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Physicochemical Characteristics of Soils of Talapilli Taluk, Thrissur, Kerala, India

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Abstract: The importance of soil resources to attain sustainability in crop production, eco-development and protection of environment is an established fact. Management of soil on a scientific basis is essential for sustained and increased agricultural production, on this prime perspective a study on physiochemical characters of soils has been conducted in the Talapilli Taluk of Thrissur District, India. Talapilli is the agricultural dominant area in the District and hence the study help in more understanding of the quality of the soil for proper management practices in agriculture and other sectors as well. The physiochemical characters analyzed in the study are texture, soil depth, slope, erosion, pH, electrical conductivity, primary nutrients like available nitrogen, phosphorus and potassium and secondary nutrients like magnesium and sulphur. The result indicates that Talapilli has gravelly clay loam and gravelly sandy clay loam soils in higher proportion having moderate to deep soil depth with moderate slope and less to moderate intensity of erosion. As far as chemical composition is concerned in Talapilli Taluk major proportion of soil has pH ranges from 5.1 to 6, that which shows the acidic nature of the soil. The nutrient status is appreciably good in the Taluk except few places in the Taluk that is in the centre, north and northeast of the Taluk. To consider the nutrients in specific available nitrogen and potassium is medium in the Taluk among primary nutrients and magnesium is low and sulphur is high among secondary nutrients.

Keywords: soil, physicochemical characteristics, nutrients, quality, agriculture

INTRODUCTION

Soil quality has recently been defined as ‘‘the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation’’ [1]. It is in the interests of the farmer, and the population as a whole, to ensure that good soil management is practiced so that this resource is preserved for continued use by the current and future generations [2]. Therefore the physico-chemical study of soil is very important because it affects the soil productivity and it is based on various parameters like pH, electrical conductivity, texture, moisture, temperature, soil organic matter, available nitrogen, phosphorus and potassium which lead farmers to economic productivity [3]. Understanding of soil chemical reaction and processes is essential for developing innovative resource management strategies, and understanding and regulating the behaviour of the terrestrial ecosystem at regional and global scale [4].

Study Area

Talapilli is one of the five taluks of Thrissur District, which is in the north of the District. The geographical extension of the Taluk is between 10˚ 35′ 34″ N and 10˚ 46′ 54″ N latitudes and 78˚ 0′ 28″ E and 78˚ 28′ 46″ E longitudes. The total area comprises of 677 sq.km. It is the second biggest Taluk of Thrissur District. It is bounded by Thrissur Taluk in the south, Malappuram District in northwest, Palakkad District in the northeast and east and the west is shared by Chavakkad Taluk. It is a low lying land with minimum of 20 metres and maximum 400 metres (MSL) adjacent to coastal margins of Arabian Sea. Talapilli Taluk has three blocks viz., Chowannur in the right, Vadakkanchery in the middle and Pazhayannur in the left of the elongated shaped taluk and also has a Municipality called Kunnamkulam in the west. Talapilli Taluk shares the district boundary with the two adjacent Districts Palakkad and Malappuram in the northeast and north respectively and south and west is shared by two adjacent taluks Thrissur and Chavakkad respectively. The north administrative boundary with Malappuram is limited by the west flowing river from the Western Ghats called Bharathapuzha [5].

