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Effect of soil properties and nutrient status on *Eucalyptus tereticornis* based agroforestry system in India

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Abstract
Here an investigation regarding soil characteristics under *Eucalyptus tereticornis* agroforestry at two depths (up to 30cm and 30 to 60cm), was carried out at Research Farm of the Department of Forestry, CCS Haryana Agricultural University, Hisar during 2019. Samples were gathered at a distance of 5, 10, 15, and 20 m from the *E. tereticornis* plantation. We analyzed the pH, electrical conductivity (EC), natural substance (OM), P, K and micronutrients (Zn, Cu, Fe, Mn). With an alkaline pH, the organic matter was deficient in both depths. In micronutrients, Zn was inadequate at both depths, Cu was marginal at up to 30 cm, Fe was deficient at both depths; Mn was inadequate at up to 30 cm thirty cm as well as marginal at 60 cm depth.

Keywords: Agroforestry, eucalyptus, soil, macronutrient, micronutrients, organic matter

Introduction

Trees create soil structure as well as help to stay bigger infiltration rats and a lot more significant water holding capacity as a result, fewer run off is generated, plus erosion is managed [1]. Eucalyptus a genus together with more than 500 species of good adaptability is a Eucalyptus comprises a selection of the very best timber forests of the Australian continent, covering large tracts. Soil material (N, P, K, and organic matter) modifications are already found where Eucalyptus was grown as than natural soil [2-4]. For high yield nitrogen (N), phosphorous (P), as well as potash (K), are supplied through commercial fertilizers. N plays an integral part in carbohydrates utilization, P in strength transformation as well as K in enzymes activation, osmotic regulation and also protein synthesis [5].

Nutrients taken available by plants are used for their growth and development, and definitely, the main objective at root surface plays an immensely important component in fulfilling these specs [6]. Imbalance utilization of NPK fertilizer likewise should have terrible soil and yield degradation perspectives. The ideal ratio of NPK is 2: 2: 0.5 [7]. Therefore, here we have studied the result of Eucalyptus on the soil physical as well as chemical properties.

Materials and Methods

To find out the effect of eucalypts on the soil properties and fertility, a field under agroforestry was selected in Hisar district planted with *Eucalyptus tereticornis*. Soil samplings were done by digging four to five pits at a distance of 5, 10, 15 and 20m from eucalyptus tree at two depths of 0-30 and 30-60cm. A total of 8 composite samples were taken through the mixing of 4-5 sub- samples using the detailed procedure defined elsewhere [8]. The soil samples were examined for pH, Electrical Conductivity (EC) in 1:5 soil water suspension, organic matter (OM) as well as nutrients (P, Cu, Zn, K, Mn) and Fe based on the detailed procedures defined elsewhere [9, 10]. Statgraphics Centurion XVI software (StatPoint Technologies, Warrenton, VA, USA) was used for the data analysis.

Results and Discussion

The soil pH ranged in the surface soil from 7.21 to 7.34 (Table 1). All the soil samples were fundamental in nature. In the sub-soil (30-60cm) pH ranges from 7.36 to 7.87, and pH increased as the distance increased from the trees. The results (Table 1) revealed that the electrical conductivity (EC) of the surface soil ranged from 0.16 to 0.35dSm-1 and were non-saline. Contrary to the surface soil, the EC values increased with increase of distance tree.

The organic matter content in surface soil ranged from 0.28 to 1.20 % (Table 1). Organic matter decreased as distance increased from the trees. In subsoil organic matter ranged from 0.59 to 0.93 %, and similar reduction response was observed as was in the soil surface. In the surface soil (0-30 cm) phosphorus and potassium concentration ranged from 0.28 to 1.06 mg kg^{-1} respectively, the frequency of phosphorus and potassium decreased with increase in distance 26 and 120 from the tree (Table 1). K concentration increased with increase in distance from tree (Table 1).

Table 1: Spatial distribution of chemical properties in agroforestry under *E. tereticornis*

S. No.	Distance (m)	pH (1:5)	EC dSm-1	Organic Matter (%)	AB-DTPA extractable (mg/kg)	
					P	K
			(0-30) cm			
1	5	7.28	0.35	1.20	1.06	120
2	10	7.21	0.26	0.28	0.46	26
3	15	7.34	0.22	0.67	0.28	36
4	20	7.23	0.16	0.82	0.45	39
			(30-60) cm			
1	5	7.36	0.10	0.93	0.14	32
2	10	7.32	0.14	0.56	0.32	33
3	15	7.43	0.16	0.60	0.16	39
4	20	7.87	0.18	0.59	0.14	110

In surface soil, Zn content ranged from 0.02 to 0.10 mg kg^{-1} (Table 2). The concentration of Cu in surface soil decreased as the distance increased from the trees. By comparing the results with the critical value of Sultanpour [11], Cu was adequate in the sub-soil. In surface soil (0-30 cm) Fe ranged from 0.13 to 0.55 mg kg^{-1} (Table 2). The concentration of Fe increased as the distance increased from the trees in the surface soil. By comparing the result with critical values of [11], the concentration of Fe in surface soil was deficient. In the sub-soil (30-60 cm), Fe ranged from 0.40 to 0.69 mg kg^{-1}. The concentration of Fe increased as the distance increased from the trees. By comparing the results with critical values of [12], the concentration of Fe in the subsoil was also deficient. The concentration of Mn in surface soil decreased with the increased distance from the trees. By comparing the results with the critical value of [11], Mn was deficient in surface soil. In the sub-soil (30-60 cm) Mn content ranged from 0.27 to 6.79 mg kg^{-1}. The concentration of Mn increased with increase in distance in case of sub-soil. By comparing the results with critical values of [12], Mn was marginal in the sub-soil.

