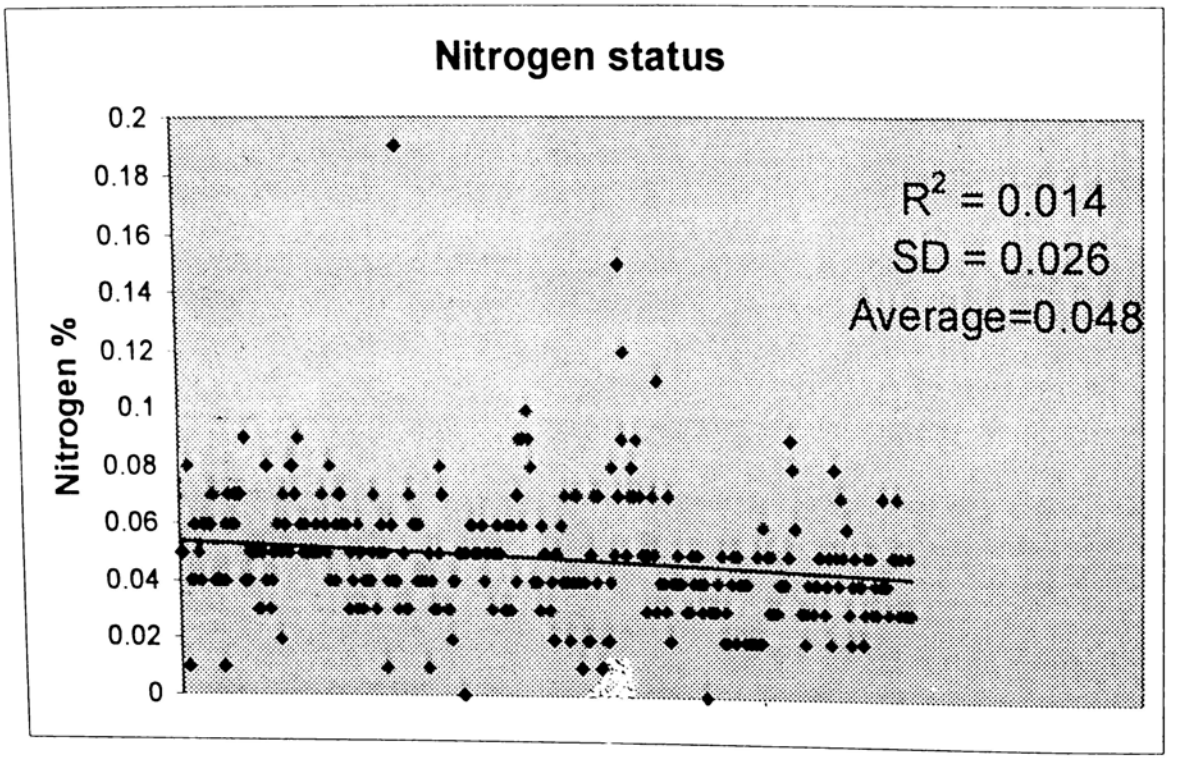
- Good land productivity and crop yield.
- Maintenance of soil fertility on the longer term.
- Most efficient use of local and external resources according to local conditions.

8 Total Nitrogen Status and Nitrogen Management in Soils

Nitrogen is the most important plant nutrient that limits crop production. It needs large amount for plant through out the plant life cycle. Its deficiency is directly related to the organic matter status. It can be obtained by decaying organic matter as well as fixed by legumes from air. Nitrogen deficiency is widespread where organic manure is in short supply. The table below summarises different N status in the soils in the district. More than 73% soil samples are in low range ,10 % samples falls in very low range. Range of nitrogen is 0.01% - 0.32 %. An average is 0.05 %

Table14 Total Nitrogen Level

Rating	Samples	%
High	3	1
Medium	50	16
Low	222	73
Very Low	31	10
Range	0.01-0.32	
Average	0.048	
Total	306	100



8.1 Efficient use of Nitrogen

Organic manure is the most important constituent, **which** supplies all types of plant nutrients. So maximization of OM is most important. Leaching and vitalization losses are the major problems in nitrogen. It can be prevented by incorporation. It is advised to use in split dose. Manage soil pH for better microbial activities. High rainfalls areas use partial decomposed FYM for demobilization. Early planting of crops with first rains for plant uptake the leaching nutrients. Apply only organic manure in basal fertilization and use inorganic fertilizer only for top-dressing. Reduce free N in the soil Use of good quality FYM / compost Maintained the OM, Increase soil OM, Activate the soil life