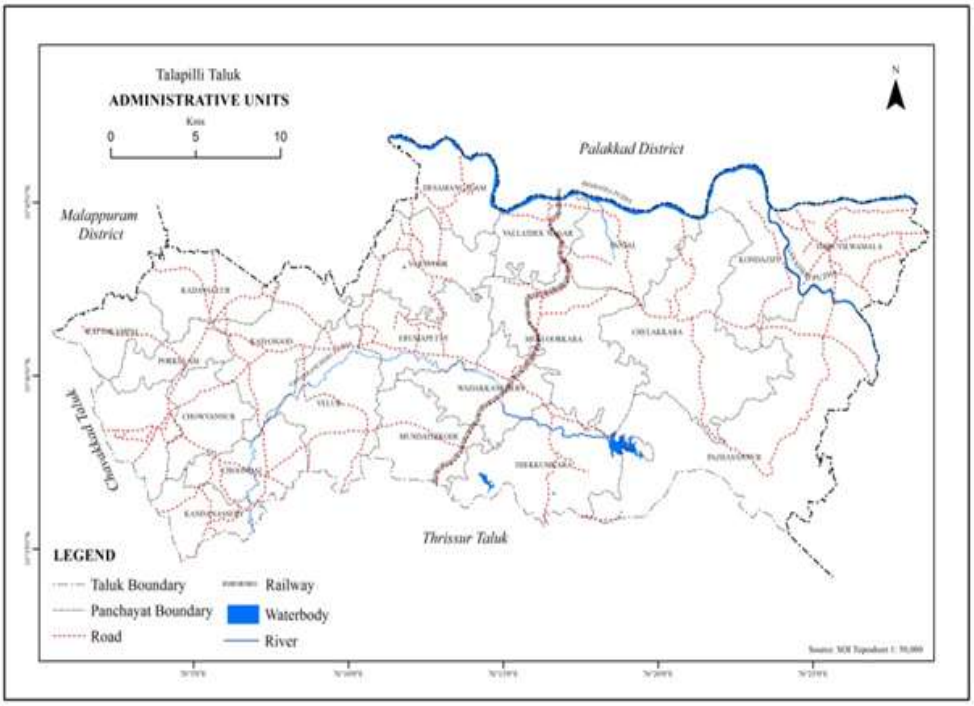

Fig-1: Study Area

Data and Methodology

Soil data is collected from the Directorate of Soil Survey and Soil Conservation (DSSC), Thiruvananthapuram. The detailed soil survey of Talapilli Taluk had been carried out at panchayat level (scale:1:5,000), following the procedure envisaged in the Soil Survey Manual. The whole Talapilli Taluk was traversed at close intervals. During the course of the traverse, the soils were subject to keen observation and examination and their differentiating characteristics were studied with respect to their capacity to support plant growth. Profiles up to a depth of 2 m or up to the parent material were dug and the profiles were examined in detail for horizon wise characteristics such as texture, structure, colour consistency, concretions, mottling, soil reactions, pores and root distribution, permeability etc. The soil samples pertaining to each horizon were collected from profiles and sent to the laboratory for analysis. On the basis of these observations and the supplementary laboratory analysis the soils of the area were classified into different soil series [6]. The resultant field observations and the laboratory data are then developed in GIS environment for further analysis and spatial representation by cartographic means.

RESULTS AND DISCUSSION

Soil Series

Soil series is the most homogenous category in the taxonomy. Soil series consists of pedons having soil horizons that are similar in soil colour, soil texture, soil structure, consistence, identical mineral and chemical composition and arrangement in the soil profile, resulting in soils of the same series performing similarly for land use purposes. The major eighteen soil series are identified in Talapilli Taluk. These soil series are grouped under two major categories garden land and wetlands series. The soil series of the cultivable garden lands covers an area of 307.2 sq.km, that is nearly 47 percent of the Taluk and cultivable wetland which covers an area of about 194.48 sq.km, that is nearly 28.7 percent of the Taluk. Velappaya is the major soil series among all covering an area of 100.07 sq.km of the garden land. Miscellaneous soils are wetland that are converted either permanently or temporarily, which cover an area of 37.62sq.km that is 5 percent of the total area of Talapilli Taluk.

Table-1: Soil series of Talapilli Taluk

Garden land series	Area in hectares	Wet land series	Area in hectares
Velappaya	10007	Koottala	7445
Kozhukully	9320	Mulayam	3991
Koratty	2696	Kizhapallikara	3986
Wadakkanchery	1443	Kolazhy	2107
Anjur	1305	Konchira	1030
Painkulam	869	Maraickal	666
Thrikkur	703	Manalur	188
Vaniyampara	270	Perumpuzha	32
Thiruvilwamala	235	Miscellaneous soils	3762
Punnayurkulam	91		

