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SODIUM CHLORIDE NUTRITION OF COCONUT PALMS

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Coconut is one of the most important crops of Kerala. Among the fertilizer elements supplied to the crop, potassium is the one that is applied in largest amounts. Application of common salt has long been practised by the farmers of the state to partially substitute potassium although the exact effect of application of sodium chloride to coconut is not well understood.

It has fairly been established in crops like tomato (Besford, 1978), spinach (Lehr, 1949) and barley (Lehr and Wybenga, 1958) that potassium can, to certain extent, be replaced by sodium in crop nutrition. Smith (1969) has reported that in coconut sodium can replace potassium under situations in which the foliar concentration of K is less that 0.5% and that of Na is less than 0.4%. Further, it is believed that application of common salt hastens the disintegration of the hard substrata of laterite soil, the mojor soil type of Kerala cropped to coconut. However the unfavourable effects of applied NaCl in effecting alkalisation and dispersion of the soil are well established.

A study was undertaken to bring out the effect of substituting potassium to various levels by sodium on the yield and nutrient uptake of coconut palms.

Materials and Methods

A field experiment was conducted with 24 year old stock of hybrid coconut palms at the Coconut Research Station, Pilicode, Kerala. These palms had been receiving NPK, and lime as per Package of Practices Recommendations of the Kerala Agricultural University (Anon, 1976) till the commencement of the experiment. The trial was laid out in 1976 in RBD with 6 treatments and 4 replications maintaining 6 palms in each plot. The soil of the experimental site was a laterite with pH 4.9. The treatments were:

T_1 Control
T_2 1000 of K_2O/palm/year
T_3 750 g K_2O/250 g Na_2O/palm/year
T_4 500 g K_2O + 500 g Na_2O/palm/year
T_5 250 g K_2O + 750 g Na_2O/palm/year
T_6 1000 g Na_2O/palm/year

K was applied as KCl and Na was applied as NaCl in two split doses. All the palms received 500 g N, 320 g P_2O_5, 300 g CaO and 170 g MgO in two doses. The crop was rainfed and all cultural and management operations were done as per the Package of Practices Recommendations of the Kerala Agricultural University (Anon. 1976).

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The yield of nuts/palm/year was registered tree-wise from 1978 to 1981. The number of leaves retained on the crown was recorded in December, 1981. Soil samples from the base of the palms and leaf samples from the 14th leaf were collected in January, 1982 by following standard procedures. The soil samples were subjected to structural analysis by the wet sieving method (Yoder, 1937) and the per cent aggregate stability was worked out. The content of available sodium and potassium in *N* neutral ammonium acetate extract was estimated using a flame photometer (Jackson, 1958). The nitrogen content of the leaf was estimated by the microkjeldah! method (Jackson, 1958). Leaf samples were digested in tri-acid mixture and the content of P in the digest was determined by vanadomolybdate method and K and Na were estimated using a flamephotometer (Jackson, 1958).

The data on the annual production of nuts per palm from 1978 to 1981 were analysed statistically using the analysis of covariance technique (Snedecor and Cochran, 1967) taking the annual nut yield of six years (1972-77) as the concommittant variable. The data on the other observations were analysed by the analysis of variance method for RBD (Snedecor and Cochran, 1967).

Results and Discussion

The mean values of the parameters studied are presented in Table 1. The number of leaves retained on the palm was not influenced by The treatments. The yield of nuts was significantly influenced by the treatments. All the treatments recorded higher yield compared to the control plot which received neither K nor Na. However, the effect was statistically significant only in the case of T_5, T_4 and T_2 which were on par. This indicates that substitution of K_2O by Na_2O to the extent of 75% (T_5) or 50% (T_4) is possible maintaining the same yield *as* that of 100% K_2O (T_2). The yield of the palm was found to be significantly correlated with the available sodium content of the soil ($r = +0.553^{**}$).

The nitrogen content of the leaf was highest in the case of T_6 whereas it was more or less similar in the other treatments. The foliar concentration of phosphorus was not appreciably influenced by the treatments.

The available K_2O status of the soil in the control plot was 190.5 kg/ha. (medium) and there was almost a linear increase in the level of available K with increasing rate of K application. As regards the potassium content of the leaf, it was remarkably increased by enhanced rate of K application. The K content of the leaf was significantly correlated with available K in the soil ($r = +0.656^{**}$)

Application of sodium to soil at various rates produced a corresponding increase in the level of available sodium. The reduced avilable sodium content in T_3 and T_2 when compared to T_1 may be as a result of competition between K and Na ions in the soil for exchange sites. The foliar concentration

Table 1

Effect of different levels of K and Na on the yield and nutrient content of coconut palms

