

THE EFFECT OF ZINC IN COMBINATION WITH LIME ON THE GROWTH AND YIELD OF RICE*

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The zinc nutrition of rice has received considerable attention in recent years after Nene (1965) showed that the "khaira" disease of paddy is due to deficiency of zinc. Fertility investigations carried out in Kerala (Varghese, 1971; Valsaji, 1972 and Praseedom and Koshy, 1975) have shown that in many Kerala soils the levels of zinc may be marginal. Even in soils apparently well supplied with zinc the application of lime, phosphatic fertilizers etc. are likely to result in induced zinc deficiency. About ninety per cent of the soils of Kerala being acid in reaction (Koshy and Varghese, 1971) liming has become a widespread practice in several paddy growing tracts in the State. As the liming of acid soils may tend to reduce the availability of the native zinc in soils the application of this element along with lime may be necessary to ensure adequate supplies of zinc to crops. Hence the present study was undertaken to find out the effect of applying zinc alone with lime on the growth and yield characteristics of rice.

Materials and Methods

A pot culture experiment was carried out during the *Virippu* season of 1974 using four levels of zinc (0, 10, 20 and 40 Kg ZnSO₄ · 7H₂O/ha) and four levels of lime (0, 250, 500 and 1000 Kg CaCO₃/ha) in a randomized block design with three replications. The soil used in the study was collected from the Vellayani Kayal area. Its pH was 4.3 and it contained 0.11% N, 0.02% P₂O₅, 0.36% K₂O, 0.10% CaO, 0.13% MgO and 4.2 ppm available zinc. Its lime requirement was 2000 Kg/ha. Earthenware pots of uniform size, viz., 25 cm x 38 cm were filled with 10 Kg portions of the ground air dried soil and mixed with the specified quantities of lime. Sufficient water was added to each pot to bring about effective mixing of the soil with lime and also puddling. N, P₂O₅ and K₂O were then added to each pot at the rate of 35 Kg/ha in the form of urea, superphosphate and muriate of potash. After mixing the soil well with the lime and NPK fertilizers, zinc sulphate was added at the specified rates in aqueous solution. Twenty day old rice seedlings of variety "Annapurna" were planted in each pot at the rate of 3 plants per pot on 26-6-1974. An additional dose of N at 35 kg/ha was applied on the 20th day after planting.

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Table 1

Effect of different levels of zinc and lime on the growth characters of rice, var. *Annapoorna*

Levels of lime Kg/ha.	Levels of zinc sulphate Kg/ha.	No. of tillers per plant.	No. of productive tillers per plant.	Height of plant cm.
0	0	13.0	11.6	54.3
	10	11.7	11.3	54.3
	20	12.7	11.6	46.9
	40	12.7	12.3	51.0
	Mean	12.5	11.7	51.6
250	0	14.0	12.0	52.6
	10	15.3	14.6	49.6
	20	12.7	11.0	53.8
	40	11.0	9.3	53.0
	Mean	13.2	11.7	52.2
500	0	14.7	13.3	51.8
	10	12.7	11.0	52.8
	20	12.7	11.6	53.8
	40	14.3	11.6	53.6
	Mean	13.8	11.9	52.9
1000	0	14.7	13.0	49.2
	10	14.0	13.0	53.8
	20	13.3	12.0	55.1
	40	14.7	13.0	55.0
	Mean	14.2	12.8	53.0
All levels	0	14.1	12.5	51.9
	10	13.4	12.5	52.6
	20	12.8	11.6	52.4
	40	13.2	11.6	53.2
C. D. for comparison between levels of zinc/lime at 0.05 level.		0.9	N.S	1.1
C. D. for comparison between combinations of zinc and lime at 0.05 level.		1.9	.NS	2.2

Table 2

Effect of different levels of zinc and lime on the yield characters
of rice, var. *Annapoorna*

of lime	Levels of zinc sulph Kg/ha.	Length of panicle cm.	No. of grain per panicle.	Weight of grain g/pot.	Weight of straw g/pot.
0	0	20.6	92.6	45.7	40.1
	10	21.6	109.3	38.6	52.3
	20	22.7	110.0	33.7	33.6
	40	21.7	104.6	42.7	47.7
	Mean	21.7	104.1	40.2	43.4
250	0	21.7	104.0	43.3	39.7
	10	22.0	111.0	45.8	46.0
	20	21.9	110.3	34.1	40.0
	40	22.2	101.6	26.9	32.0
	Mean	22.0	106.7	37.5	39.4
500	0	22.2	101.3	41.4	40.9
	10	22.1	103.0	43.7	45.3
	20	22.2	99.0	41.3	47.3
	40	22.9	106.6	41.8	39.7
	Mean	22.3	102.4	42.1	43.2
1000	0	22.8	113.6	39.5	40.0
	10	22.8	116.3	39.7	41.3
	20	22.8	120.0	40.8	42.0
	40	22.5	117.3	51.7	40.0
	Mean	22.7	116.8	42.9	40.8
All levels	0	21.8	102.9	42.5	40.1
	10	22.1	109.9	42.0	46.2
	20	22.4	109.8	37.5	40.7
	40	22.3	107.5	40.8	39.9

C. D. for comparison between
levels of zinc/lime at 0.05 level,

0.5

6.5

NS

NS

C. D. for comparison between
combinations of zinc/and lime
at 0.05 level

1.0

13.1

NS

NS

Irrigation was given using tap water at the optimum rate. The crop was harvested on 17-9-1974 after noting the number of tillers per plant (one month after planting) height of plants (35th day after planting) and the number of productive tillers (70th day). The yields of grain and straw per pot were recorded. The length of panicles and the number of grains per panicle were also noted.

