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SOIL CHARACTERISTICS STUDY OF TREATED AND UNTREATED AREAS OF DIFFERENT WATERSHEDS IN PALAKKAD DISTRICT, KERALA

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ABSTRACT
Watershed management is a tool for sustainable development. This contributes to soil and water conservation and improves the livelihood of the inhabitants there. Soil conservation mainly means conserving and protecting the soil from water erosion thereby improving the moisture content and microbial activities in the soil. In the study area water conservation was achieved through various structural and biological measures. The present study has been undertaken to find the variations in physico-chemical parameters of soil samples from selected watersheds. Soils were collected from treated and untreated areas of Alanagad vengassery and Konnakkalkadavu watersheds during pre- monsoon and post - monsoon seasons within an interval of six months from three different heights 240, 160 and 80 meters from sea level. The soil parameters like organic carbon, organic matter, nutrients such as N, P, and K were monitored using standard procedures. Variation in the parameters during seasonal change and change in altitude has been interpreted.

KEY WORDS: Watersheds, Agronomic intervention, Soil nutrients, Agro Ecological Units

INTRODUCTION

The engineered agronomical measures such as contour bunding, mulching, terracing, construction of rain pits *etc*. will enhance the fertility of soil by preventing direct runoff and soil erosion. It is envisaged that by adopting these measures the nutrient content and moisture holding capacity of the soil get improved. However, the literature survey indicated that study of nutrient movement due to rain water flow is very scanty, particularly in the Indian scenario. Hence the objective of the present study is to monitor the soil quality of treated and untreated areas at Alangad-Vengasserry and Konnakkalkadavu watersheds typical sloppy areas of Palakkad district, Kerala (Fig. 1 & 2).

