REFERENCES

BAWASKAR, V.S., PATIL S.P. and J. RANADIVE, (1980). Reap more harvest of sugarcane with pressmud cake. **Agric. Agro-Inds. J. 19**: 125-132.

GEORGE, J.F. (1982). Effect of tannery effluents on sugarcane production and measures for securing economic yields. Proc. 46th Ann. Conv. Sug. Tech. Assoc. India. Ag. 131-140

KOTHANDARAMAN, V., RAO P.M. and C.A. SASTRY, (1972). Characteristics of wastes from three typical tanneries in Madras. Proc. Seminar on treatment and disposal of tannery and slaughter house waste. CLRI., Madras. 1-17

PARAMESWARAN, P. (1985). Studies on the measures to alleviate drought conditions in sugarcane due to canal closure in wet lands. M.Sc. (Ag.)., Thesis. Tamil Nadu Agric. Univ., Coimbatore

PATIL. S.P., KALE S.P. and D.G. HAPASE, (1983). Quality pressmud from various sugar factories in Maharashtra. **Indian Sug., 32**(1) : 779-783

PRASAD. M. (1984). The effect of filter pressmud application on the availability of macro and micro nutrients. Proc. Int. Soc. Sug. Technol. 15th Congr. 20: 568-578

RAMASWAMI. P.P. and U.S. SREE RAMULU, (1983) Efficient utilisation of an industrial waste for moisture conservation and yield. Proc. Natl. Seminar on utilization of organic wastes. Ac and RI, Madurai, Tamil Nadu Agri. Univ.l Madurai, 101-103

SASTRY. C.A. and B.G.S. PRASAD, (1980). Treatment and disposal of tannery wastes. In Leather Trade Year Book Sci. and Tech. Special Supplement. 75-86

SINGARAM. P. (1994). Effect of coir pith as an amendment for tannery polluted soils. **Madras Agric. J. 81**(10) : 548

VARADARAJAN. S., GOVINDAIYAR, T.A. GOPALA SWAMY. A. and S. PREMANATHAN, (1970). Influence of tannery effluents on soils and crops and proper disposals of effluents. **Madras Agric. J., 57**(3): 53-60

YANG, S.C. and W.Y. CHANG, (1976). The effect of organic matter on physico chemical properties of soil and cane yield in red soil. Rep. Taiwan Sug. Res. Inst., Taiwan, No. 76: 1-3

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RESPONSE OF RICE TO VARIOUS LEVELS OF ZINC AND IRON WITH AND WITHOUT FYM IN BLACK CALCAREOUS SOIL

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ABSTRACT

A pot culture experiment was conducted to study the response of rice to various levels of Zn and Fe with and without FYM in black calcareous soil of Palghar (Thane). Application of Zn at 5 ppm and Fe at 10 ppm with NPK and FYM significantly increased the grain and straw yield of rice over recommended dose of NPK alone. the uptake of N, P and K by grain and straw also increased due to application of Zn at 5 ppm with NPK and FYM and application of Fe at 10 ppm with NPK and FYM as compared to NPK alone. The uptake of Fe significatly increased due to application of Fe with and without FYM as compared to NPK alone. However, Zn application did not show significant effect on Fe uptake. While the uptake of Zn significantly increased due to application of both the levels i.e.. 5 ppm of Zn with NPK and FYM as compared to NPK alone. However, Fe application did not increase the Zn uptake indicating and antagonistic relationship between these two elements.

KEY WORDS : Yield of rice, Calcareous soil, Zinc, Iron uptake

Micronutrients have assumed an increasing importance in crop production. Under present day intensive agriculture, introduction of high yielding crop varieites, increased use of chemically pure fetilisers, increased cropping intensity and restricted recycling of organic wastes or farm wastes resulted into widespread deficiencies of micronutrients. At many places, the normal yield of crops are not achieved despite judicial application of NPK fertilisers. This occured mainly due to to micronutrients deficiencies (Katyal and Agarwal, 1982). Zinc and iron are required by the plants for their normal growth and development.

The present study was therefore taken up to study the response of rice var. Jaya to various levels of Zn and Fe with and without FYM in black calcareous soil of Palghar (Thane).

MATERIALS AND METHODS

The pot culture study was conducted on calcareous soil collected from Agricultural Research Station, Palghar (Thane). The characteristics of the soil were, pH 7.35, organic carbon 0.72%, $CaCO_3$ 7.25% CEC 35.80 cmol (p+) Kg^{-1}, available P 10.85 Kg ha^{-1}, available K 246.35 Kg ha^{-1}, available Zn 1.94 ppm and available Fe 11.46 ppm. A basal dose of nitrogen, phosphorus and potassium was given to all pots except control. Nitrogen was applied at 100 Kg N ha^{-1} (as urea) in two splits, first at the time of transplanting and second 40 days after transplanting. Phosphorus (as single super phosphate) and potassium (as muriate of potash) were applied at 21.5 Kg P ha^{-1} and 41.5 Kg K ha^{-1} at the time of transplanting only. Two levels of Zn (5 ppm, 10 ppm) as $ZnSO_4$ and two levels of Fe (10 ppm, 20 ppm) as $FeSO_4.7H_2O$ were applied with and without FYM. FYM was applied at 10 t ha^{-1} and the treatments were replicated thrice in completely randomised design.