Results and Discussion

The results are presented in Tables 1 and 2. It is noted from Table 1 that the application of zinc slightly suppressed the number of tillers per plant, although the effect was not statistically significant. The application of lime, however, resulted in significant increase in the number of tillers per plant. The number of productive tillers was not affected by the application of either lime or zinc. However, the height of plants was increased significantly by lime as well as zinc.

As regards the yield attributes (Table 2) the length of panicles was increased significantly by the application of lime. The application of zinc also resulted in slightly increased length of panicles, but the effect was not statistically significant. The number of grains per panicle was also increased significantly by the application of both lime and zinc. Nevertheless, these beneficial effects of lime and zinc on the length of panicles and the number of grains per panicle were not reflected in the total yields of grain and straw. The effect of zinc on the yield of grain and straw was inconsistent, whereas the yield of grain tended to increase with increase in the application of lime.

The reason for the insignificant response of rice to applications of zinc may be that the soil used in this study already had an available zinc status of 4.2 ppm which is much above the threshold value of 0.5 ppm suggested by Brown *et al.* (1962). However, this soil was used in the present study because even soils which are apparently well supplied with zinc may also respond to applications of zinc for various reasons. The zinc nutrition of the rice plant is a complex phenomenon which is influenced by several environmental factors. For instance, an increase in the soil pH consequent on the application of lime may result in a deficiency of this element. Similarly the indiscriminate use of phosphatic fertilizers may result in reduced availability of zinc due to the formation of insoluble zinc phosphate. Again, too much of exchangeable aluminium, iron or manganese in the soil can also result in restricted availability of these micro-nutrient elements. The submerged acid rice soils of Kerala, as represented by the soil used in this study, are prone to all these adverse conditions and hence it will be advisable to include zinc also in the fertilizer schedule for rice in Kerala.

Summary

A pot culture experiment was carried out using the Vellayani Kayal soil in a randomized block design to study the effect of zinc in combination with lime on the growth and yield of rice. The number of tillers per plant was increased significantly by lime, but not by zinc. Neither lime, nor zinc had any significant effect on the number of productive tillers, whereas these treatments resulted in significant increase in the height of plants. The panicle length was increased significantly by lime and the number of grains per panicle was increased by both lime and zinc. The effect of zinc on the yield of grain and straw was inconsistent whereas the yield of grain tended to increase with increase in the levels of lime.

സംഗ്രഹം

കുറായവും സിങ്കും കൂടി ചേർത്തു് നെൽകൃഷി ചെയ്യുന്നതിൻ്റെ ഫലം അറിയുവാൻ വേണ്ടി വെള്ളായണി കായലിലെ മണ്ണു് ഉപയോഗിച്ചു് പൂച്ചട്ടികളിൽ ഒരു പരീക്ഷണം നടത്തി. ചിനപ്പകളുടെ എണ്ണം ഗണ്യമായി വർദ്ധിക്കുന്നതിനു് കുറായം സഹായിച്ചു. സിങ്ക് ചേർത്തതിനാൽ ഈ പ്രയോജനം സിദ്ധിച്ചില്ല. കതിരുകൾ ഉണ്ടാകുന്ന ചിനപ്പകളുടെ എണ്ണം കുറായമോ സിങ്കോ ചേർന്നതു നിമിത്തം വർദ്ധിച്ചില്ലെങ്കിലും ചെടികളുടെ ഉയരം ഗണ്യമായി വർദ്ധിക്കുന്നതിനു് ഇവ സഹായിച്ചു. കുറായം ചേർത്തതുകൊണ്ടു് കതിരുകളുടെ നീളം ഗണ്യമായി വർദ്ധിക്കുകയുണ്ടായി. ഓരോ കതിരിലുമുള്ള നെന്മണികളുടെ എണ്ണം കൂടുന്നതിനു് കുറായവും സിങ്കും ഇടയാക്കി. കുറായം ചേർത്തതിനു് അനുസരണമായി നെൻ മണികളുടേയും വൈസ്കോലിൻ്റെയും തൂക്കം അൽപ്പമായി വർദ്ധിച്ചെങ്കിലും സിങ്കിനു് ഇങ്ങനെ ഒരു ഫലം ഉള്ളതായി കണ്ടില്ല.

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