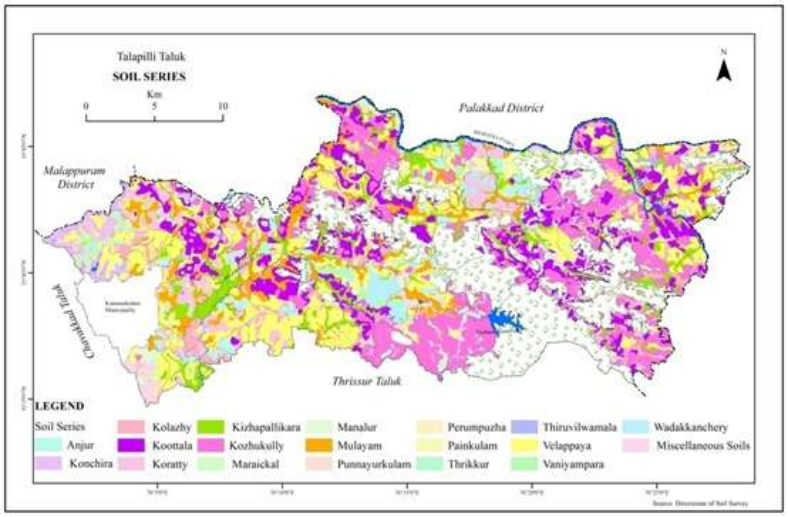

Fig-2: Soil Series

Surface Texture

Texture indicates the relative content of particles of various sizes, such as sand, silt and clay in the soil. Gravelly clay loam is the major surface texture type which is distributed throughout the Taluk adjacent to the foot hills and elevated in the north, northeast and northwest covering 21.68 percent of the total area. Gravelly sandy clay loam noticed mainly in south, central and west of the Taluk. Clay loam and sandy clay loam soils are noticed along the river tracks and wetlands and is distributed highly in centre and south east of the Taluk. Clay soil is found distributed highly in northwest of the Taluk and there are several other types of soil textures in the Taluk, found in traces having minor proportion.

Table-2: Surface texture

Surface Texture	Area in hectares
Gravelly clay loam	14680
Gravelly sandy clay loam	11449
Sandy clay loam	9865
Clay loam	7131
Clay	1715
Sandy clay	907
Sandy loam	267
Silty clay	157
Gravelly sandy clay	98
Gravelly loam	49
Loam	45
Loamy sand	25

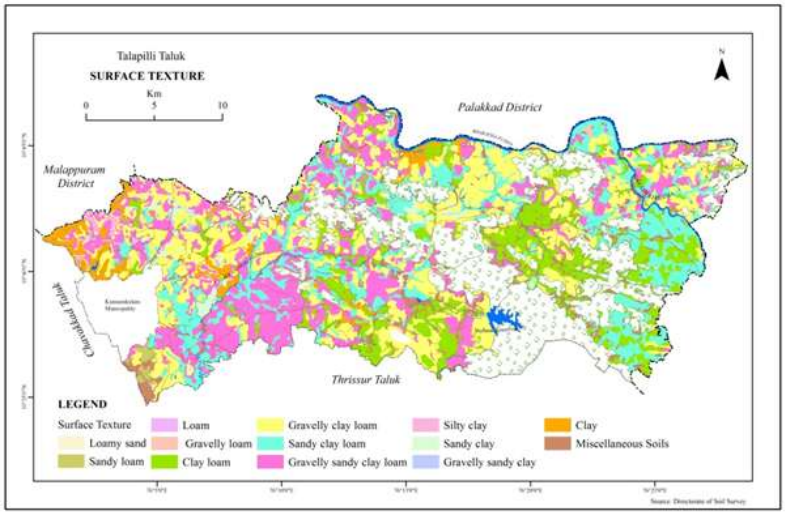

Fig-3: Surface Texture

Soil Depth

Depth of the soil is one of the most important parameters for rooting conditions, higher the depth of the soil maximum the support for plant growth. In Talapilli most of the areas has moderately deep to deep soils, which occupies an area of about 60.24 percent of the total area. It reflects that the area is good for agriculture in terms of soil depth. The soil depth of moderately shallow and very deep is noticed at south and east of the Taluk occupying an area of nearly 50 sq.km that 7 percent of the Taluk.