No.	Treatment		No. Of leaves on the crown	Yield of nuts/ palm/ year	Nutrient level in leaf				Available K and Na in soil		Aggregate stability of soil %
	K_2O (g/palm/ year)	Na_2O (g/palm/ year)			N%	P%	K%	Na%	K_2O (kg/ha)	Na_2O (kg/ha)	
1	0	0	29.6	68.8	1.82	0.124	0.57	0.356	190.5	11.8	22.3
2	1000	0	27.9	80.7	1.72	0.133	1.28	0.236	321.5	7.4	12.8
3	750	250	28,3	75.7	1.68	0.140	1.15	0.292	288,4	10.8	16.9
4	500	500	32.0	83.6	1.75	0.127	0.82	0.370	264.3	20.2	14.2
5	250	750	27.6	84.4	1,71	0.134	1.12	0.314	259.3	22.6	17.4
6	0	1000	29.6	79.0	2.07	0.130	0.49	0.388	189.7	31.0	19.5
CD (0.05)			NS	11.5	0.19	NS	0.21	0.061	67.8	9.9	NS

NS = Not significant

Table 2

Coefficients of correlation between yield and nutrient levels of soil and leaf

	Yield	N% (leaf)	K% (leaf)	Na% (leaf)	Available K(soil)	Available Na(soil)
N% (leaf)	-0.113	—	—	—	—	—
K% (leaf)	0,367	-0.464*	—	—	—	—
Na% (leaf)	—0.328	0.264	—0.728**	—	—	—
Available K (Soil)	0.091	—0.554**	0.656**	—0.402	—	—
Available Na (Soil)	0.553**	0.126	-0.205	0.211	—0.191	—

*Significant at 5% level

**Significan1 at 1% level

of sodium was maximum in the case of T_9 which received the maximum amount of sodium. Relatively higher concentration of Na in the leaves of palms receiving T_1 when compared to the other treatments can be explained by the antagonistic effect of K in the soil on the uptake of Na, as reported by Smith (1969). A significant negative correlation was observed between the contents of K and Na in the leaf (r= —0.728**).

The treatments did not produce any pronounced effect on the aggregate stability of the soil. The pH and EC of the soil also were not affected by the treatments suggesting that in highly acidic laterite soils receiving good rainfall, application of NaCl to coconut at the rate upto 1000 g Na_2O/palm/year for a period upto 5 years does not hamper the physico-chemical properties of the soil.

Summary

An experiment was conducted at the Coconut Research Station, Pilicode, Kerala to study the effect of substitution of potassium applied to coconut by sodium. Twentyfour year old coconut palms grown in laterite soil and which received N,P and K at the recommended dose were selected for the study. Replacement of potassium applied as KCl at the rate of 1000 g K_2O/palm/year to the extent of 50% or even 75% by Na_2O applied as NaCl for 5 years did not reduce the yield of nuts. Application of NaCl at this rate for 5 years to the laterite soils of Pilicode receiving fairly good rainfall did not alter the pH, EC and aggregate stability of the soil.

സംഗ്രഹം

പിലിക്കോട് തെങ്ങുഗവേഷണ കേന്ദ്രത്തിലെ 24 വർഷം പ്രായമുള്ള തെങ്ങുകളിൽ കഴിഞ്ഞ അഞ്ചുവർഷം നടത്തിയ ഒരു പരീക്ഷണത്തിൽ നല്ല മഴ ലഭിക്കുന്ന അമ്ല വെട്ടുകൽ മണ്ണിൽ വളരുന്ന തെങ്ങിന് ഇപ്പോഴം നൽകുന്ന ക്ഷാരത്തിന്റെ അളവ് (1000 ഗ്രാം K 0) അൻപതു മുതൽഎഴുപത്തി അഞ്ചു ശതമാനം വരെ കുറച്ചുകൊണ്ട് അതിനുപകരം കറിയുപ്പ് നൽകുന്നതിനാൽ തേങ്ങയുൽപാaനം കുറയുകയില്ലെന്ന് മനസ്സിലായി. ffififpleic^o ro.ojrooc/1 ലും രാസസ്വഭാവങ്ങളിലും മാറ്റമുണ്ടായതായി കണ്ടില്ല.

References

Anonymous, 1976. *Package of Practices Recommendations,* Kerala Agricultural University, Vellanikkara, Trichur

Besford, R. J. 1978. Effect of replacing nutrient potassium by sodium on uptake and distribution of sodium in tomato plants. *Pl, Soil* 50 : 399-409.

Jackson, M. L, 1958. *Soil Chemical Analysis.* Prentice Hall Inc., N. J., U, S. A,

Lehr, J. J. 1949 Exploratory experiments on sensitiveness of different crops to sodium: A, Spinach. *Pl. Soil 2:* 37-48.

Lehr, J. and Wybenga, J. M., 1958. Exploratory experiments on sensitiveness of different crops to sodium; D. Barley, *Pl. Soil* 9:237-253.

Smith, R. W. 1969. Fertilizer responses by coconut on two contrasting Jamaica soils. *Exp. Agric.* 5: 133-145.

Snedecor, G, W. and Cochran, W. G. 1967. *Statistical Methods.* 6th ed., Oxford and 1BH Pub. Co., Calcutta

Yoder. R. E. 1937. Significance of soil structure in relation to the tilth problem. *Proc. Soil Sci. Soc. Am.* 2:21-23.