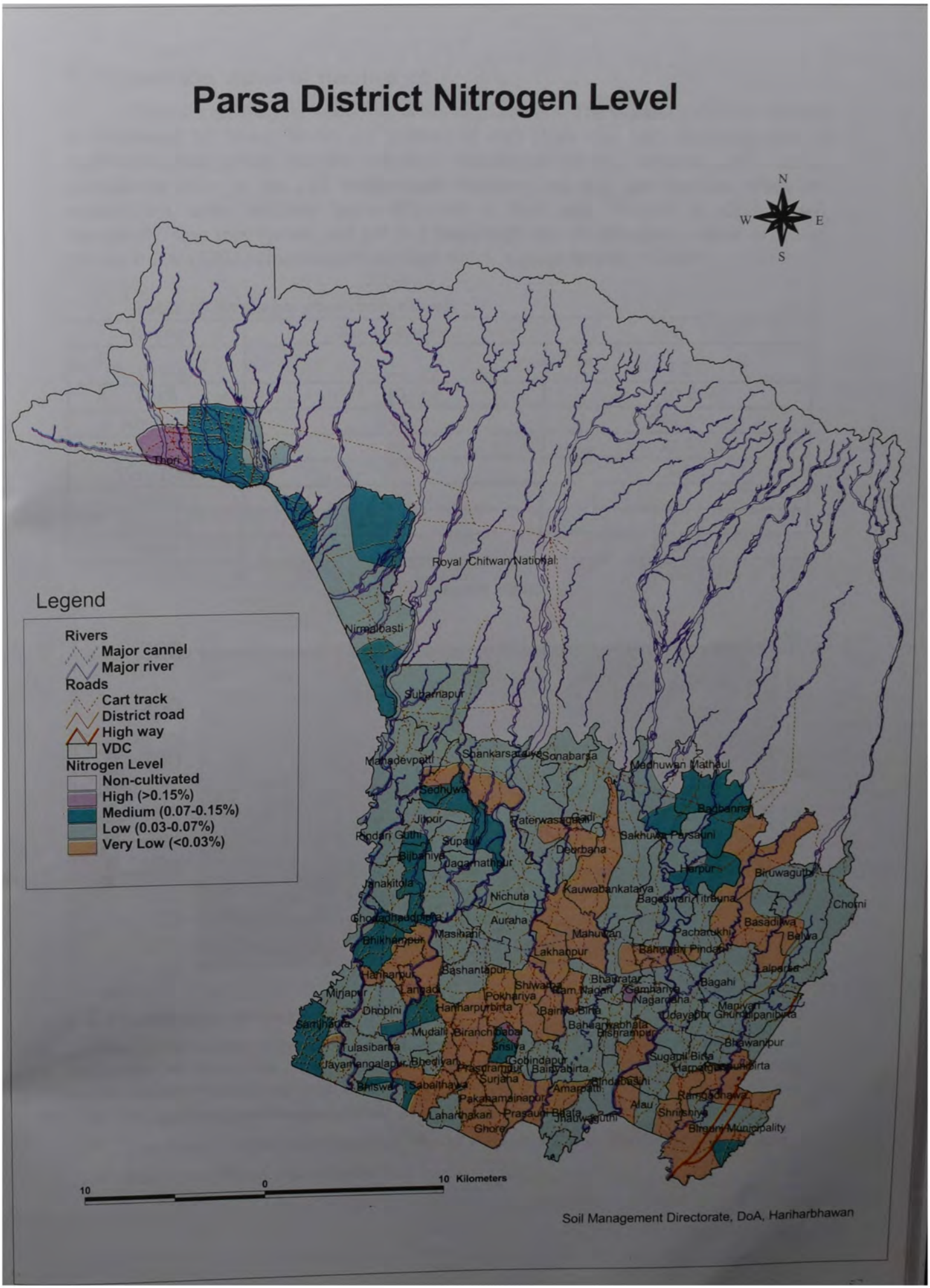
8.2. Increase N-fixation

- By integration of food legumes into the cropping system
- By the use of Rhizobia for increased N-fixation in legumes
- By the use of legume green manure inter/ relay crops/ main crop
- By the use of free-living organisms for N Fixation e.g. Azotobactor

8.3. Application of N

- Use organic and in-organic fertilizer
- Urine application 3-5 time
- Low phosphorus and low Nitrogen use DAP+ urea
- High phosphorus use urea.
- Follow recommended dose, which is given table 17.

Parsa District Nitrogen Level



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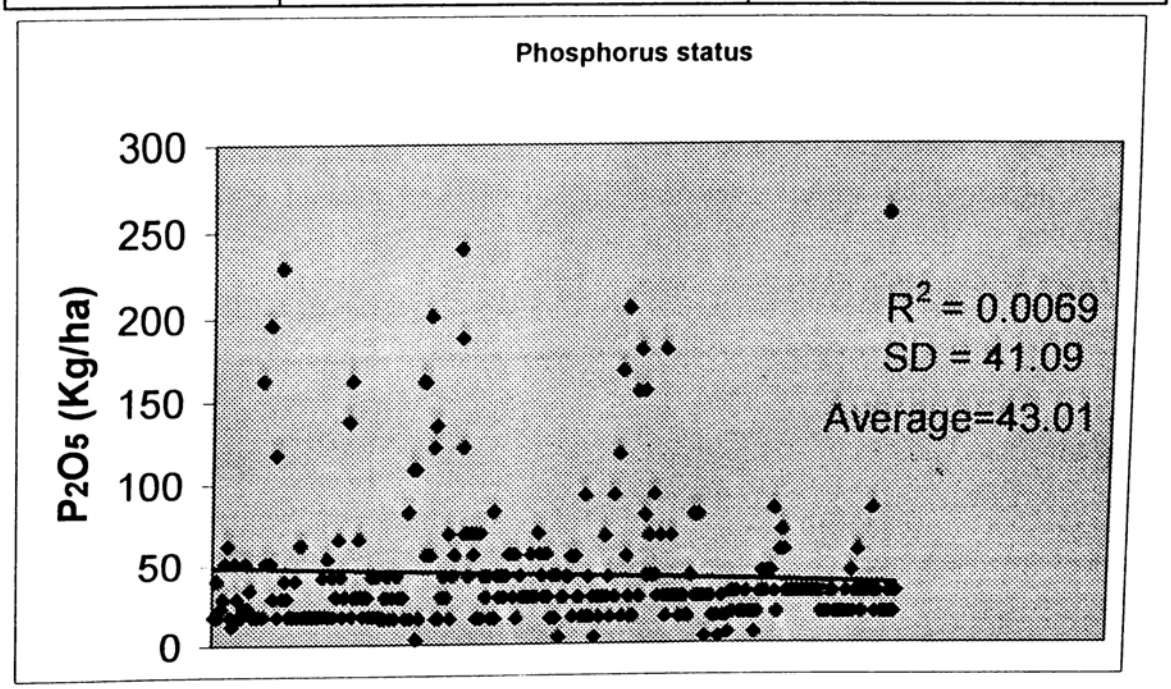
9. Phosphorus status of the district

This is a second macronutrient, needs large amount. The availability of this nutrient is influenced by many factors e.g. amount of clay (high clay high fixation), time of application (use safely), oxygen viability), compactness of soil, moisture optimisation, phosphorus status in the soil, temperature condition (too high and too low affect the availability), other nutrients status (Calcium in acid soil, Sulphur in alkaline soil beneficial), crop root system, soil pH (6-7 best range) etc. the phosphorus level of Parsa district is low (32%) to medium (48%) range which is given in table 15 below.

Table 15 Available phosphorus levels

Rating	No. of samples	%
Very high	22	7.2
High	30	10.1
Medium	148	48.4
Low	99	32.4
Very Low	7	2.3
Range		
Average	43	
Total	306	100.0



9.1. Phosphorus management

Most crops recover only 10-30 percent of fertilizer phosphorus during the first year of application but remaining phosphorus will be available to succeeding crops. Phosphorus can be managed by applying organic as well as chemical fertilizers.