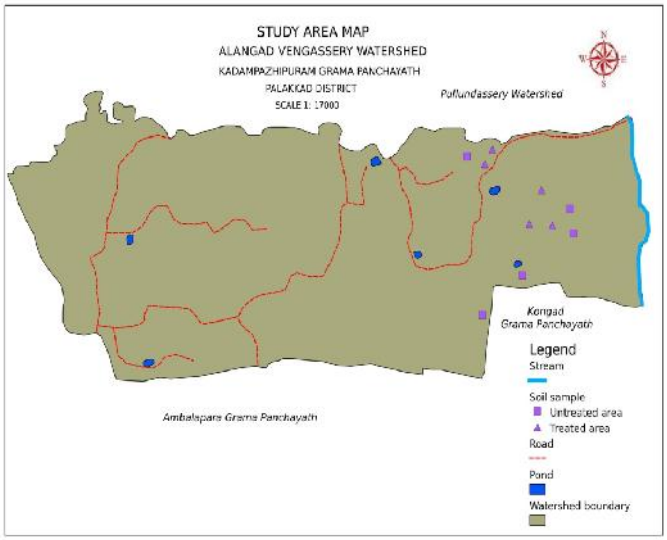

FIGURE 1: Study area map of Alangad-Vengassery watershed

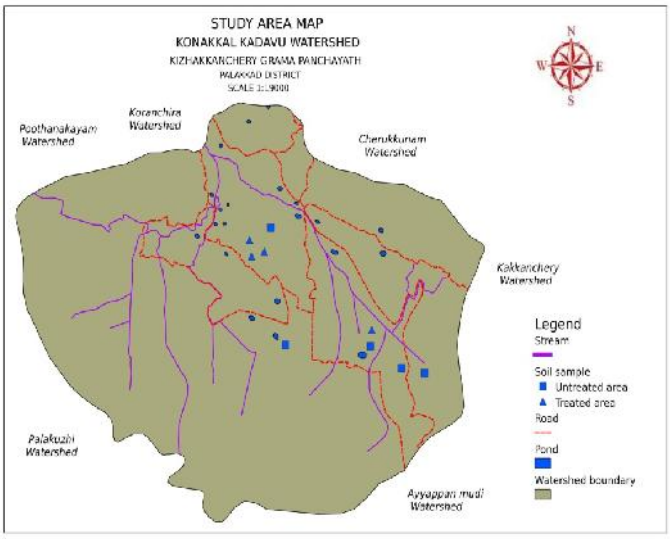

FIGURE 2: Study area map of Konnakkalkdadavu watershed

**Treated- Where there was agronomical interventions, Untreated – Where there was no agronomical interventions*

MATERIALS & METHODS

Location

Those selected watersheds are Alangad-Vengassery (Agro Ecological Unit (AEU) 10: North Central Laterite) with latitude 10^0 50'22" - 10^0 37'35" N and longitude 16^0 25' 32" - 76^0 27' 46"E and Konnakkalkadavu water shed in Kizhakkenchery Gramapanchayath (Agro Ecological Unit (AEU) 22: Palakkad Central Plains) with latitude 10^0 28' 35" - 10^0 29' 47" N and longitude 76^0 28' 43" to 76^0 32' 45" E.

Soil sampling

The study is based on soil sampling and analysis. Soil samples were collected from 240 m elevation in the upper region, 160 m elevation in the middle region and 80 m elevation in the lower region of the selected watersheds. In each watershed 5 soil samples each were collected during pre and post monsoon periods from treated and untreated areas. Altogether 20 soil samples were collected separately from treated and untreated areas during pre and post monsoon seasons for investigation. Physico-chemical parameters such as pH, Moisture Content, Total Organic Carbon (TOC), Total Organic Matter (TOM), Nitrogen (N), Phosphorus (P) and Potassium (K) were estimated by standard methods (ICARDA 2013).

GIS mapping

Latitude and longitude values of the locations were taken using GPS for locating the sampling points. These are plotted into the study area map using GIS software Q GIS (Quantum GIS) a free and open source system which has data viewing, editing, and analysis capabilities.

RESULTS & DISCUSSIONS

