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Survey on Fertility Status of Cashew Gardens in Coastal Districts of Andhra Pradesh

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ABSTRACT

Thirty six soil samples were collected from coastal districts of Andhra Pradesh, from different depths (0-15, 15-30 and 30-45 cms) of ten- year old cashewnut plantations and were analyzed adopting standard procedures during 2006. In general these soils were nearer to neutral and slightly alkaline in reaction and free from salt stress. Available N, P, K. S, Ca, Mg, Mn, Zn and Fe ranged from 141.23 to 384.36 kg ha^{-1} , 13.29 to 28.12 kg ha^{-1} , 144.42 to 189.80 kg ha^{-1} , 10.46 to 25.12 ppm, 1.71 to 2.45 [cmol (P^+) kg^{-1}],0.06 to 0.84 (cmol (P^+) kg^{-1}), 5.42 to 13.25 ppm, 1.03 to 1.37ppm and 3.77 to 9.24 ppm, respectively. The availability of all the nutrient contents decreased with increasing depth of soil.

Key words : Cashew, Soil nutrients

Andhra Pradesh is the second largest state to grow cashew of the country and occupies an area of 1.5 lakh ha and a production of 88,000 metric tonnes, with an average productivity of 840 kg kernels ha^{-1}. Cashew crop is mostly cultivated in marginal and low fertile soils with little or no manurial management practices and thus resulted in poor yields. Cashew being regular bearer, considerable amount of nutrients is removed every year from the soil. A thirty year old bearing cashew tree yielding 24 kg of nuts and 155 kg of apple, removes annually 2.845 kg of nitrogen, 0.331 kg of phosphorus and 1.012 kg of potassium through roots, stems, nuts and apple (Mohapatra *et al.,* 1973). Besides this, majority of the farmers are not in the habit of applying manures and fertilizers, because most of the cashew growers are having very small holdings with poor economic back ground. Hence, there is a need to make a survey on nutrient status of the cashew plantation soils coastal districts of Andhra Pradesh

MATERIAL AND METHODS

The investigation was carried out using 10 year old cashew tree plantations. Twenty four cashew orchards were selected for investigation, two orchards from each of twelve different mandals in coastal districts of Andhra Pradesh for collection of soil samples. Representative soil samples from different depths *viz.,* 0-15 cm, 15-30 cm and 30-45 cm, separately from each orchard were collected in cloth bags. The samples were processed and analyzed for soil reaction (pH), electrical conductivity (EC) (Jackson, 1973), available nitrogen (Subbiah and Asija, 1956), available phosphorus (Watanabe and Olsen, 1965), available potassium (Muhr *et al.,* 1963), exchangeable calcium and magnesium (Jackson, 1973) and available sulphur (Cottenie *et al.,* 1979). The available micronutrients Fe, Zn and Mn in the soil samples were extracted with DTPA (Lindsay and Norvell, (1978) and determined by using atomic absorption spectrophotometer (AAS).

RESULTS AND DISCUSSION

Physico-chemical properties:

The distribution and availability of nutrients in the soil samples collected from different depths is presented in Table. The soils in all the twenty four orchards were found to be nearer to neutral and slightly alkaline in reaction with a pH range 6.43 to 7.85 and a mean value of 7.14 at different depths as per the prescribed ratings (Anonymous, 1984). The pH increased slightly with increasing depth. This is to be expected since there was clay migration and leaching of exchangeable bases into the lower horizons, which contributed to the increase in pH. The soil EC varied from 0.25 to 0.72 dSm^{-1} (medium saline) with a mean value of 0.48 dSm^{-1} at different depths of all the twelve mandals cashewnut orchards. Thus it can be concluded that the orchards were free from salt stress.

The available nitrogen content of all the soil samples analyzed was found to be varying from (low to medium) 141.23 to 384.36 kg ha^{-1}. The available nitrogen content decreased progressively with