- By application of Phosphorus according to recomendation.
- Use Asuro, Titepati, kalo Banmara, Jhushe til Biomass, kalo Siris litter, Khirro litter
- Make phosphorus rich compost.

- Use P-fertilizer or rock-P as a starter for composting .
- Apply DAP as a basal dose
- Mobilize P-reserve
- Increase soil OM-content to increase the reserve of organic P
- Inter crop or rotation with P-mobilizing crops (e.g. pigeon pea)
- Avoid soil acidification
- Use mycorrhiza (e.g. in tree crops like Litchi)
- Available P may be immobilized in the soil as organic P through the application of biomass,
- Compost or FYM with a low P-content. Mix such organic materials with biomass rich in P

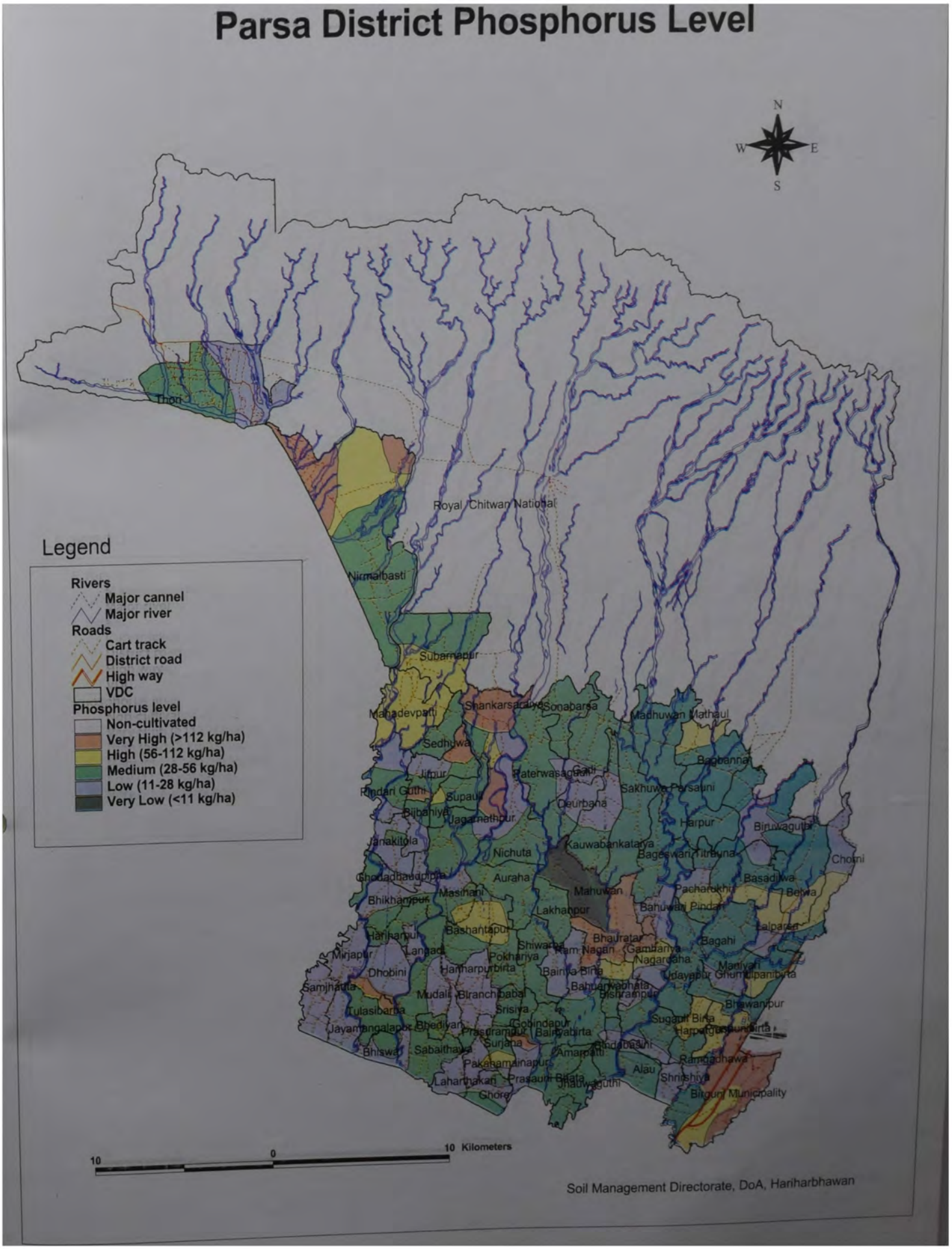
10. Potash Status of District

Potash is vital for photosynthesis.. If the soil becomes deficient in potassium plant reduced photosynthesis and increased respiration, lower the plant's carbohydrate supply, disease and insect resistance reduce, hampered other activities. Potassium content in Parsa district is very low (11%), low (55%) to medium (28%). The available potassium in soil is very small amount. Potassium content in soil is in unavailable, slowly available and available form. Potassium ion fixed in clay mineral. So soil having low status of potassium can be improved by applying the urine rich FYM and mineral K as part of basal fertilization.