The average pH values of the soil of the treated and untreated areas during pre monsoon season were 5.94 and 6.15 respectively. The similar values during the post monsoon season ie after a gap of 6 months indicated the values to be 6.58 and 6.64. It is obvious from the results that there is slight decrease in pH in the treated samples indicative of a higher amount of humic and content in the soil. A similar trend was observed in the values obtained from the middle (160 m) and lower regions (80 m). The results obtained indicated that the pH of the soil was more alkaline in pre monsoon than in post monsoon period. Average values of pH in Alangad-Vengassery and Konnakkalkadavu are given in the table 1 & 2.

TABLE 1. Physico- chemical characterization of soil from upper region of Alangad-Vengassery watershed (240 m from SL)

Sl.No	Sample No.		pH		EC(µs)		Moisture%		TOC (%)		TOM (%)		N (%)		P (%)		K (%)	
	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT
	A-1	A-6	7.4	7.3	63.6	89.2	26.3	26.5	1.62	0.58	2.79	0.99	1.2	1.2	0.81	0.32	0.63	0.41
Post	A-2	A-7	6.7	7.2	72.5	65.2	31	28.2	1.26	0.67	2.17	1.15	1.5	1.6	0.52	1.31	0.55	0.14
monsoon	A-3	A-8	6.3	7.5	80.3	74.9	29	29.3	0.9	0.48	1.55	0.83	0.96	0.69	0.98	0.71	0.63	0.25
season	A-4	A-9	7.4	6.7	46	84.2	26.4	23.6	1.44	0.78	2.5	1.3	0.95	0.98	2.23	0.35	0.85	0.16
	A-5	A-10	7.4	6.6	45.2	84.1	25.3	22.3	1.22	0.75	2.3	1.2	0.92	0.95	2.21	0.31	0.82	0.13
	A-1	A-6	7	7.1	94	52.8	11.9	4.45	1.5	1.06	2.59	1.83	3.2	2.5	2.1	1.7	2.76	0.71
Pre	A-2	A-7	6.8	6.51	49.5	51.1	4.8	9.25	1.23	1.02	2.13	1.76	2	2.2	4.5	0.9	1.29	0.35
monsoon	A-3	A-8	6.7	7.52	40.4	41.9	8.5	4.5	1.41	0.89	2.44	1.54	2.6	2.2	2.2	6	1.59	1.94
season	A-4	A-9	7.2	7.53	30.2	18	9.5	7.25	1.58	0.92	2.73	1.59	2.7	2.3	2	1.7	1.29	0.4
	A-5	A-10	8	7.48	347	78.5	6.3	3.6	1.44	1.03	2.49	1.78	2.3	2.7	5.1	2.7	2.92	2.15