Table-3: Depth

Category	Depth in Cm	Area in hectares
Moderately Shallow	50-75	1358
Moderately deep	75 - 100	5278
Deep	100 - 150	35504
Very Deep	>150	4247

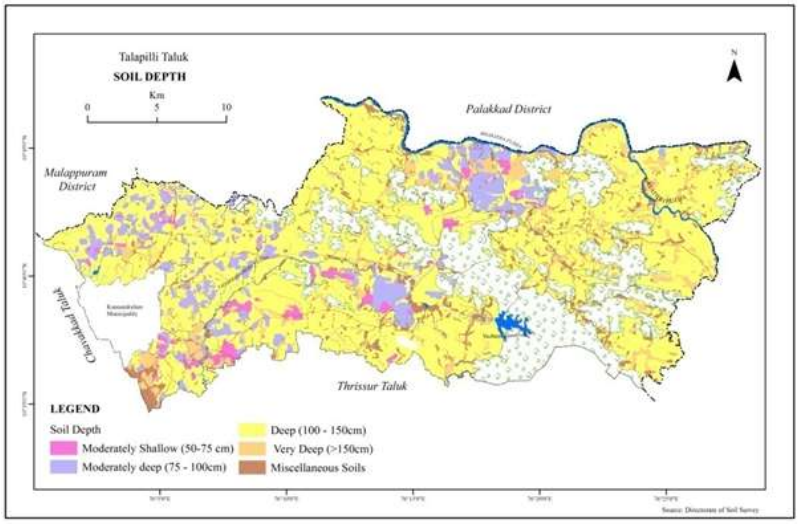

Fig-4: Depth

Soil Slope

Talapilli soils has moderate slope adjacent to low lying lands having very gentle slope. Very gentle slope is noticed along the streams and rivers in the centre. Strong slope is found along the foot hills of high elevated areas in east, northeast and south and covers an

area of 18, 16 and 14 percentage respectively. It is found that there is transition of slope from steep to nearly level that begins from the east of the Taluk where the elevated places in the Taluk and it gradually reduces towards the west and south west along with the flow of streams and rivers and nearly level land is found in the west and very gentle to gentle slope in the centre and south of the Taluk.

Table-4: Slope

Category	Slope in Percentage	Area in hectares
Nearly level	0-1	280
Very gentle slope	1 - 3	11218
Gentle slope	3-5	5548
Moderate slope	5-10	12846
Strong slope	10-15	10095
Moderately steep to steep	15 - 25	5031
Steep	25-33	997
Very steep	33-50	357
Very very steep	>50	52

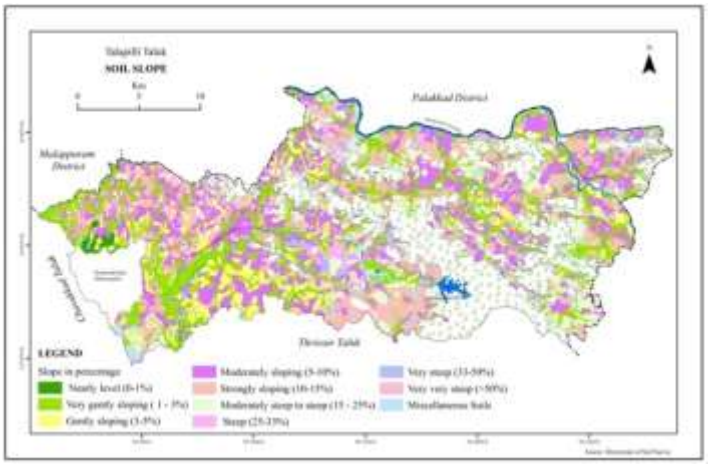

Fig-5: Slope

Soil Erosion

The status of soil erosion has been classified into three namely slight or nil, moderate, severe and very severe based on the intensity of soil erosion. Moderate erosion is noticed highly in the Taluk and is distributed in all corners. Intensity of moderate erosion is nearly 311.64 sq.km. comprising 46 percent of the total area. Intensity of erosion is less or nil along the places of low elevation or the places having deposits along the riverbanks and wetland areas. The west of the Taluk has low intensity of erosion where elevation is comparatively less, slight or nil erosion is found in these areas occupying 130.66 sq.km comprising 19 percent of Talapilli Taluk. Severe erosion is in minor level noticed at base of the mountainous areas having high elevation.