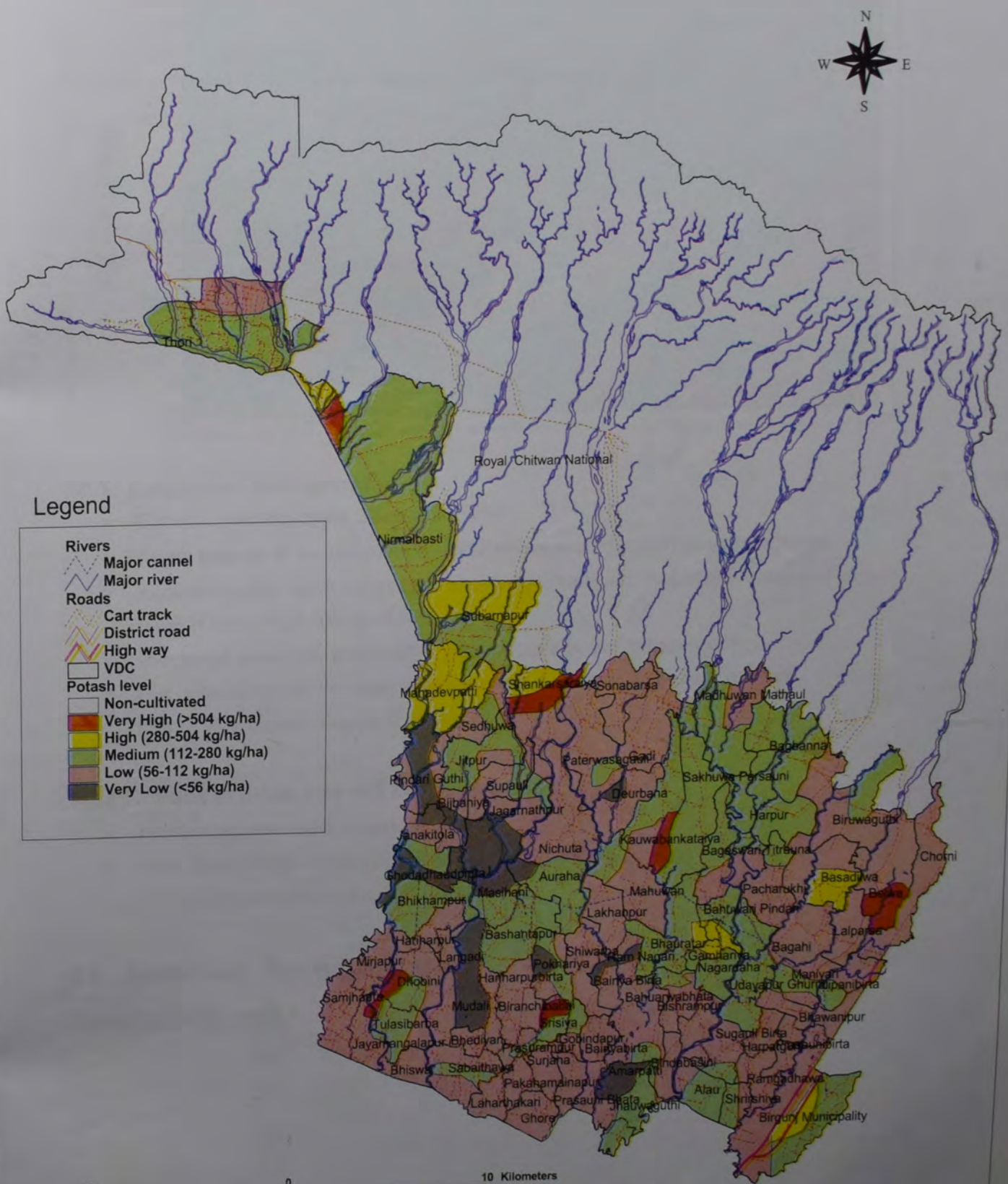
Table 16 Available Potassium status

Rating	Samples	%
Very high	7	2.4
High	8	2.7
Medium	82	28.2
Low	161	55.3
Very Low	33	11.3
Range	22-2994	
Average	118.9	43.1
Total	291	100

Parsa District Phosphorus Level



Parsa District Potash Level



Legend

Rivers
- Major cannel
- Major river

Roads
- Cart track
- District road
- High way
- VDC

Potash level
- Non-cultivated
- Very High (>504 kg/ha)
- High (280-504 kg/ha)
- Medium (112-280 kg/ha)
- Low (56-112 kg/ha)
- Very Low (<56 kg/ha)

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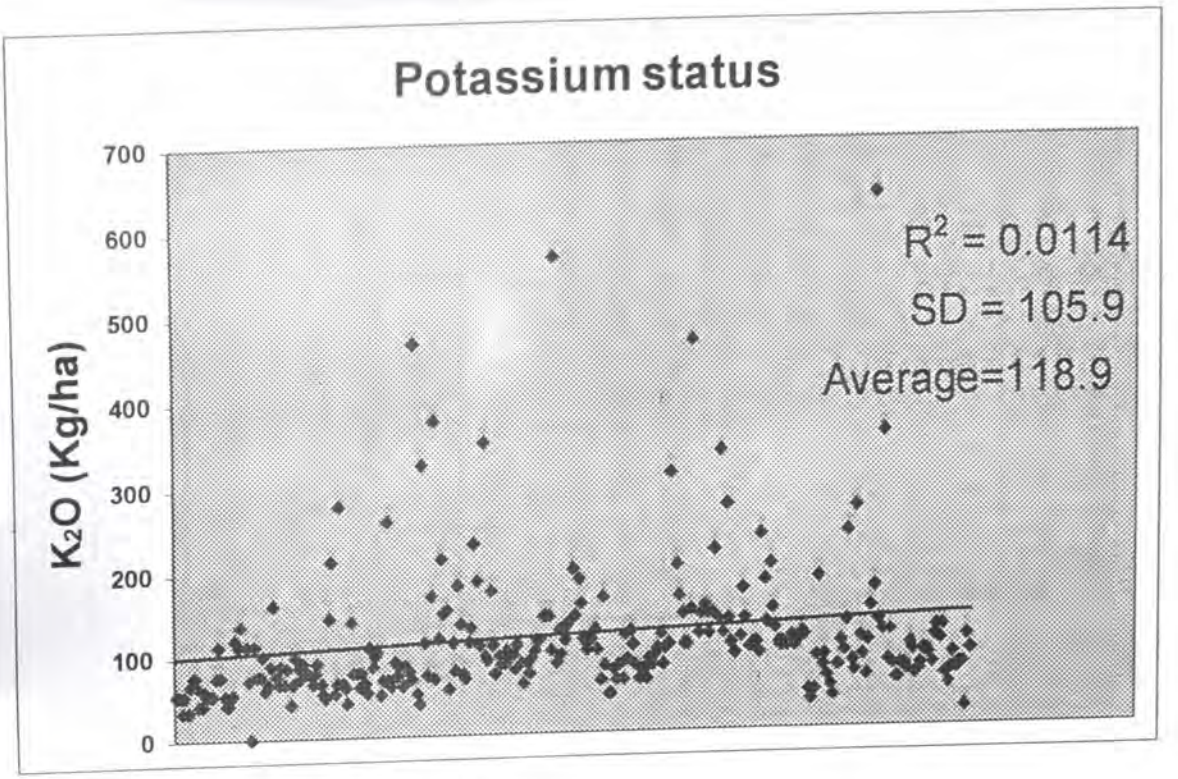

10.1. Potassium management

- Collect urine and apply urine-rich FYM
- Apply mineral K as part of basal fertilization according to recommendation.
- Reduce erosion and Run-on from above (pre monsoon, monsoon) water and surface erosion cause high losses of K.
- Use wood ashes e.g. wood ashes, eucalyptus ahs, and tobacco ash
- Use potassium rich biomass in compost, as a litter, or as a green manure
- Use recommended dose of fertilizer.

