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EFFECT OF LIMING ON AVAILABLE NUTRIENTS AND YIELD OF PADDY IN THE ACID SOILS OF KUTTANAD

S. KABEERATHUMMA and N. S. MONEY
College of Agriculture, Vellayani

The cultivators of Kuttanad area in Kerala are faced with fertility problems due to the high acidity of the soils in this region. Though liming is a common practice in this area data relating to the effect of liming in graded dozes, on available nutrients and yield of paddy are not adequate. Hence a pot culture experiment was carried out and the results are reported here.

Meterials and Methods

Bulk quantities of Kari and Karapadom soils were collected from water-logged fields of Purakad and Ambalapuzha and were filled in pots. Two sets of pots were taken, one with crop (4 replications) and the other without crop (3 replications) to draw periodical samples of soil for analysis. Annapoorna was the rice variety used. Three levels of lime viz. 0, ½ LR and LR were applied and the levels were chosen on the basis of the lime requirement of these soils. The lime was applied in the form of CaO two days before planting. Fertilizers were applied on the day of planting at the rate of 60 Kg. N, 50 Kg. P_2O_5 and 50 Kg. K_2O. All the pots were exposed to the same conditions and watered daily at uniform rate Soil samples were drawn from the pots without crop on the 15th, 45th and 75th day after liming and samples were drawn from cropped pots after harvest only. The soil samples were analysed for nitrate nitrogen at the field moisture condition by the phenol di-sulphonic acid method as given by Jackson (1960). After air drying the pH, available P and K were determined by standard methods. Available N was estimated by the alkaline permanganate method. Plant samples were also analysed for the N, P, K, Ca and Mg contents

Results and Discussion

Data are presented in Tables ! to 3. A sharp increase in the available nitrogen, nitrate nitrogen was noted up to 45th day of liming. The Kari soil showed a higher rate of increase than Karapadom soil. Although the no lime pots for both the soils received the same amount of fertilizer N as the limed pots the contents of available and nitrate N were lower in no lime pots than in limed pots, thereby indicating that the utilisation of applied N in both these soils is poor in the absence of lime. Liming has therefore accelerated mineralisation of applied N resulting in its enhanced availability. A significant correlation ($r = 0.519$, 0 582, 0.478) was obtained between pH and available N for all the three samples. Liming, by causing a rise in pH, helps microbial activity and mineralisaiion of N resulting in increased availability. Pockets of microheterogenity may be attributed for the existence of nitrate nitrogen under water-logged conditions.

The results also showed that there was substantial increase in the content of available phosphate when increasing levels of lime were applied. Maximum availability was noted on 15th day and P showed a tendency to decrease with duration (Table 1). A positive correlation existed between pH and available phosphate. The content of available P was higher in Karapadom soil and it showed a higher capacity for utilisation of applied P. It also appears that the optinum doze of lime for maximum efficiency in the utilisation of applied P is ' LR for Karapadom soil while this was at best full LR for Kari soil In all treatments the available P decreased up to 45th day and an increasing tendency was noticed at 75th day in Karapadom soil. In case of Kari soil this trend was not very much in evidence. This may be attributed to changes in pH. Availability of P is restricted to pH range of approximately 6 to 7. In the Karapadom soil, the pH on the 75th day of liming was very near this range while it was farther away in the case of the Kari soil.

A marked decrease of available K was noted in soils receiving full LR dose and it increased slightly in soils receiving ' LR dose. K content was least in 15th day sample and maximum in 75th day sample. The available K was higher in Karapadom soil than in the Kari soil. The increase in availability of

Table 1

Effect of liming on soil pH and available nutrients (N. P. K. expressed as mg/100 g soil)

Date of Sampling	Characters (Mean values)	Kan soil			Karapadom soil		
		No lime	Half lime	Full lime	No lime	Half lime	Full lime
15thday of liming	pH	3.5	4.5	4.8	5.0	6.0	6.4
	Available N	21.86	25.86	28.82	23.33	26.80	31.86
	Nitrate N	0.10	0.14	0.19	0.12	0.16	0.18
	Available P	1.55	1.62	3,00	2.37	3.70	4.50
	Avaliable K	3.27	3.70	2.38	7.00	7.16	6.00
45th day of liming	pH	4.2	4.9	5.5	5.7	6.5	6.8
	Available N	29.43	32.70	36.95	30.10	36.65	39.42
	Nitrate N	0.18	0.20	• 0.30	0.24	0.27	0.29
	Available P	0.40	0.44	0.10	0.74	1.00	1.31
	Available K	3.27	4.60	3.57	7.00	7.32	6.11
75th day of liming	pH	4 00	4.4	5.2	5.2	6.6	6.8
	Available N	26.46	31.66	37.00	27.45	32 53	38.76
	Nitrate X	0.18	0.29	0.30	0.21	0.28	0.29
	Available P	0.90	1.33	1.74	3.10	2.75	2.36
	Available K	9.61	11.38	7.33	9.72	8.88	7.44
After harvest	PH	3.4	4.5	4.6	4.8	5.0	5.3
	Available N	10.00	15.20	20.30	20.50	25.40	28.00
	Nitrate N	0.90	0.11	0.12	0.10	0.13	0.14
	Available P	2.60	6.00	6.60	3.24	5.00	*1.40*
	Available K	0.83	3.83	4.50	3.00	3.50	8.00

