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EFFECT OF AMENDMENTS AND ZINC ON CHEMICAL PROPERTIES OF AN ALKALI SOIL

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To study the comparative efficiency of different amendments alone and in combination with Zn on the progressive chemical changes of an alkali soil, a pot study was conducted with rice as test crop. Application of amendments and Zm individually and in combinations reudced the soil pH considerably to a significant level. Submergence of soil also contributed to the reduction in soil pH. Electrical conductivity of the soil increased by the application of amendments and Zn. Combined application of gypsum at 50% requirement and pressmud reduced the E. S. P. significantly.

About 7 million hectares of land are affected either by salinity or alkalinity in India (Abrol and Bhumbla, 1971). Two lakh hectares are accounted for sodicity in Tamil Nadu. These soils are of low productive in nature due to the presence of high amounts of free salts and exchangeable Na which constitute more than 15% and high soil pH of more than 8.5. These soils are to be reclaimed and made cultivable to support the ever increasing demand for food. Any attempt to reclaim these alkali soil would mean removal of exchangeable Na from clay complex. For this purpose various amendments such as gypsum are being recommended. Gypsum has been found more effective under Indian conditions but its use involves high cost. Hence, cheaply available materials like pressmud, daincha and farmyard manure have also been used successfully.

Symptoms of Zn deficiency in rice in alkali soils has been reported (Takkar and Tarjit Singh, 1978). Deficiency of zn due to high pH in these soils may be the major cause for low yields zinc application in alkali soil and knowledge on its individual and combined effects with amendments on soil chemical properties is lacking. Hence, a study was conducted to assess the efficiency of amendments and Zn alone and in combination on soil pH, E.C and E.S.P.

MATERIALS AND METHODS

Soil sample was collected from an alkali soil area of Trichy District. The pH of the soil is 9.2, E. C. 0.7 m, mhos/cm and is having an E.S.P.

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of 56.54. The pot experiment was conducted in a factorial randomized block design with rice (Bhavani) as test crop. The treatments included three levels of Zn (0,10 and 20 ppm) as $ZnSO_4$ $7H_2O$ and four amendments viz. Gypsum (11t/ha and 22 t/ha) as $CaSO_4$. $2H_2O$. FYM (25t/ha), daincha (25t/ha) and pressmud (12.5 and 25 t/ha) and their combinations. There were totally 24 treatment combinations replicated twice. Amendments were added and mixed thoroughly and left as such for 15 days under submergence. Three leachings were given during this period. Fertilizer dose of 120, 60 and 60 kg N, P_2O_5 and K_2O/ha in the from of urea, diammonium phosphate and potassium chloride were used. Phosphorus and K were added basally while N was applied in two split doses at planting and tillering.

Soil samples were colletced at harvest stage. Soil pH and E. C. were determined. Exchangeable sodium percent was calculated following the method as described in U.S.D.A Hand book No. 60 (Richards, 1954).

RESULTS AND DISCUSSION

Soil Reaction (pH) (Table

Amendments and Zn significantly reduced the pH of the soil. Application of gypsum 50% requirement

Table 1 Effect of Amendments and Zinc on Soil Reaction (pH)

Amendments / Zn levels (ppm)	Zn_0	Zn_{10}	Zn_{20}	Mean
Control	8.65	8.35	8.30	8.43
Gypsum 50%	8.00	7.90	7.85	7.92
Gypsum 100%	7.75	7.75	7.75	7.75
FYM (25 t/ha)	8.05	7.90	7.85	7.93
Daincha (25 t/ha)	7.95	7.85	7.80	7.87
Pressmud (25 t/ha)	8.10	7.95	7.90	7.98
Gypsum 50% + Daincha (25 t/ha)	7.75	7.65	7.80	7.73
Gypsum 50% + Pressmud (12.5 t/ha)	7.80	7.75	7.80	7.78
Mean	8.00	7.89	7.88	—

Source	S. E.	C. D.
Amendments	0.025	0.07
Zn	0.016	0.05
Interaction	0.044	0.13

and daincha (25 t/ha) followed by gypsum 100% requirement. gypsum 50% requirement and pressmud (12.5 t/ha) reduced the soil pH from 8.43 to 7.73, 7.75 and 7.78 respectively. This reduction might be attributed to the replacement of Na by Ca in the exchange sites of clay complex through addition of gypsum and by the production of organic acids through the decomposition of organic amendments. Similar results were also reported by Gaul and Dargan (1978). Mere submergence alone also remarkably reduced the pH from 9.20 to 8.65. This might be due to the accumulation of CO_2 under submergence

Addition of Zn at 20 and 10 ppm significantly reduced the soil pH to 7.88 and 7.19. While the highest pH of 8.00 was noticed at zero level of Zn, when amendments was ignored. This might be due to the replacement of Na by Zn. Takkar and Tarjit Singh (1978) also have reported that both gypsum and Zn application reduced the soil pH but the effect was not so appreciable in case of Zn. The results of the present study also followed the same trend.