10.2 Reduce erosion run-off in terraces

- Reduce slop by making terrace.
- Plant dense hedge of tree or grasses at the terrace edge.
- Use mulch and protect the soil surface.

11. Fertiliser Recommendation Sheet Based on Soil Annual Analysis Result

Table 17 General Recommendation of fertiliser and Manure Kg/ha (20 Ropani or 30 Kattha)

Crop	Nitrogen (Kg/ha)			Phosphorus (Kg/ha)			Potash (Kg/ha)			FYM (t/ha)	Remarks
	Low	Med	High	Low	Med	High	Low	Med	High		
Paddy irrigated	100	50	25	30	15	8	30	15	8	6ton/ha (240 Doka)	1 kg Nitrogen = 4.8 kg Ammonium Sulphate = 2.2 Kg Urea 1 kg phosphate = 6.25 kg sing Super phosphate = 3.12 kg Double Super phosphate = 2.1 Kg Triple Super Phosphate, 1 Kg Potash =1.67 Kg Muriate of Potash,
Paddy un irrigated	60	30	15	20	10	5	20	10	5	"	
Wheat irrigated	100	50	25	50	25	13	25	12	6	"	
Wheat unirrigated	50	25	13	50	25	13	20	10	5	"	
Maize (summer + winter)	60	30	15	30	15	8	30	15	8	"	
Barley + naked barley	30	15	7.5	20	10	5	10	5	205	"	
Millet	20	10	5	10	5	2.5	10	5	205	"	
Sugarcane Raton	150	75	37.5	60	30	15	40	20	10	"	
Sugarcane (main)	120	60	30	60	30	15	40	20	10	10ton/ha(200 doko)	
Buck wheat	30	15	7.5	20	10	5	10	5	2.5	6ton/ha(240 Doko)	
Ginger	30	15	7.5	30	15	7.5	60	30	15	24 ton/ha	
Potato	70	35	17.5	50	25	12.5	40	20	10	30 ton/ha	
Tobacco	35	17.5	8.75	23	11.5	5.75	60	30	15	10 ton/ha	
Mustard	60	30	15	40	20	10	20	10	5	6 ton /ha	
Sunflower	60	30	15	40	20	10	20	10	5	6 ton/ha	
Vegetable crop	70	35	17.5	50	25	12.5	40	20	10	32 ton/ha	
Lentil, Black gram, green gram	20	10	5	20	10	5	20	10	5	4-6 ton/ha	
Cowpea, Pigeon pea	20	10	5	40	20	10	30	150	7.5		
Chick pea	20	10	5	40	20	10	20	10	5	"	
Pea	15	7.5	3.75	40	20	10	10	5	2.5	"	

Soybean	10	5	2.5	40	20	10	30	15	7.5	"
Ground nut	40	20	10	60	30	15	20	10	5	6 ton/ha
Mulberry Terai Unirrigated	300	150	75	140	70	35	180	90	45	
Mulberry Terai irrigated	150	75	37.5	70	35	17.5	90	45	22.5	
Mulberry Hill irrigated	200	100	50	80	40	20	120	60	30	
Mulberry Hill unirrigated	100	50	25	40	20	10	60	30	15	

L = Low, M = Medium, H = High

Table 18 Fertiliser Recommendation for fruit Crops:

Age	1	2	3	4	5	6	7	8 and above
1. FYM (Kg/tree)	25	30	40	50	60	60-100	60-100	60-100
2. Nitrogen N (g/tree)	-	100	125	150	200	300	400	500
3. Phosphorus P2O5 (g/tree)	-	50	75	100	150	200	200	200
4. Potash K2O (g/tree)	-	20	30	40	50	5	100	100

It is highly advised to the farmers to use high amount of organic manure in their field. Integrated application of chemical fertiliser along with organic manure is the best way to maintain and sustain the soil fertility. On the basis of soil analysis result, the recommendation is full dose for low nutrients content; if the nutrients content of any soil samples are medium then the recommendation of fertiliser is half dose. Similarly high nutrient content in any soil then one-fourth (1/4) dose is recommended. Fertiliser dose of any field varied with the soil fertility status, crop types, varietal characteristics, cropping intensity, irrigation facility, root system of the crops, crops duration etc affect the fertiliser dose of any soil.