TABLE 2. Physico- chemical characterization of soil from upper region of Konnakkalkadavu watershed (240 m from SL)

Sl. No	Sample No		pH		EC(µs)		Moisture (%)		TOC (%)		TOM (%)		Ni (%)		P (%)		K (%)	
	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT
	K1	K6	6.2	6.5	156	261	28	20.2	1.5	1.1	2.6	1.9	0.42	0.22	2	1.3	0.8	0.71
Post	K2	K7	6.3	6.6	250	247	20.5	20.1	1.23	1.01	2.2	1.7	0.29	0.39	2	1.18	1.9	0.18
monsoon	K3	K8	6.7	6.7	273	198	20.7	20.6	1.25	1.23	2.2	2.2	1.27	0.31	3.8	1.35	1.49	0.49
season	K4	K9	6.8	6.8	233	256	20.9	20.4	1.9	1.56	3.3	2.7	0.58	0.42	3.7	1.4	2.07	1.46
	K5	K10	6.9	6.6	257	345	20.8	20.1	1.95	1.69	3.4	2.9	0.97	0.38	4.1	1.45	2.88	1.09
	K1	K2	5.58	6.3	26.4	112	10.1	8.35	1.68	1.47	2.9	2.5	2.17	1.26	2.4	1.5	1.46	0.85
Pre	K3	K4	5.56	6.54	53.6	27.8	4.65	3.55	1.87	1.05	1.5	1.8	1.89	1.01	2.8	1.9	2.03	0.97
monsoon	K6	K5	6.5	5.6	29.7	46.7	1.3	5.4	1.9	1.65	1.55	2.85	1.75	1.33	6.7	1.55	1.8	1.39
season	K7	K8	5.5	6.52	53.2	55.9	10.9	1.9	2.02	1.7	3.49	2.94	2.31	1.8	6.8	1.8	2.34	1.72
	K9	K10	6.58	5.8	131	25.7	11.2	9.05	1.84	1.52	3.18	2.6	2.52	1.47	6.5	1.2	3.04	1.45

TABLE 3: Average value of physico-chemical parameters of soils from middle region of watersheds (160 m from SL)

Seasons	Middle region of watersheds	pH		Moisture%		TOC (%)		TOM (%)		N (%)		P (%)		K (%)	
		T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT
Pre monsoon	Alangad-vengassery	6.98	7.12	10.2	6.92	1.56	0.99	2.7	1.63	2.6	2.02	3.1	2.46	2.22	0.8
season	Konnakkalkadavu	5.68	6.3	8.24	6.69	2.08	1.52	2.64	2.44	2.28	1.36	2.44	1.58	2.26	1.02
Post monsoon	Alangad-vengassery	6.78	6.96	28	25.2	1.57	0.54	2.13	1.01	1.42	0.88	1.27	0.47	0.91	0.2
season	Konnakkalkadavu	6.46	6.66	23.2	21.1	1.83	1.2	2.5	2.08	1.56	0.36	3.2	1.54	1.98	0.84

TABLE 4: Average value of physic-chemical parameters of soils from lower region of watersheds (80 m from SL)