Twenty one day old, four rice seedlings (var. Jaya) were transplanted in two hills per pot of 5 kg each. A water level of 2.5 cm was maintained constantly by periodical addition of deionized water. The crop was harvested on maturity and the yield of grain and straw samples were analysed following standard procedures.

RESULTS AND DISCUSSION

Application of NPK alone significantly increased the grain yield of rice as compared to control. Application of Zn at 10 ppm with NPK and application of Fe at 20 ppm with NPK significantly increased the grain yield of rice as compare to NPK alone (Table-1). Incorporation of FYM at 10 t ha^{-1} to these treatments further significantly increased the grain yield of rice. As far as straw yield was concerned, application of NPK alone did not show any increase in the straw yield of rice over control. Application of Zn at 5 ppm and 10 ppm with NPK and application of Fe at 10 ppm and 20 ppm with NPK also did not show any increase in the straw yield of rice as compared to NPK and FYM and application of Fe at 10 ppm with NPK and FYM significantly increased the straw yield of rice over NPK alone although it was at par with 10 ppm Zn, 20 ppm Fe with NPK and FYM. Similar results were also reported by Singh *et al.* (1982, 1992).

Table 1. Effect of various treatments on the grain yield of rice (cv. Jaya in calcareous soil (g pot^{-1})

Treatments	Grain yield	Straw yield
Control	1.42	4.92
NPK	2.32	4.56
5 ppm Zn + NPK	2.89	3.07
10 ppm Zn + NPK	3.19	5.68
5 ppm Zn + NPK + FYM	3.64	6.34
10 ppm Zn + NPK + FYM	4.04	5.28
10 ppm Fe + NPK	3.08	4.26
20 ppm Fe + NPK	3.21	3.79
10 ppm Fe + NPK + FYM	3.83	7.91
20 ppm Fe + NPK + FYM	4.14	6.69
C.D. (P=0.05)	0.75	1.36

The uptake of nitrogen in grain due to application of NPK alone significantly increased as compared to control. However, in case of straw, both the treatments were at par with the control. Application of Zn at 10 ppm and application of Fe at 10 ppm and 20 ppm with NPK significantly increased the N uptake in grain as compared to NPK alone (Table - 2). In case of straw, application of both the levels of Zn and Fe with NPK did not show any significant increase in the N uptake. However, application of Zn at 10 ppm with NPK and FYM and application of Fe at 10 ppm and 20 ppm with NPK and FYM significantly increased the N uptake as compared to its application without FYM. However, application of Fe at 10 ppm and 20 ppm with NPk and FYM significantly increased the N uptake in straw as compared to their application without FYM.

Table 2. Effect of various treatments on the uptake of nitrogen, phosphorus and potassium by rice cv. Jaya (mg pot^{-1})

Treatments	Nitrogen		Phosphorus		Potassium	
	Grain	Straw	Grain	Straw	Grain	Straw
Control	19.70	30.21	3.69	4.80	2.39	124.48
NPK	35.25	29.28	6.68	4.44	3.94	109.31
5 ppm Zn + NPK	45.92	20.10	9.03	3.12	5.33	76.84
10 ppm Zn + NPK	55.16	37.94	8.84	5.71	5.62	149.72
5 ppm Zn + NPK + FYM	63.94	43.53	12.17	11.41	7.17	188.67
10 ppm Zn + NPK + FYM	74.63	38.19	14.94	7.05	7.60	145.29
10 ppm Fe + NPK	47.20	27.85	8.87	3.70	5.18	114.88
20 ppm Fe + NPK	54.57	25.85	8.70	3.54	5.66	87.89
10 ppm Fe + NPK + FYM	70.53	55.07	13.83	10.21	7.46	235.29
20 ppm Fe + NPK + FYM	78.91	48.80	13.30	5.95	8.28	197.56
C.D. (P=0.05)	11.29	10.90	2.24	1.73	1.53	45.48

Application of NPK alone significantly increased the P uptake in grain as compared to contorl. However, in case of straw, both the treatments were at par with each other. Application of Zn at 5 ppm with NPK significantly increased the P uptake in grain as compared to NPK alone. However, application of Zn at 10 ppm with NPK and application of Fe at 10 ppm and 20 ppm with NPK did not show any significant increase in the P uptake in grain as compared to NPK alone (Table - 2). In case of straw, both the levels of Zn and Fe with NPK did not show significant increase in the P uptake as compared to NPK alone. Application of Zn at 5 ppm and 10 ppm with NPk ad FYM and application of Fe at 10 ppm and 20 ppm with NPK and FYM significantly increased the P uptake in grain as compared to their applications without FYM. However, in case of straw, application of Zn at 5 ppm with NPK and FYM and application of Fe at 10 ppm with NPK and FYM significantly increased the P uptake as compared to their application without FYM. Similar results were reported by Patil and Deshpande (1983) for sorghum crop.