Index soil test result

Name of the VDC of Sample collection areas analysis result							
VDC	Ward	pH	pH_Rating	OM	N_Rating	P_Rating	K2O
Mudali	2	6.50	NN	L	L	L	VL
Alau		6.50	NN	VL	L	L	M
Alau		4.40	A	VL	VL	M	L
Ambarpatti		4.50	A	L	L	M	VL
Ambarpatti		4.40	A	L	L	M	VL
Aurahawa	9	4.70	A	L	L	M	VL
Babahi	7	7.50	AL	L	L	M	L
Babahi	3	7.50	AL	L	L	M	L
Bageshowri	2	5.10	A	L	L	M	L
Bageshowri	3	5.10	A	L	L	M	L
Bageshowri	6	6.00	SA	VL	L	M	L
Bahuarwabhatta		5.10	A	L	L	M	L
Bahuarwabhatta		6.40	SA	VL	VL	M	M
Bahuarwabhatta		4.00	A	L	L	L	L
Bahuwaripidari	8	5.10	A	L	L	L	L
Bahuwaripidari	6	6.80	NN	L	L	L	M
Bahuwaripidari	9	6.00	SA	L	L	M	L
Bairiyabirta		5.50	SA	L	L	M	L
Bairiyabirta		4.40	A	VL	L	M	L
Bairiyabirta		6.40	SA	VL	VL	VL	L
Bairiyabirta	1	7.00	NN	L	L	L	L
Bairiyabirta	5	5.00	A	VL	VL	L	L
Bairiyabirta	8	6.10	SA	L	L	L	L
Bairiyabirta	9	5.20	A	VL	VL	M	VL
Basantapur	4	7.40	NN	L	L	H	M
Basantapur	6	7.40	NN	L	L	M	M
Basantapur	1	6.80	NN	L	L	M	M
Basantapur	1	6.00	SA	VL	L	M	M
Basdalawa	2	5.20	A	L	L	L	L
Basdalawa	3	6.90	NN	VL	VL	H	H
Bgwana	8	5.20	A	L	L	M	M
Bgwana	8	6.10	SA	M	M	H	M
Bgwana	3	5.90	SA	M	M	M	M
Bhauratar	4	6.80	NN	L	L	VH	H
Bhauratar	2	6.60	NN	VL	L	M	L
Bhauratar	1	5.20	A	VL	L	VH	M
Bhauratar	8	5.70	SA	L	M	M	M
Bhauratar	8	5.20	A	L	L	VH	M
Bhauratar	8	5.00	A	L	L	VH	M
Bhawanipur	4	7.50	AL	L	L	H	L
Bhawanipur	8	5.10	A	L	L	M	L
Bijbiniya	1	4.50	A	L	M	L	L
Bijbiniya	2	4.30	A	L	M	M	L
Bijbiniya	5	4.30	A	L	L	M	L

Bikhampur	3	4.30	A	L	M	L	VL
Bikhampur	6	6.50	NN	L	M	L	VL
Bikhampur	2	6.70	NN	L	L	VH	M
Bikhampur	1	7.20	NN	L	L	L	M
Bikhampur	1	6.50	NN	L	M	M	M
Bindhawasini		4.70	A	L	L	M	L
Bindhawasini		5.40	A	L	L	L	L
Bindhawasini		5.20	A	L	M	M	L
Birambi Barma	6	7.70	AL	VL	L	L	L
Birambi Barma	2	7.70	AL	VL	L	L	L
Birambi Barma	6	7.40	NN	L	L	VL	L
Birgunja sub.mu.	18	6.70	NN	VL	L	M	M
Birgunja sub.mu.	19	6.50	NN	L	L	VH	M
Birgunja sub.mu.	3	7.60	AL	M	M	VH	M
Birgunja sub.mu.	1	6.50	NN	L	M	VH	L
Birgunja sub.mu.	14	7.40	NN	VL	L	H	H
Birgunja sub.mu.	14	5.50	SA	VL	L	H	L
Birgunja sub.mu.	14	6.50	NN	VL	VL	M	L
Biruwaguthi	2	4.30	A	L	L	L	L
Biruwaguthi	3	6.80	NN	L	L	M	L
Biruwaguthi	5	5.80	SA	VL	L	M	L
Biruwaguthi	5	4.90	A	VL	L	L	L
Biruwaguthi	1	5.20	A	VL	L	L	L
Biruwaguthi	1	5.70	SA	VL	L	M	M
Bishrampur		5.50	SA	L	M	H	M
Bishrampur		5.50	SA	L	M	L	L
Bishrampur		5.90	SA	VL	VL	L	L
Chorni	1	5.50	SA	L	L	H	L
Chorni	6	6.60	NN	L	L	L	L
Debkhana	8	4.80	A	L	L	M	L
Debkhana	9	5.50	SA	VL	L	L	L
Debkhana	5	5.00	A	L	L	L	VL
Dhaubani	8	7.20	NN	L	M	VH	VH
Dhaubani	2	7.20	NN	L	L	M	L
Dhaubani	1	6.00	SA	VL	L	M	L
Dhaubani	2	4.50	A	VL	L	L	L
Dhaubani	4	6.00	SA	L	L	L	L
Dhaubani	3	7.20	NN	L	L	L	M
Dhaubani	1	7.20	NN	M	M	M	L
Dhauwagadi		5.50	SA	L	L	M	M
Dhauwagadi		5.30	A	VL	VL	M	L
Dhod Dhauda	3	7.00	NN	L	L	L	VL
Dhod Dhauda	5	7.00	NN	L	L	M	L
Dhore	9	7.60	AL	L	L	M	
Dhore	1	6.30	SA	VL	L	L	
Dhore	4	5.20	A	L	L	L	
Dhore	5	7.00	NN	VL	L	M	
Gadi	4	5.00	A	L	L	L	L

Gadi	5	5.50	SA	L	M	M	L
Gadi	8	4.80	A	VL	L	M	L
Gahumana	2	7.40	NN	VL	VL	VL	L
Gahumana	2	7.20	NN	VL	VL	L	L
Gahumana	4	7.30	NN	L	L	M	M
Gahumana	3	7.20	NN	L	L	M	M
Gamhariya	3	6.00	SA	L	L	H	H
Gamhariya	4	5.30	A	L	L	VL	M
Gamhariya	3	5.30	A	VL	L	L	L
Gamhariya	6	5.80	SA	H	H	VH	M
Govindapur	3	6.40	SA	L	L	M	L
Govindapur	3	6.50	NN	L	L	M	M
Govindapur	2	6.30	SA	VL	L	H	M
Govindapur	2	5.10	A	L	L	H	M
Hariharpur	9	6.40	SA	L	L	M	L
Hariharpur	7	6.00	SA	VL	VL	VL	L
Hariharpur	8	6.80	NN	VL	L	M	L
Hariharpur	1	7.10	NN	VL	L	M	L
Hariharpur	1	6.90	NN	VL	L	L	L
Haripur	2	5.80	SA	L	L	M	VL
Haripur	4	5.80	SA	L	L	M	L
Haripur	5	5.70	SA	L	L	L	VL
Harpata ganja	9	5.50	SA	L	L	L	L
Harpata ganja	4	6.10	SA	L	L	M	L
Harpur	7	5.30	A	VL	L	M	L
Harpur	8	5.50	SA	M	M	M	M
Harpur	9	6.80	NN	M	M	M	M
Jagannathpur	1	5.70	SA	L	M	VH	M
Jagannathpur	3	5.60	SA	L	L	VH	L
Jagannathpur	3	4.30	A	L	L	L	L
Jagannathpur	4	4.70	A	VL	L	M	VL
Janakitola	3	5.60	SA	L	L	L	M
Janakitola	3	4.90	A	L	L	M	L
Janakitola	2	5.50	SA	VL	VL	L	VL
Janakitola	5	5.30	A	L	L	L	VL
Janakitola	4	6.00	SA	L	L	L	VL
Jayamangalpur	4	5.20	A	VL	VL	L	VL
Jayamangalpur	1	6.30	SA	L	L	L	L
Jayamangalpur	2	6.10	SA	L	M	L	L
Jayamangalpur	1	5.80	SA	L	L	L	L
Jitpur	9	6.00	SA	L	L	L	M
Jitpur	9	5.00	A	L	M	VH	M
Jitpur	6	6.70	NN	M	M	VH	M
Jitpur	5	6.90	NN	VL	L	M	M
Jitpur	2	5.10	A	L	L	L	L
Jitpur	4	7.00	NN	VL	L	M	L
Kauwa Bnakataiya	7	5.00	A	L	L	M	M
Kauwa Bnakataiya	7	5.60	SA	VL	L	L	M