Seasons	Lower region of watersheds	pH		Moisture%		TOC (%)		TOM (%)		N (%)		P (%)		K (%)	
		T	UT	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT
Pre monsoon season	Alangad-vengassery	6.74	7.06	12.7	7.58	1.81	0.98	2.68	1.6	2.56	1.68	2.8	2.06	2.3	0.89
	Konnakkalkadavu	4.34	6.24	9.24	6.02	1.8	1.64	2.68	2.42	2.5	1.5	2.48	1.72	2.26	1.06
Post monsoon season	Alangad-vengassery	6.66	6.86	29.4	26.4	1.84	0.52	2.52	1.32	1.72	0.92	1.76	0.57	0.55	0.33
	Konnakkalkadavu	6.34	6.66	26	23.4	2.05	1.22	2.84	2.2	1.74	0.54	3.2	1.6	2.02	0.87

Soil characteristic status Alangad – vengassery watershed

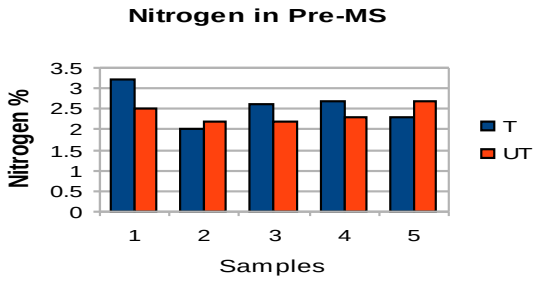

FIGURE 3: Nitrogen in pre-monsoon

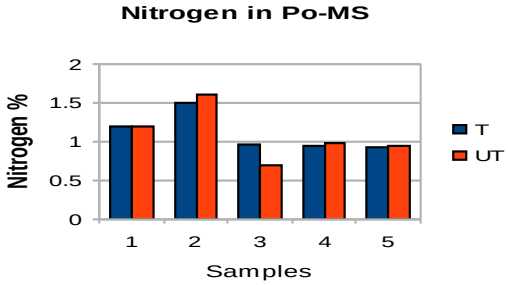

FIGURE 4: Nitrogen in post -monsoon

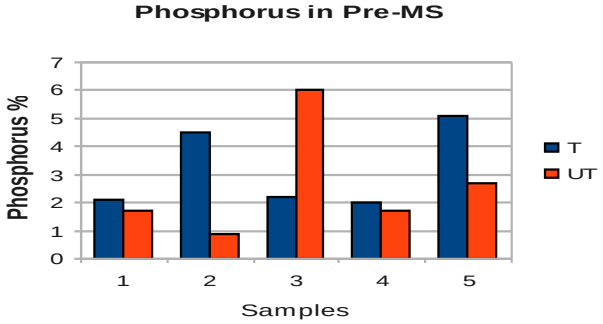

FIGURE 5: Phosphorus in pre-monsoon

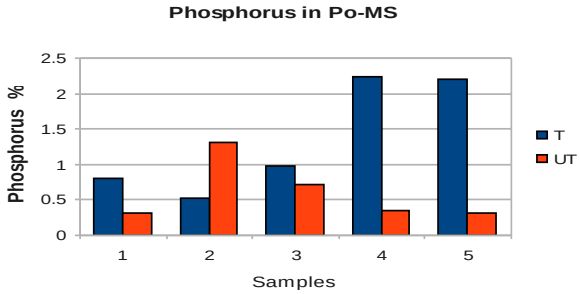

FIGURE 6: Phosphorus in post -monsoon

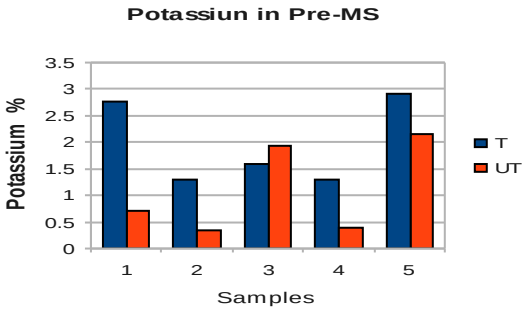

FIGURE 7: Potassium in pre-monsoon

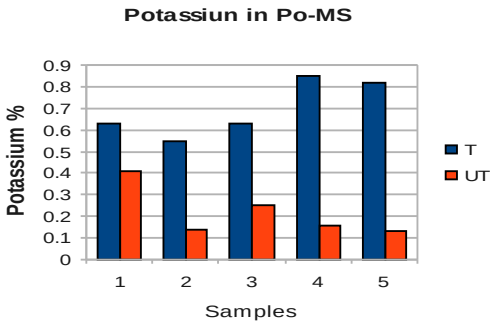

FIGURE 8: Potassium in post -monsoon

As envisaged the moisture content showed a higher value in both the seasons in the treated areas indicative of a higher moisture holding capacity of the soil. The Alangad-Vengassery watershed seems to be higher in soil moisture content compared with Konnakkalkadavu watershed. All treated areas of the selected watersheds exhibit increasing level of moisture content compared to the untreated areas. This is because the addition of organic matter increases the number of micro and macro pores in the soil either by gluing soil particles together or by creating favourable living conditions for soil organisms. Penna, (2012) reported the same observation in her study 'Soil moisture temporal stability at different depths on two alpine hill slopes during wet and dry periods'. Organic matter intimately mixed with mineral soil materials has considerable influence in increasing moisture holding capacity especially in the

topsoil, where the organic matter content is greater. Similar observations were made by Rajesh Rajora (1998) in his study ' Integrated watershed management'. TOC and TOM and nutrients like N, P and K show an increasing trend in the treated samples, both in the pre and post monsoon seasons. This increasing trend is due to the increasing microbial activity resulting in increased humic acid content in the soil. The potassium content was found to decrease during post monsoon season. Similar observations were made by Dengiz et.al. (2011).

TABLE 5. Soil texture in Alangad-vengassery & Konnakkalkadavu watersheds

Name of watershed	Gravels and Stones %	Sand %	Silt %	Clay %	Soil Texture
Alangad- Vengassery	13.0	45.5	20.5	21.0	Sandy clay loam
Konnakkal kadavu	25.3	12.5	34.2	28.0	Silty clay loam