Table 2: Spatial distribution of micronutrients under agroforestry with *E. tereticornis*

S. No.	Distance (m)	Zn	Cu	Fe	Mn
			mg/kg		
			(0-30) cm		
1	5	0.10	2.98	0.13	1.67
2	10	0.02	1.20	0.39	1.00
3	15	0.04	1.39	0.55	1.31
4	20	0.06	2.80	0.39	0.23
			(30-60) cm		
1	5	0.03	1.44	0.40	0.98
2	10	0.06	1.23	0.42	0.27
3	15	0.08	2.00	0.59	0.96
4	20	0.09	2.42	0.69	6.79

We performed the regression analysis to establish the relationship between the distance and the soil properties (Tables 3 and 4). Soil pH had a positive correlation with distance, i.e. pH increased with distance from the trees in the surface soil. EC, OM, K and P had a negative correlation with distance. As the distance from the Eucalyptus trees increased, the EC, OM, P and K content of the soil decreased. While in sub-soil pH, EC and K had a positive correlation with distance, i.e. pH, K, and EC increased with distance in the sub-soil. OM and P had a negative relationship with distance. As the distance from the Eucalyptus trees increased, the OM and P content of the soil decreased. Regression analysis of micronutrients with range showed that in surface soil, Zn, Cu and Fe had a negative correlation with distance, i.e. Zn, Cu and Fe, increased with distance in the surface soil (Table 4), while Mn had a positive relationship. It's that defecting response for nutrition, high pH and alkaline, as well as minimal organic matter, have been found in most soil samples. Soil organic and also inorganic fertility might be documented to stay away from soil and yield reduction amended for a decrease of pH as well as dirt nutrients accessibility.

Table 3: Coefficient of regression analysis of micronutrients with distance

S. No.	Soil properties	A	B	r^2
(0-30)cm				
1	pH	7.225	0.005	0.316
2	EC	0.40	-0.012	0.975
3	OM	0.94	-0.016	0.076
4	P	1.056	-0.040	0.576
5	K	113.5	-4.66	0.477
(30-60)cm				
1	pH	7.085	0.032	0.694
2	EC	0.08	0.005	0.965
3	OM	0.915	-0.019	0.527
4	P	0.23	-0.003	0.056
5	K	-6.5	4.8	0.672

Table 4: Coefficient of regression analysis of micronutrients with distance

S. No.	Micronutrients	a	b	r^2
(0-30) cm				
1	Zn	0.085	-0.002	0.142
2	Cu	2.18	-0.007	0.002
3	Fe	0.13	-0.018	0.487
4	Mn	2.055	0.080	0.713
(30-60) cm				
1	Zn	0.015	0.004	0.952
2	Cu	0.845	0.074	0.785
3	Fe	0.265	0.024	0.930
4	Mn	-2.28	0.362	0.590

Conclusions: It is concluded that defecting response for nutrients, alkaline and high pH and low organic matter were found in all soil samples. Soil organic and inorganic fertility may be recorded to avoid yield reduction and soil amended for reduction of pH and soil nutrients availability.

References

1. Verma CK. Water Pollution and Management of land. Wily Eastern Ltd. New Delhi 1999, 219.
2. Kumar T, Kumari B, Kaushik P. Tree growth, litter fall and feaf litter decomposition of Eucalyptus tereticornis base Agri-silviculture System. International Journal of Current Microbiology and Applied Sciences 2019;8:3014-3023.
3. Kumar T, Kumari B, Arya S, Kaushik P. Effect of different spacings of Eucalyptus based agroforestry systems soil nutrient status and chemical properties in semi-arid ecosystem of India. Journal of Pharmacognosy and Phytochemistry 2019;8:18-23.
4. Kaushik P. Classification of Indian states and union territories based on their Soil macronutrient and organic carbon profiles. Bio Rxiv 2020, 1-4.
5. Samuel LT, Wernner NL, James BD. Soil fertility and fertilizers. 4th Ed. Macmillan Publish. Co. Inc. USA 1985, 61-70.
6. Wild A, Jones LHP. Mineral nutrition of crop plants. In: Russell's soil conditions and plant growth. Wild, A. (ed.) 11th Ed. Longman Group UK Ltd. Harlow, UK 1988, 107-112.
7. Hussain T, Higa T. Beneficial and effective microorganisms for a sustainable agricultural and environment. Nature Farming Res. Center, Univ. of Agric. Faisalabad, Pakistan 2001, 155.
8. Halvin JL, Soltanpour PN. Evaluation of the NH4HCO3 E-DTPA Soil test for Fe, Zn, Mn, Cu. Soil Sci. Soc. Amer. J 1981;45:70-55.
9. Nelson DW, Sommer LE. Total Carbon, organic Carbon and Organic matter 1982.
10. Miller ALMH, Keeny DR. (eds) Method of Soil Anal. Part-2. 2nd Ed. chemical and microbiological properties. Am. Soc. Agron. Madison. WI. USA. PD 539-577, 539-580.
11. Schwab AP. A new soil test for simultaneous extraction of Macro and micronutrients in alkaline soils. Common soil Sci. Plant Anial 1997;8:195-267.
12. Soltanpour N. Use of NH4HNO3- DTPA soil test to evaluate elemental availability and toxicity. Common soil Sci and plant 1985;16:323-338.
13. Chauhan J, Saini I, Singh T, Kaushik P. A brief perspective on Acacia a member of family Leguminosae. Preprints 2020.