Table-5: Intensity of soil erosion

Intensity of soil erosion	Area in hectares
Slight / Nil	13066
Moderate	31164
Severe	2159

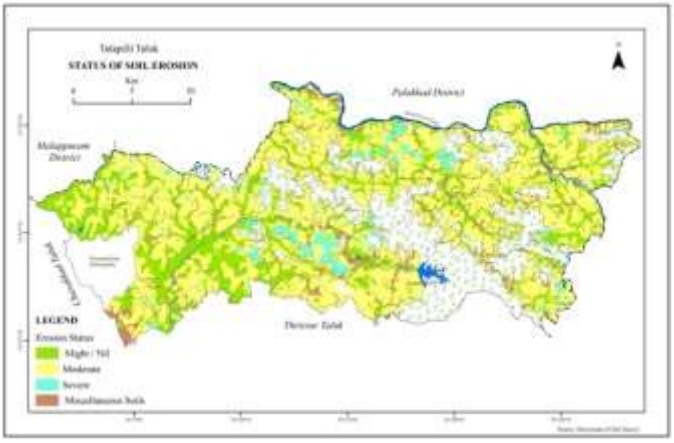

Fig-6: Erosion

Soil Reaction

A soil that is acid or alkaline in reaction throughout the root zone is called acid soil or alkaline soil. The soil having pH less than 6.6 or precisely 7.0 is acidic. Soil having pH values precisely greater than 7 is alkaline or soil having pH above 7.3 is alkaline. The pH of soil in between the acid soil and the alkaline soil is neutral soil that is pH value precisely 7 or range between 6.6 and 7.3. The pH of the soils of the Taluk varies highly from place to place has the places of extremely acidic soils covering an area of 27.91 sq.km., very strongly acidic soils occupying an area of 108.50 sq.km, strongly acidic soils covering an area 162.57 sq.km and is the highest in area compared to others. Medium acidic soils cover an area of 122.77 sq.km. which is the second highest, slightly acid soil cover 57.30 sq.km, neutral soil is found in minor proportion along the foot hills of dense forested high lands and mildly alkaline soil is in very minor proportion found in parcels in the centre and north of the taluk covering 1.18 sq.km. The pH of the Talapilli is grouped into 7 categories.

Table-6: Soil reaction

Category	pH rating	Area in sq.km.
Extremely acid	< 4.5	27
Very strongly acid	4.5 - 5.0	108
Strongly acid	5.1 - 5.5	162
Medium acid	5.6 - 6.0	122
Slightly acid	6.1 - 6.5	57
Neutral	6.6 - 7.3	21
Mildly alkaline	7.4 - 7.8	1

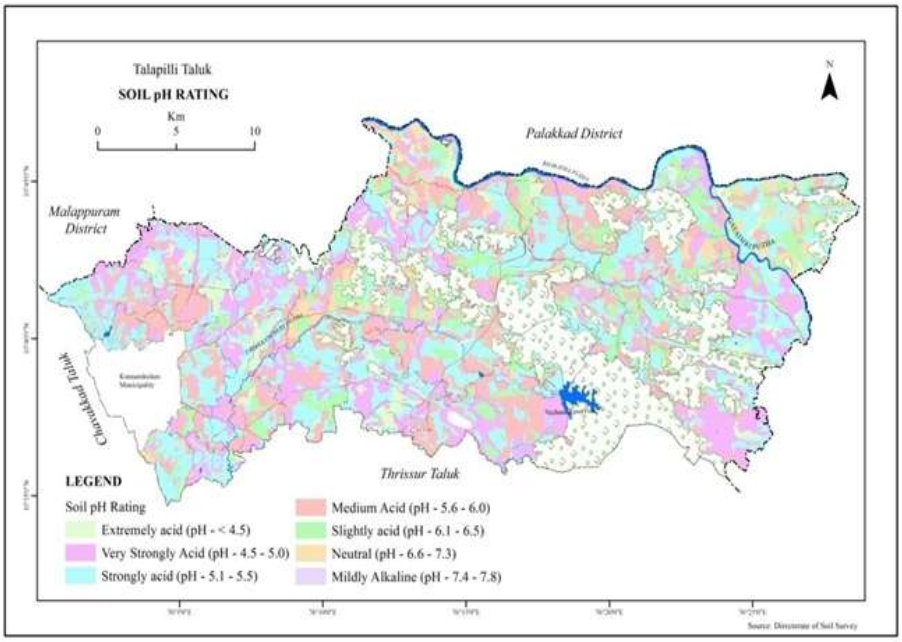

Fig-7: Soil reaction

Primary Nutrients

The analysis of the data reveals that the primary nutrients like nitrogen, phosphorus and potassium is not evenly distributed in Talapilli Taluk. Nitrogen available for plants is sufficient in the taluk only 8.19 percent of the total area is having low nitrogen at central west and north eastern parts and is medium in all parts of the Taluk, few places in centre and west of the Taluk are rich in nitrogen. In Talapilli 41 percent of the area is having medium nitrogen and 24.12 percent is having higher proportion of available nitrogen.