Soil characteristic status Konnakkalkadave watershed

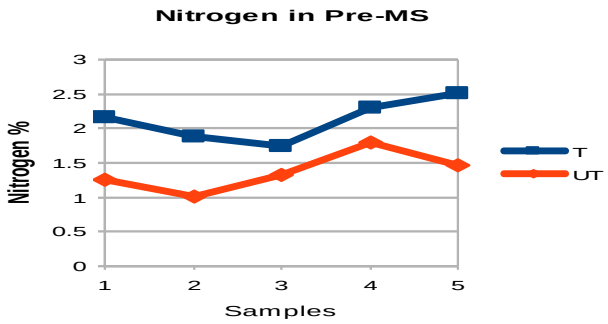

FIGURE 9: Nitrogen in pre-monsoon

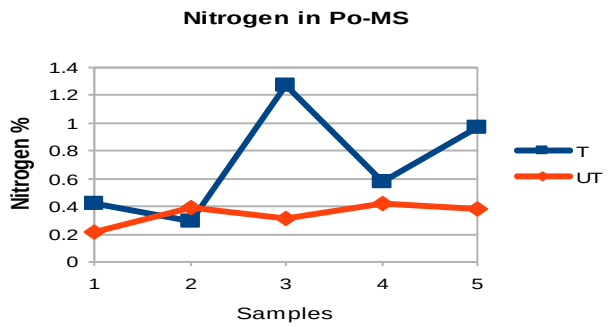

FIGURE 10: Nitrogen in post -monsoon

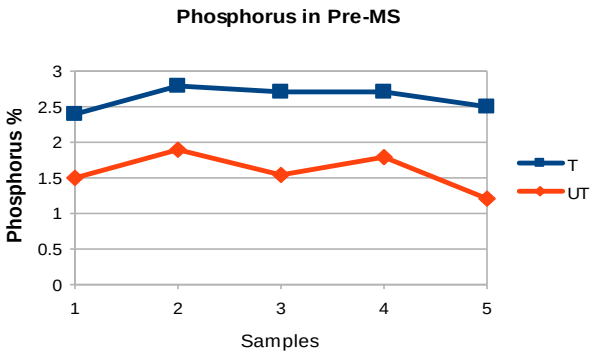

FIGURE 11: Phosphorus in pre-monsoon

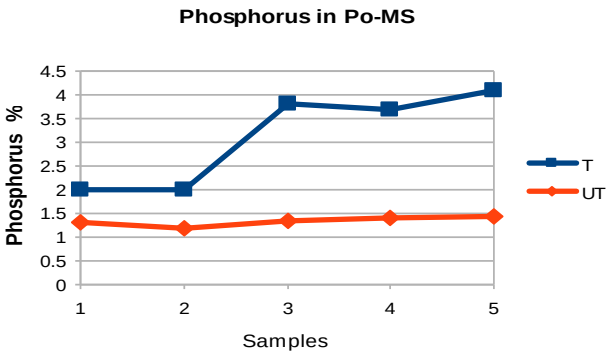

FIGURE 12: Phosphorus in post -monsoon

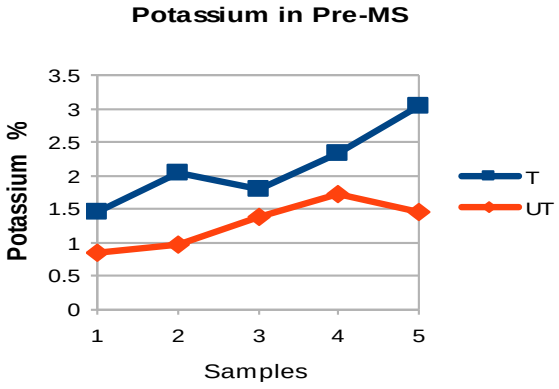

FIGURE 13: Potassium in pre-monsoon

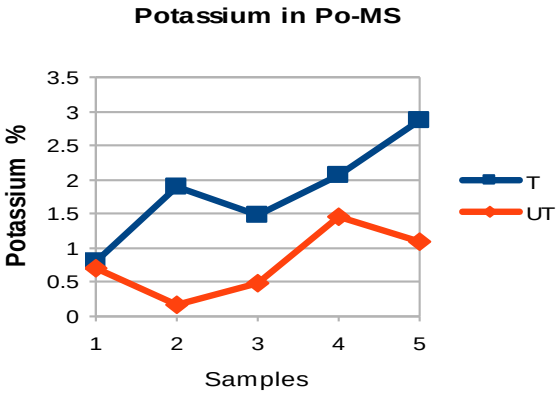

FIGURE 14: Potassium in post -monsoon

They suggested that the decreasing trend was due to the leaching of K ions from soil profiles. Moisture content and nutrient such as Nitrogen, Phosphorus and Potassium concentration was found to be higher in Konnakkalkadavu soil which on analysis was found to have higher clay content (28.0%) compared to 21.0% in Alangad-Vengaserry watershed (Table 5). An interesting trend was observed in the soil parameters of upper, middle and lower regions (Table 1to 4). All parameters from the upper region of watersheds are presented and although for middle and lower region the same parameters are estimated and only the average values have been reported. The pH values measured during both the seasons showed a decreasing trend while all other parameters like organic carbon and nutrients indicated higher values. This could be due to the concentration of higher level of humic acid in the lower regions by the effect of leaching.

CONCLUSION

Watershed management is an essential intervention for soil and water conservation. Two chosen watersheds belonging to two different agroclimatic units were subjected to agronomic interventions like contour bunding, mulching, and construction of rain pits. The soil quality parameters obtained from the treated area during the experiment were compared with the data generated from untreated counter parts. As a result of agronomic interventions the soil health and moisture retention capacity of the treated areas showed an increasing trend in both the seasons. The soil sample studies from higher level to a lower level indicated that the accumulation of nutrients is more in the lower regions. As Konnakkalkadavu is more clayey compared to Alanagad – Vengassery the accumulation of nutrients was found higher in this soil. The results give an indication of the necessity of improved agronomical intervention in the high land areas.

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