Kauwa Bnakataiya	5	5.50	SA	VL	L	M	L
Kauwa Bnakataiya	5	5.50	SA	L	L	M	VH
Laigadi	1	5.70	SA	L	L	H	L
Laigadi	1	5.40	A	L	L	L	L
Laigadi	4	5.50	SA	L	L	L	VL
Lalparsa	2	5.00	A	VL	VL	H	L
Lalparsa	4	7.50	AL	L	L	L	L
Lipini Birta	3	5.50	SA	L	L	H	M
Lipini Birta	5	5.20	A	L	L	M	L
Lkhanpur	4	6.00	SA	VL	L	M	L
Lkhanpur	1	5.90	SA	L	L	M	L
Lkhanpur	5	6.50	NN	VL	L	M	M
Lkhanpur	6	5.60	SA	VL	L	M	L
Lkhanpur	7	5.70	SA	VL	L	H	L
Lohawarmadi	5	7.50	AL	VL	VL	L	L
Lohawarmadi	5	6.30	SA	VL	L	L	VL
Lohawarmadi	4	6.80	NN	L	L	L	L
Lohawarmadi	3	6.90	NN	L	L	M	L
Lohawarmadi	3	6.90	NN	L	L	L	L
Lohawarmadi	3	7.00	NN	VL	VL	M	L
Madhuban	8	5.40	A	L	L	M	M
Madhuban	9	6.50	NN	VL	L	M	L
Madhuban	9	6.60	NN	L	M	M	M
Madhuban	9	5.30	A	M	M	M	M
Maniyari	9	6.50	NN	L	L	M	L
Maniyari	5	6.40	SA	L	L	L	L
Masiyani	7	6.50	NN	L	L	H	M
Masiyani	7	5.60	SA	L	L	M	M
Masiyani	8	4.50	A	L	L	L	VL
Masiyani	6	4.70	A	L	L	M	L
Mirjapur	9	7.20	NN	VL	L	L	L
Mirjapur	1	5.50	SA	L	L	H	L
Mirjapur	3	6.00	SA	L	L	L	L
Mirjapur	9	6.00	SA	L	L	L	L
Mosiyani	9	5.80	SA	L	L	L	VL
Mudali	3	5.20	A	L	L	M	VL
Mudali	2	6.80	NN	VL	VL	L	VL
Mudali	5	6.60	NN	M	M	L	VL
Mudali	4	7.10	NN	VL	L	M	VL
Mudali	4	6.00	SA	L	L	M	L
Nagrdaha	9	5.80	SA	L	L	L	VL
Nagrdaha	1	6.20	SA	L	L	H	VL
Nichuta	9	6.00	SA	L	L	L	L
Nichuta	5	5.80	SA	L	L	M	L
Nirmalbasti	1	6.20	SA	L	M	VH	H
Nirmalbasti	1	7.10	NN	M	M	VH	VH
Nirmalbasti	2	4.70	A	L	M	M	M
Nirmalbasti	3	5.50	SA	M	M	VH	M

Nirmalbasti	5	5.90	SA	L	M	H	M
Nirmalbasti	8	5.90	SA	L	L	M	M
Nirmalbasti	6	5.90	SA	L	L	H	M
Nirmalbasti	5	5.50	SA	VL	L	M	M
Nirmalbasti	3	6.30	SA	L	L	H	M
Nirmalbasti	3	5.90	SA	L	M	M	M
PakahaMainapur	8	6.30	SA	VL	L	L	L
PakahaMainapur	9	6.50	NN	L	L	M	VL
PakahaMainapur	7	7.50	AL	L	L	H	L
PakahaMainapur	7	7.20	NN	VL	L	M	L
PakahaMainapur	6	7.20	NN	L	L	L	
PakahaMainapur	9	7.00	NN	VL	L	M	
PakahaMainapur	6	7.00	NN	VL	L	L	
Pancha Sakhi	7	7.40	NN	VL	VL	M	M
Pancha Sakhi	6	6.00	SA	L	L	H	L
Pancha Sakhi	8	5.00	A	L	L	L	L
Pancha Sakhi	6	6.10	SA	VL	L	M	M
Parsauni Bhatta	2	5.60	SA	L	L	M	
Parsauni Bhatta	2	5.90	SA	L	L	VH	
Parsauni Bhatta	3	6.30	SA	L	M	L	
Parsauni Bhatta	3	5.90	SA	VL	L	L	
Parsauni Bhatta	3	6.40	SA	L	L	L	
Parsauni Bhatta	3	7.20	NN	VL	L	M	
Parsurampur	1	6.00	SA	VL	VL	M	L
Parsurampur	4	6.90	NN	VL	L	L	M
Parsurampur	3	6.60	NN	VL	VL	L	L
Parsurampur	5	6.50	NN	VL	L	VL	VL
Pathakasugauli	4	5.00	A	L	L	L	L
Pathakasugauli	2	6.50	NN	VL	L	M	M
Pathakasugauli	1	4.80	A	L	L	M	L
Pidari guthi	3	4.50	A	L	L	L	VL
Pidari guthi	7	4.50	A	VL	L	M	L
Pidari guthi	4	4.40	A	L	L	L	L
Pokhariya	2	5.50	SA	L	L	H	M
Pokhariya	7	6.50	NN	L	L	M	VL
Pokhariya	7	7.00	NN	VL	VL	L	VL
Pokhariya	7	6.00	SA	VL	L	M	L
Pokhariya	4	6.70	NN	VL	L	M	M
Pokhariya	5	6.90	NN	VL	VL	M	L
Ramgadawa		6.20	SA	L	L	M	M
Ramgadawa		4.90	A	L	L	L	L
Ramnagari	4	5.80	SA	VL	VL	L	VL
Ramnagari	2	5.00	A	VL	VL	L	L
Ramnagari	1	6.20	SA	L	L	L	L
Sabainba	5	7.50	AL	VL	L	M	L
Sabainba	4	7.30	NN	VL	L	M	L
Sabainba	4	7.60	AL	VL	L	M	L
Sabainba	4	7.10	NN	L	L	M	L