Table-7: Categorization of available primary nutrients in Talapilli Taluk

Sl. No	Category	Plant available nitrogen soil organic carbon	Plant available Phosphorus kg P/ha	Plant available Potassium kg K/ha
1	Low	< 0.50%	< 10.0	< 115
2	Medium	0.51-1.50%	10.0- 24.0	115- 275
3	High	>1.50%	> 24.0	> 275

The plant available phosphorus in Talapilli is distributed as 20.33, 20.96 and 32.78 percent as low, medium and high respectively. The spatial distribution of phosphorus shows that it is high in major parts of the Taluk distributed in all the corners and the traces in between throughout the Taluk has medium and low concentration of available phosphorus.

The spatial distribution of plant available potassium is high in the centre and east of the Taluk leaving the west and the other places having concentration of medium and low potassium. The percentage proportion of the available potassium is like 11.99, 36.41 and 25.67 percent as low, medium and high respectively.

Table-8: Available primary nutrients in soil series of Talapilli Taluk, area in hectares

Soil Series	Plant available nitrogen Area in hectares			Plant available phosphorus Area in hectares			Plant available potassium Area in hectares		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Anjur	198	747	359	184	395	724	150	972	181
Konchira		138	891	366	191	472	138	663	227
Kolazhy	451	1008	647	727	815	564	524	1396	186
Koottala	513	4456	2475	1679	2465	3299	950	3401	3092
Koratty	705	1551	439	994	660	1041	533	1502	660
Kizhapallikara	223	2339	1423	778	952	2255	1103	1797	1086
Kozhukully	981	5454	2885	2714	2348	4257	1142	3915	4262
Miscellaneous Soils	428	2173	1161	863	1112	1787	647	1541	1574
Maraickal	175	291	199	289	201	175	134	233	298
Manalur	-	21	166	21	1174	166	21	24	142
Mulayam	609	2575	806	1287	-	1529	982	2005	1002
Punnayurkulam	-	-	91	-	-	91	-	73	18
Perumpuzha	-	-	32	32	-		-	32	-
Painkulam	200	483	185	274	156	438	172	152	544
Thrikkur	25	376	302	244	165	294	93	219	390
Thiruvilwamala	-	235	-	12	223	-	12	-	223
Velappaya	626	5239	4142	3006	3040	3960	1400	5647	2959
Vaniyampara	-	216	54	-	-	270	-	140	130
Vadakkanchery	401	1015	63	287	288	867	109	932	402

Secondary Nutrients

The criteria used for categorizing soils with respect to their plant available secondary nutrient levels are as follows.

Table-9: Categorization of available secondary nutrients in Talapilli Taluk

Category	Plant available Magnesium ppm	Plant available Sulphur ppm
Adequate	> 120	5 - 10
Deficient	<120	<5

The available data on secondary nutrients for Talapilli Taluk is Magnesium and Sulphur. The data analyzed for the secondary nutrients reveals that the availability of sulphur is rich in Talapilli and it is distributed throughout the Taluk which is adequate for the plants and it is deficient only in southeast of the Taluk in minor proportion, in other hand magnesium is deficient in most parts of the Taluk except south central and northeast of the Taluk where it is in adequacy. In Talapilli nearly 59.82 percentage land is having availability of sulphur in adequate manner and 9.02 percent of land is sulphur deficient. Magnesium is adequate in 48.94 percentage of the Taluk and 19.90 percentage of area in Talapilli is magnesium deficient.