Table 2

Effect of liming on chemical composition on grain and straw (percentage)

Plant part	Nutrient	Kari soil			Karapadom soil		
		No lime	Half lime	Full lime	No lime	Half lime	Full lime
Grain	N	0.770	0.830	0.880	0.700	0.800	0.900
	P	0,046	0.064	0.094	0.110	0.112	0.132
	K	1.443	1.580	0.800	1.050	1.120	0.740
	CaO	0.962	0.999	1.000	0.891	1.100	1.100
	Mg	0.133	0.143	0.153	0.120	0.122	0.132
Straw	N	0.770	0.790	0.800	0.810	0.622	0.850
	P	0,520	0.630	0.650	0.500	0.640	0.640
	K	0.880	0.920	0.500	0.800	0.900	0.450
	CaO	0.096	0.101	1.109	1.100	0.130	0.152
	Mg	0.071	0.074	0.100	0.072	0.100	1.106

Table 3

Effect of inning on the growth characters and yield of paddy

Characters	Kari soil			Karapadom soil		
	No lime	Half lime	Full lime	No lime	Halflime	Full lime
Straw yield	11.87	17.50	20.60	4.37	10.80	13.75
Grain yield	4.87	15.12	18.50	2.37	7.75	12.00
1000 grain weight (in g)	19.00	19.60	25.70	17.60	20.20	22.00
Number of tillers at flowering stage	3	9	10	7	14	15
Number of productive tillers						12
Heihgt of plants at flowering stage (cms)	30			57	61	67

K with duration might be at the expense of exchangable K. When K is supplied after application of lime, it is possible that K ions of the soil solution replace Ca ions, thereby resulting in a decrease in the K content of the soil solution.

In the case of Kan soil maximum pH was noted after 45th day of liming at full LR where-as in Karapadom soil it reached only after 75th day at $\frac{1}{2}$ LR thus bringing out the inherent differences between the two types of soils. The Karapadom soil differs markedly from Kari soil in the nature of its acidity, the acidity of latter being mainly due to mineral acids. Hence the lime applied in Karapadom soils acts in such a way as to result in gradual rise of pH over a prolonged period of time.

The effect produced by liming Kari and Karapadom soils is clearly manifested in the content of major plant nutrients in the grain and straw. N and P content of grain and straw increased appreciably with increasing levels of lime applied to soils. In the case of the K content of grain and straw an increase in this constituent was noticed with lime applied at $\frac{1}{2}$ LR while with higher levels there was a tendency for K content to decrease. Evidently the highest levels of lime might have resulted in a certain amount of fixation of applie 1 K which is seen in the K content of plant also.

All the treatments involving lime have shown substantial increase in yield in respect of grain and straw. In both the soils application of lime at full lime requirement, has given the maximum yield (Table 3). This effect of lime on yield can be attributed, among other factors such as correction of soil acidity to increased supply of calcium also as a nutrient.

Summary

The significance of lime application to the acid paddy soils of Kuttanad with respect to enhancing available nutrients and yield of paddy varieties was studied. Lime application apart from correction of harmful effects of acidity, increases the availability of essential nutrients and provides better conditions for their assimilation thereby resulting in enhanced yields of rice. The study has also brought out the inherent difference in the nature of acidity between Kari and Karapadom soils and in their capacity for utilisation of applied fertilizers.

സംഗ്രഹം

കുട്ടനാടൻ പാടങ്ങളിൽ കുമ്മായം ചേർക്കുന്നതുകൊണ്ട് മണ്ണിന്റെ അമ്ലത്വം കുറക്കുന്നതോ fflso.iJo ചെടികൾക്ക വളങ്ങളം വർദ്ധിച്ചതോതാൽ ലഭ്യമാക്കുകയും ചെയ്യുന്നതിനാൽ വിളവിൽ വർദ്ധനവുണ്ടാക്കുന്നതായി തെളിഞ്ഞു. കരിമണ്ണിനും കരപ്പാടത്തുള്ള മണ്ണിനും ഈ സ്വഭാവത്തിൽ വ്യത്യാസമുള്ള raioajo തെളിഞ്ഞു.

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