The uptake of K due to application of NPK of alone significantly increased in grain as compared to control. However, in case of straw, both the treatments were at par with each other. Application of zn at 10 ppm with NPK and application of Fe at 20 ppm with NPK significantly increased the K uptake in grain as compared to NPK alone. However, in case of straw, application of both the levels of Zn and Fe with NPK did not show significant increase in the K uptake as compared to NPK alone. Application of both the levels of Zn and Fe with NPK and FYM significantly increased the K uptake in grain their application without FYM. However, in case of straw, application of Zn at 5 ppm with NPK and fYM significantly increased the K uptake as compared to application of Zn at 5 ppm with NPK. Application of Fe at 10 ppm with NPK and FYM significantly increased the K in straw as compared to the application of both the levels of Fe without FYM.

Application of NPK alone significantly increased the Fe uptake in grain as compared to control. In the case of straw, both the treatments were at par with each other. Application of both the levels of Zn with NPK were at par with NPK alone. However, application of Fe at 10 ppm and 20 ppm with NPK significantly increased Fe up take in grain as compared to NPK alone (Table - 3). In case of straw, application of both the levels of Zn and Fe with NPK did not show significant increase

Table 3. Effect of various treatments on the uptake of Fe and Zn by rice cv. Jaya (mg pot^{-1})

Treatments	Fe		Zn	
	Grain	Straw	Grain	Straw
Control	0.45	2.36	0.07	0.34
NPK	0.89	3.38	0.10	0.34
5 ppm Zn + NPK	1.18	2.19	0.15	0.41
10 ppm Zn + NPK	1.08	3.85	0.15	0.47
5 ppm Zn + NPK + FYM	1.63	4.81	0.20	0.50
10 ppm Zn + NPK + FYM	1.12	5.20	0.23	0.50
10 ppm Fe + NPK	1.34	2.83	0.16	0.29
20 ppm Fe + NPK	1.65	2.43	0.14	0.26
10 ppm Fe + NPK + FYM	1.53	5.46	0.15	0.44
20 ppm Fe + NPK + FYM	1.81	6.04	0.17	0.24
C.D. (p=0.05)	0.34	1.92	0.07	0.14

in the Fe uptake as compared to NPk alone. Application of Zn at 5 ppm with NPK and FYM and application of Fe at 20 ppm with NPK and FYM significantly increased the Fe uptake in grain as compared to their application without FYM in case of straw, application of both the levels of Fe with NPK and FYM significantly increased the Fe uptake as compared to the application of both the levels of Fe without FYM. Similar results were also reported by sakal *et al* (1982) with respect to Fe application for rice and maize crops.

The uptake values of Zn observed due to application of NPK alone were at par with control in grain as well as straw. Application of Zn at 5 ppm and 10 ppm with NPK and FYM (Table - 3) significantly increased the Zn uptake in grain as well as straw as compared to NPK alone. However, application of Fe with or without FYM decreased the Zn uptake indicating an antaagonistic relationship between these two elements. Similar observations were made by Devarajan and Palaniappan (1995) in respect of Zn application of soybean crop and Singh *et al* (1978) in respect of Fe application to rice crop in calcareous soil.

REFERENCES

DEVARAJAN, R. and PALANIAPPAN, S.P. (1995). Zinc and molybdenum on yield and nutrition of soybean. **Madras Agric. J. 82(3)**: 188-189.

KAYAL, J.C. and AGARWAL, S. C. (1982). Micronutrient research in India. **Fert. News 27** (2): 66-86.

PATIL, M.D. and DESHPANDE, P.B. (1983). Effect of phosphorus, iron and Zinc fertilization on dry matter yield and uptake of N, P, K Ca and Mg by *sorghum bicolor* (L.) Moench. **Mysore J. Agric. Sci. 17** : 846-356.

SAKAL, R., SINGH, B.P. and SINGH, A.P. (1982). Iron nutrition of rice and maize as influenced by iron carriers and compost application in calcareious soil. **J. Indian Soc. Soil. Sci. 30** (2): 190-193.

SINGH, A.P., PRASAD, B. and SINHA, H. (1982). Effect of zinc enriched compost and other methods on zinc application on zinc nutrition of rice in calcareious soil. **J. Indian Soc. Soil. Sci. 30** (4): 380-384.

SINGH, A.P., SAKAL, R. and SINGH, B.P. (1982). Effect of zinc enriched compost and other methods on zinc application on zinc nutrition of rice in calcareious soil. **J. Indian Soc. Soil. Sci. 30**(4): 572-573.

SINGH, K. CHANDRA DEO, BOHRA, J.S. SINGH, J.P. and SINGH, R.N. (1992). Effect of iron carriers and compost application on rice yield and their residual effect on succeeding wheat crop in entisols. **Ann. Agric. Res. 13**(2): 181-183.

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