Table-10: Available secondary nutrients in soil series of Talapilli Taluk, area in hectares

Soil series	Plant available magnesium Area in hectares		Plant available sulphur Area in hectares	
	Adequate	Deficient	Adequate	Deficient
Anjur	267	1037	1111	193
Konchira	227	802	1030	
Kolazhy	402	1705	2107	
Koottala	2184	5260	4226	3218
Koratty	275	2420	2696	
Kizhapallikara	1418	2567	3354	632
Kozhukully	1560	7760	7896	1424
Maraickal	-	666	666	-
Manalur	23	164	188	-
Mulayam	1690	230	3723	267
Punnayurkulam	-	91	91	-
Perumpuzha	32	-	32	-
Painkulam	279	589	869	-
Thrikkur	172	531	703	-
Thiruvilwamala	235	-	235	-
Velappaya	4700	5307	9638	369
Vaniyampara	-	270	270	-
Vadakkanchery	-	1443	1443	-

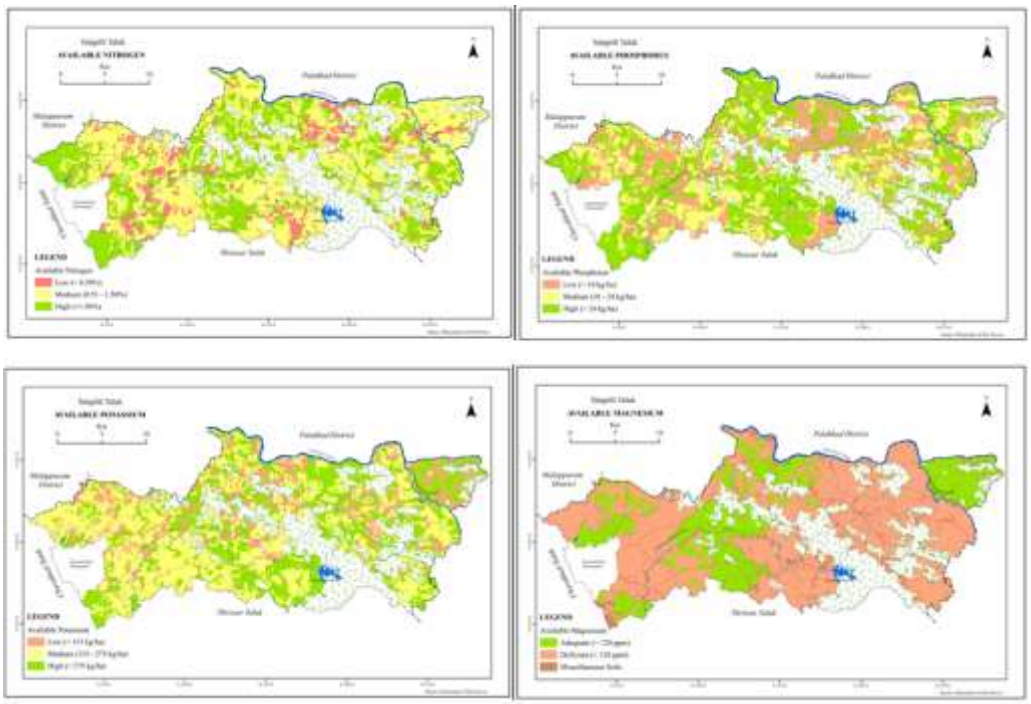

Fig-8: Primary and secondary nutrient status

CONCLUSION

Talapilli Taluk is rich in varied physical and chemical properties in the soil. The physical properties analyzed in the study are surface texture, soil slope, depth and erosion status and the chemical properties analyzed are pH and mineral nutrients for plants. The proportion of areal coverage of each parameter in different soil series of the Taluk varies highly and it is identified that all the physical and chemical characters are not evenly distributed in all the series of the soil, it reflects that each soil series is unique in character. Talapilli has gravelly clay loam and gravelly sandy clay

loam soils in higher proportion having moderate to deep soil depth with moderate slope and less to moderate intensity of erosion. As far as chemical composition is concerned in Talapilli Taluk major proportion of soil has pH ranges from 5.1 to 6, that which shows the acidic nature of the soil. The nutrient status is appreciably good in the Taluk except few places in the Taluk that is in the centre, north and northeast of the Taluk. To consider the nutrients in specific available nitrogen and potassium is medium in the Taluk among primary nutrients and magnesium is low and sulphur is high among secondary nutrients and the micro nutrients are all high in the Taluk except few places in minor proportion.

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