Sabainba	4	7.50	AL	VL	L	M	L
Sabainba	5	7.10	NN	L	L	M	L
Sabainba	5	7.20	NN	VL	VL	L	L
Sabainba	5	7.00	NN	M	M	M	L
Sabainba	5	7.50	AL	L	L	L	L
Sabainba	3	7.00	NN	L	L	L	L
Sabainba	3	6.60	NN	L	M	M	L
Sabainba	5	7.20	NN	L	L	M	M
Sabainba	5	7.00	NN	L	L	L	L
Sabainba	5	7.00	NN	VL	L	L	M
Sakhuwaparsauni	9	4.70	A	L	L	M	M
Sakhuwaparsauni	9	5.60	SA	L	L	M	M
Sakhuwaparsauni	3	5.50	SA	L	L	M	M
Sankar Saiya	3	4.50	A	VL	VL	L	L
Sankar Saiya	3	4.80	A	VL	VL	H	L
Sankar Saiya	4	5.80	SA	VL	VL	M	L
Sankar Saiya	8	4.90	A	L	L	VH	H
Sankar Saiya	9	6.30	SA	M	M	VH	VH
Seduwa	6	4.80	A	L	M	M	L
Seduwa	6	4.50	A	L	L	H	L
Seduwa	6	5.10	A	L	M	M	L
Seduwa	6	4.50	A	VL	VL	M	M
Shrisiya		5.80	SA	VL	L	M	L
Sirsiya	7	5.10	A	M	M	H	VH
Sirsiya	9	7.40	NN	M	M	M	M
Sirsiya	7	5.00	A	L	L	M	M
Sirsiya	1	6.50	NN	H	H	M	H
Siwababa	3	5.80	SA	L	L	M	L
Siwababa	3	6.60	NN	L	L	L	L
Smbhauta	2	7.00	NN	L	L	L	L
Smbhauta	5	5.80	SA	M	M	L	L
Smbhauta	8	6.00	SA	M	M	L	L
Smbhauta	5	6.70	NN	L	M	M	L
Sugauli	3	5.00	A	M	M	M	M
Sugauli	5	4.40	A	VL	L	H	L
Sugauli	6	5.00	A	L	L	M	L
Sugauli birta		5.50	SA	L	L	M	M
Sugauli birta		5.60	SA	L	L	L	M
Sugauli birta		6.40	SA	L	L	M	L
Sugauli birta		6.80	NN	VL	L	VL	L
Sunbarsha	8	4.50	A	L	L	M	L
Sunbarsha	5	6.00	SA	L	L	M	L
Suryaha	4	7.00	NN	VL	L	M	
Suryaha	5	7.10	NN	L	M	M	
Suryaha	5	6.70	NN	L	L	H	
Suwarnapur	4	6.50	NN	L	L	M	H
Suwarnapur	1	6.00	SA	VL	L	H	M
Thori	7	6.30	SA	M	H	M	M

Thori	6	5.70	SA	M	M	M	L
Thori	8	5.00	A	M	M	L	L
Thori	5	5.00	A	L	L	L	M
Tulashiban	2	7.40	NN	L	M	M	M
Tulashiban	1	6.50	NN	L	L	M	L
Tulashiban	3	7.40	NN	M	M	VH	VH
Tulashiban	2	7.40	NN	L	L	L	M
Tulashiban	4	6.00	SA	L	L	VH	L
Tulashiban	3	6.00	SA	L	L	M	L
Udayapur Ghurmi	7	7.50	AL	L	L	M	M
Vedihari	1	7.10	NN	L	L	M	L
Vedihari	5	7.20	NN	L	L	M	L
Vedihari	1	6.90	NN	VL	L	M	L
Vedihari	1	7.00	NN	L	L	M	L
Viswa	5	5.30	A	M	M	L	L
Viswa	7	5.70	SA	L	L	M	L
Viswa	6	5.30	A	L	L	L	L
Viswa	7	5.00	A	L	L	M	L
Walwa	3	7.40	NN	L	M	H	VH
Walwa	3	7.50	AL	VL	VL	M	L
Walwa	1	6.60	NN	L	L	M	M
Walwa	8	6.00	SA	L	L	M	M

References:

- Annual report of DADO Parsa district. 2057/58.
- Annual report of SMD 2057/58.
- District Development Profile of Nepal .2001. Informal sector research and study centre.
- Soil fertility map of Chitawan irrigation and East Rapti command area of Chitawan district. 2057.
- LRMP, Land utilisations report (Appendix one). 1986.
- Jaishy S.N Mahato, N. Manandhar R, K.H. Maskey (1997). Study on use of compost at farmers level, (SMD annual report)
- Jaishy S N , Mandal, S. N Fujimoto T. Karki T.B. K.H. Maskey (1999). Study Report on organic manure and micronutrients.
- Jaishy S N, Subedi T.B., Paudyal S.P. Production and utilisation of FYM compost by the farmers in Kavre District of Nepal.
- Jaishy S N , Mandal, S. N , Subedi T.B., (2058) fertility Mapping of Kavre District and Study report on manure and fertiliser use in Palpa.
- MOAC. Statistical information on Nepalese Agriculture. 2057/58.
- Sustaining growth Soil fertility management in tropical smallholdings Karl M. Muller Samann and Johan kotschi1994.