Combined application of gypsum at 50% requirement and daincha (25 t/ha) recorded lower pH values of 7.75 and 7.65 at zero and 10 ppm

Table 2. Effect of Amendments and Zinc on Electrical Conductivity (m. mhos/cm)

Amendments / Zn levels (ppm)	Zn_0	Zn_{10}	Zn_{20}	Mean
Control	1.10	1.25	1.30	1.22
Gypsum 50%	1.55	2.20	2.10	1.95
Gypsum 100%	2.45	2.50	2.35	2.43
FYM (25 t/ha)	1.30	1.40	1.80	1.50
Daincha (25 t/ha)	1.10	1.25	2.30	1.55
Pressmud (25 t/ha)	1.75	1.75	2.30	1.93
Gypsum 50% + Daincha (25 t/ha)	1.75	2.05	2.05	2.37
Gypsum 50%+Pressmud (12 5 t/ha)	1.55	2.55	2.80	1.89
Mean	1.57	1.87	2.13	—

Source	S. E.	C. D.
Amendments	0.034	0.10
Zn	0.021	0.06
Interactions	0.059	0.17

Zn levels respectively. While at 20 ppm level of Zn, gypsum at 100% requirement accounted for the low pH (7.75). Irrespective of the amendments both levels of Zn were equally effective in reducing the soil pH over no Zn application. The results corraborated with the findings of Shivaram Shetty (1975) who reported that gypsum and pressumed in combination with $ZnSO_4$ was effective in reducing the pH.

ELECTRICAL CONDUCTIVITY

(Table 2)

Application of various amendments and Zn significantly increased the E. C. of the soil. Gypsum at 100% requirement had the significant influence in increasing the E. C. (2.43 m.mhos/cm) followed by the treatment of gypsum at 50% requirement and daincha (25 t/ha) with 2.37 m.mhos/cm. Increase in E. C. in gypsum treatments might be due to the increase in total soluble salts by the replacement of Na by Ca. The increase in E. C. by the application of gypsum, gypsum and green manure was also reported by Velayutham *et al.* (1977). Electrical conductivity has increased from 0.7 m.mhos/cm (original soil) to 1.10

Table 3. Effect of Amendments and Zinc on Exchangeable Sodium percentage

Amendments / Zn levels (ppm)	Zn_0	Zn_{10}	Zn_{20}	Mean
Control	22.87	16.78	16.59	18.74
Gypsum 50%	21.53	15 51	9.44	15.89
Gypsum 100%	13.79	18.72	8.43	13.64
FYM (25 t/ha)	16.89	12.72	15.83	15.15
Daincha (25 t/ha)	24.26	11.71	10.55	15.50
Pressmud (25 t/ha)	30.89	12.86	12.14	18.63
Gypsum 50% + Daincha (25 t/ha)	24.73	17.40	8.52	16.88
Gypsum 50% + Pressmud (12.5 t/ha)	17.14	12.84	7.22	11.40
Mean	21.14	14.82	11.09	—

Source	S. E.	C. D.
Amendments	0.725	2.12
Zn	0.444	1.30
Interaction	1.255	3.67

m.mhos/cm in the absolute control and is in accordance with the work of Rahmatullah *et al.* (1976) who stated that flooding increased the E. C.

Application of Zn significantly increased the E. C. of the soil. Over all mean values were 2.13, 1.87 and 1.57 m.mhos/cm for 20, 10 and zero ppm Zn levels respectively Interaction between amendments and Zn showed that irrespective of the amendments, Zn addition increased the E. C. while at all the three Zn levels, control registered lower values of E.C. (1.10 1.25 and 1.30 m.mhos/cm for 0, 10 and 20 ppm Zn respectively).

EXCHANGEABLE SODIUM PERCENTAGE (Table 3)

Amendments and Zn had significant influences in reducing the exchangeable Na of the alkali soil. Gypsum at 50% requirement and pressmud (12.5 t/ha) registered the lowest E.S P. of 11.40. Individual application of gypsum at 100% requirement, FYM (25 t/ha), gypsum at 50% requirement and daincha (25 t/ha) also contributed to the reduction of E S.P. recording 13.64, 15.15, 15.44 and 15.50 respectively. Venureddy *et al* (1973) also have found that FYM and daincha were equally effective in reducing the E.S.P. This reduction in E.S P. might be due to the removal of Na from the clay complex by way of addition of amendments (Muthuswamy *et al.* 1973).

The different levels of Zn significantly reduced the E.S.P. of the soil. The values were 11.09 and 14.82 for 20 and 10 ppm levels of Zn respectively while zero level of Zn registered the highest E.S P. of 21 14. The reduction in exchangeable Na by Zn was confirmed by the negative relationship between soil available Zn and E.S.P. (r=—0.745**).

Conclusively, application of amendments and Zn individually and in combinations reduced the soil pH considerably. Submergence also helps in the reduction of soil pH and E.S.P. Triple combination of gypsum at 50% requirement and daincha (25 t/ha) or pressmud (12.5 t/ha) and Zn was found to be more effective in reducing the soil pH. The pH could safely be taken as a creiterion for assessing the magnitude of alkalinity and was closely related to E.S P. The EC of the soil increased by the addition of amendments and Zn.

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EVALUATION OF INSECTICIDES FOR THE CONTROL OF MAJOR PEST COMPLEX OF RADISH

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Chemical control of major pest complex of radish grown for its edible root was studied over three seasons at Bangalore. Results revealed that insecticide sprays were not necessary when the crop is either attacked by flea beetles alone or by flea beetles and lepidopterous pests at late crop growth stages, since it did not affect the marketable yield. However, there was a need to resort to insecticide sprays when the crop was attacked by both flea beetles and mustard sawfly. Significant reduction of both the pests was observed after application of 0.07% endosulfan, 0.05% monocrotophos, 0.07% phosalone, 0.05% methyl parathion, 0.01% fenvalerate and 0.0014% deltamethrin, with a consequent increase in yield.

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