Table 1. Soil nutrient status of the 12 mandals cashew orchards during July 2006

Mandal	Depth (cm)	pH	EC (dSm^{-1})	Kg ha^{-1}			ppm	Exchangeable ions cmol (P+) kg^{-1}		DTPA extractable (ppm)		
				N	P	K	S	Ca	Mg	Fe	Mn	Zn
Tekkali	0-15	7.48	0.63	280.12	23.42	170.67	20.74	2.18	0.15	7.68	8.22	1.28
	15-30	7.49	0.65	277.23	21.35	165.34	18.37	2.10	0.17	7.21	7.91	1.24
	30-45	7.49	0.66	273.14	19.81	162.58	15.83	2.09	0.13	6.79	7.48	1.21
S. Bommalli	0-15	7.21	0.64	275.14	21.88	168.56	19.42	2.16	0.61	7.56	7.52	1.23
	15-30	7.22	0.66	271.56	19.72	164.32	17.86	2.08	0.43	7.12	7.46	1.19
	30-45	7.22	0.68	269.54	17.43	160.58	15.17	2.00	0.27	6.79	7.32	1.16
Salur	0-15	7.63	0.69	271.34	23.82	172.63	21.38	2.28	0.29	7.85	6.58	1.28
	15-30	7.64	0.70	269.45	21.52	169.34	19.31	2.12	0.21	7.63	6.27	1.22
	30-45	7.64	0.72	265.48	19.91	160.42	17.52	2.07	0.03	6.82	6.01	0.18
R. B. Puram	0-15	7.45	0.59	273.14	25.73	174.38	22.32	2.21	0.38	7.88	7.48	1.32
	15-30	7.46	0.62	270.56	23.42	170.81	20.12	2.14	0.27	7.63	7.21	1.28
	30-45	7.46	0.64	268.46	20.81	168.53	17.58	2.06	0.25	6.74	7.12	1.23
Rolugunta	0-15	7.47	0.58	222.31	20.23	160.15	16.59	2.42	0.17	6.73	7.89	1.18
	15-30	7.46	0.60	220.74	18.61	158.54	14.27	2.18	0.13	6.52	7.63	1.12
	30-45	7.47	0.62	214.65	16.82	156.83	12.78	2.13	0.14	6.18	7.22	0.98
Narsipatnam	0-15	7.33	0.43	198.65	18.92	169.56	14.24	2.12	0.15	6.73	7.01	1.21
	15-30	7.32	0.45	194.57	16.73	157.34	12.37	2.01	0.17	6.54	6.91	1.17
	30-45	7.33	0.46	192.45	15.31	155.63	11.49	1.95	0.13	6.01	6.73	1.13
Nidadavol	0-15	7.85	0.48	382.31	28.12	189.80	25.12	2.45	0.84	9.24	13.25	1.37
	15-30	7.84	0.49	369.41	24.32	175.23	23.24	2.31	0.81	8.12	12.85	1.31
	30-45	7.83	0.52	340.59	22.53	170.28	21.57	2.23	0.76	8.01	11.73	1.28
J.R. Gudem	0-15	7.21	0.46	384.36	27.35	178.32	24.32	2.39	0.74	8.11	11.87	1.31
	15-30	7.32	0.48	371.42	22.74	176.83	22.58	2.28	0.68	7.98	11.49	1.25
	30-45	7.32	0.52	361.68	20.81	171.52	20.21	2.21	0.62	7.65	10.32	1.20
Vetapalem	0-15	6.57	0.25	157.52	16.81	159.63	14.21	1.89	0.12	6.74	7.81	1.21
	15-30	6.58	0.27	155.49	15.42	157.37	12.63	1.83	0.09	6.32	7.63	1.18
	30-45	6.60	0.29	152.43	14.37	154.84	11.71	1.75	0.06	5.19	7.04	1.13
Chinnaganjam	0-15	6.55	0.26	150.53	15.23	152.56	12.46	1.84	0.16	6.32	9.72	1.09
	15-30	6.57	0.28	146.75	14.32	148.34	11.37	1.78	0.13	5.79	9.51	1.07
	30-45	6.57	0.29	141.23	13.36	145.28	10.46	1.71	0.11	5.12	9.07	1.06
Bapatla	0-15	6.43	0.28	169.32	16.32	164.83	13.34	1.95	0.18	6.74	6.72	1.21
	15-30	6.44	0.29	168.53	14.89	160.62	12.73	1.86	0.13	6.16	6.57	1.17
	30-45	6.45	0.32	161.35	13.30	149.32	11.48	1.78	0.12	5.12	6.43	1.13
Karlapalem	0-15	6.62	0.29	155.63	15.15	151.65	13.74	1.94	0.18	5.77	6.12	1.08
	15-30	6.63	0.31	153.48	14.22	147.31	11.81	1.89	0.13	4.31	5.78	1.06
	30-45	6.64	0.34	149.54.	13.29	144.42	10.77	1.75	0.12	3.77	5.42	1.03
Range		6.43	0.25	141.23	13.29	144.42	10.46	1.71	0.06	3.77	5.42	1.03
		7.85	0.72	384.36	28.12	189.80	25.12	2.45	0.84	9.24	13.25	1.37

increasing depth in all the orchards. Maximum values for available nitrogen content were recorded in Jangareddygudem mandal orchards of West Godavari district while the lower values were recorded by Chinnaganjam mandal orchards of Prakasam district.

The available soil phosphorus status of all the orchards studied was found to be low as it ranged from (low to medium) 13.29 to 28.12 kg ha^{-1} as per the ratings proposed by Muhr *et al.* (1963). The soil phosphorus content was more or less decreased with increasing depth. Higher values of phosphorus were recorded by Nidadavol mandal orchards followed by Jangareddygudem mandal of West Godavari district while lower values were recorded by Chinnaganjam mandal orchards of Prakasam district.

The available potassium status of all the soil samples analysed in different orchards was found to be low to medium in K content, with the values ranging from 144.42 to 189.80 kg ha^{-1} as per the ratings suggested by Muhr *et al.* (1963). The highest potassium value of 189.80 kg ha^{-1} was recorded by Nidadavol mandal orchards while lowest value of 144.42 kg ha^{-1} was recorded by Karlapalem mandal orchards of Guntur district. The higher potassium content could be attributed to the presence of potassium bearing minerals in heavy textured soils than fine textured soils.

The available sulphur content of all the soil samples analysed in different orchards was ranging from 10.46 to 25.12 ppm. All mandal orchards were found to be falling in sufficiency range of soil samples. The soil sulphur content was lower in sub surface layers than the surface layers. Orchards of Nidadavol mandal recorded higher sulphur content, while, Chinnaganjam mandal orchards of Prakasam district recorded lower sulphur content.

The exchangeable calcium in the orchards of twelve mandal was ranging from (deficient to sufficiency) 1.71 to 2.45 cmol (p^+) kg^{-1}. Nidadavol mandal orchards recorded maximum values of calcium while lower values were recorded by Chinnaganjam mandal orchards.

The exchangeable magnesium content was ranged from (deficient to sufficiency) 0.06 to 0.84 cmol (p^+ kg^{-1}). The exchangeable magnesium content decreased with increasing depth. The Tekkali mandal orchards of Srikakulam district recorded maximum values of magnesium while lower values were recorded by Vetapalem mandal orchards of Prakasam district.

Available micro nutrients

The DTPA extractable iron in all the orchards was varying from (deficient to sufficiency) 3.77 to 9.24 ppm as per the ratings suggested by Lindsay and Norvell (1978). Maximum values of iron were recorded by Nidadavol mandal orchards of West Godavari district while low values were recorded by Vetapalem mandal orchards of Prakasam district.

The DTPA extractable manganese in the samples analyzed of all the orchards ranged between 5.42 and 13.25 ppm. All mandal orchards were found to be falling sufficiency in range as per the ratings suggested by Lindsay and Norvell (1978). There was a decrease in Mn content with increasing depth. Nidadavol mandal orchards of West Godavari district recorded maximum values of manganese while lower values were recorded by Vetapalem mandal orchards of Prakasam district.

The DTPA extractable zinc in the twelve mandal orchards was found to be ranging between 1.03 and 1.37 ppm. All mandal orchards were found to be falling sufficiency in range as per the ratings suggested by Lindsay and Norvell (1978). The zinc content decreased with increasing depth. Maximum values of zinc were recorded by Nidadavol mandal orchards while low values were recorded by Karlapalem mandal orchards of Guntur district.

It can also be concluded that the surface soil samples were richer in all the nutrients *viz.,* N, P, K, Ca, Mg, S, Fe, Zn and Mn than the lower layers and it might be due to accumulation of leaf litter and humus at the surface that probably accounted for this difference. This was also due to higher organic carbon content and addition of fertilizers on surface layers. Surface layers were found to contain higher amounts of available micro nutrient cations than subsurface layers. Variation in nutrient content among cashew plantation may be attributed to soil heterogeneity, irregular distribution of manures and fertilizers, adopted cultural operations etc., adopted by farmers. As plant grows, nutrients in surface layers get depleted. They exert pressure on subsoil to meet their requirement and trans-locate them to leaves. Continuous decay and fall of these leaves maintain higher concentration of nutrients in surface layers.

The results of soil nutrient status revealed that nutrient content at surface level of the soil is more and showed a static or a decline in its content at lower depths. In a perennial tree like cashewnut there may be a possibility of uptake of nutrients by the absorbing roots from the lower depths of 0-15 cm and 15-30 cm depth and thus their status was lower in lower soil depths.

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