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VARIETAL STRESS TO ZINC NUTRITION IN RICE

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Twenty three rice varieties and pre-release cultures selected for the experiment from main rice growing tracts of Tamil Nadu were screened for their susceptibility or resistancy to zinc deficiency by sand culture technique. The characters such as germination percentage, dry weight of seedlings and vigour index which is a product of germination percentage and dry weight of seedlings were determined. The varieties were categorised into four groups namely resistant, less susceptible, moderately susceptible and highly susceptible based on their performance in vigour index over the Control and the concentrations of nutrient applied. The tissue zinc content of seed and seedlings was also determined to find out the relationship.

Rice is being considered as one of the major cereals and food crops and it provides nourishment for the millions of population both in India as well as in South Asian parts of the World. The introduction of high yielding varieties by genetic manipulation to increase the productivity per unit area is also depends upon the requirement and their efficiency in utilizing the available soil nutrients. In this regard the utilization of micronutrients besides macronutrients also gained importance. The response of rice varieties to the applied nutrients and their level of susceptibility or resistancy to them give the basis for requirement of nutrients for enhancing the growth and yield. It was possible to assess by the sand culture technique as already reported by Dhangarwala and Patel (1981) and Chavan and Banerjee (1980). The screeing of varieties by sand culture technique to a specific nutrient would pave a way to select the varieties for the location specific experiments based on the available soil micronutrients to increase the productivity per unit area. The development of deficiency or toxicity of soil nutrients due to unconducive weather and soil complexity can be rectified by screening and selecting the varieties for the location specific trials based on their nature of susceptibility or resistancy to the nutrients concerned. The cost to ameliorate the soil further if necessary can be reduced to a minimum by this technology.

MATERIALS AND METHODS

Twenty three rice varieties and pre-release cultures (which are appended in the table) representing main rice growing tracts of Tamil Nadu were included for the experiment. The experiment was carried out under a glass house condition in a rivers and medium washed with acid and alkali.

A uniform population was maintained in each variety for each treatment and the experiment was replicated twice. The zinc nutrient was applied as zinc sulphate at three concentrations namely 2.5 ppm, 5.0 ppm and 10.0 ppm besides a control at the time of sowing

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the seed. The data on germination percentage, dry weight of seedlings and vigour index on 7th day were gathered and the data were subjected to statistical scrutiny in a factorial randomized block design to find out the individual effect of varieties, zinc nutrient and the interaction effect of varieties, zinc nutrient and the interaction effect between varieties and zinc. The tissue zinc content of 15 days old seedlings and seed was analysed AA 120 spectrophotometrically and the data were statistically analysed.

RESULTS AND DISCUSSION

(i) Germination percentage :

There was an appreciable difference noticed among the varieties and a slight difference within the varieties to the applied nutrient. The values ranged between 40 per cent recorded in A S 781/1 and 98 percent in CR 1009, and A S 11820.

(ii) Dry weight of seedlings :

The dry weight varied between 14.8 mg and 26.8 mg among the varieties. A significant difference at 5 per cent level was noticed among the varieties, could not have any significant role on this.

(iii) Vigour index :

It is a parameter governed by the twin characters of germination percentage dry weight of seedlings. The varieties showed significant difference at 5 percent level for the character studied, but however zinc application did not have any significant effect. The varieties were categorised into four groups by taking into account the over all increase in response of vigour Index over the control and other concentration of nutrients.

Criteria for Catagorisation :

(a) If the variety does better in Vigour index in control. (0 level zinc) it was classified as resistant, as these varieties can withstand even under a zinc fertilizer need be recommended.

b) If the variety performed better in Vigour Index with response to the application of zinc they were classified as less susceptible, moderately susceptible and highly susceptible and if they recorded high values to 2.5 ppm, 5.0 ppm and 10.0 ppm, concentration respectively and the recommendation can be made based on their susceptibility. The zinc requirement to produce more dry matter per unit area was evident from the study made by Tiwari and Pathak (1982) in chickpea, wheat and mustard and this support the results obtained in rice varieties in this experiment. The findings of Agarwala *et al.* (1971) in Wheat (1978) in barley and by Ambler *et al.* (1969) in *Phaseolus vulgaris* amply support the results obtained in this investigation. Varieties were classified as follows based on the criteriadefined above.

Resistant :

IR 50, Kannagi, ASD 1 and AS 8106

Less Susceptible :

ADT 31, T (N) 1, AD 3488 and AS 688.

Moderately susceptible :

ADT 34; ADT 35, AD 9246, IET. 4786, NLR 9672, Karuna. ASD 15, AS 11820; AS 781/1, TM3320 and TM3324

Highly susceptible :

ADT. 36, IET, 1722, IR 20 and and CR 1009.

The statistical analysis of tissue zinc content of 15 days old seedlings clearly manifested a significant differences both for the varieties and zinc treatments individually at one per cent level as well as for the interaction effect between varieties and zinc. : Though there were differences in zinc content of seed among the varieties no relationship could be attributed to the parameters studied for screening the varieties.

Table—1 Effect of zinc application on germination percentage, seedling dry weight (MG) and vigour index (VI) of rice varieties. (Mean of two replications)

Sl. No.	Varieties	Treatments	Germination %	Dry wt.(MG)	VI
1.	ADT 31	Control	86	19.7	1669
		2.5 ppm	94	18.5	1737
		5.0 ppm	90	19.0	1708
		10.0 ppm	96	17.6	1694
2.	ADT 34	Control	84	20.3	1691
		2.5 ppm	88	18 7	1648
		5·0 ppm	94	18 7	1758
		10.0 ppm	90	19.1	1717
3.	ADT 35	Control	96	22.2	2129
		2.5 ppm	90	22.6	2027
		5.0 ppm	90	22.6	2043
		10.0 ppm	86	22.7	1914
4.	ADT 36	Control	74	17 7	1312
		2.5 ppm	88	18.9	1664
		5.0 ppm	84	17.9	1497
		10.0 ppm	90	18.8	1696
5.	T(N) 1	Control	72	23 0	1664
		2.5 ppm	84	20.2	1696
		5.0 ppm	78	22.6	1250
		10.0 ppm	70	24.3	1694
6.	AD 9246	Control	92	20.3	1872
		2.5 ppm	96	19.4	1866
		5.0 ppm	96	20.5	1972
		10.0 ppm	86	20.7	1760

Sl. No.	Varieties	Treatments	Getmation %	Dry wt.(MG)	VI
7	AD 3488	Control	92	18.4	1682
		2.5 ppm	88	19.7	1741
		5.0 ppm	78	19.7	1530
		10.0 ppm	96	17.0	1632
8.	IET 1722	Control	80	24 6	1950
		2.5 ppm	80	24.5	1945
		5.0 ppm	80	25.3	2023
		10.0 ppm	84	24.8	2084
9.	IET 4786	Control	76	16.3	1241
		2.5 ppm	70	17.0	1186
		5.0 ppm	74	17.5	1295
		10.0 ppm	70	16.8	1175
10.	IR 20	Control	86	18.0	1586
		2.5 ppm	96	17.1	1642
		5.0 ppm	92	18.8	1717
		10 0 ppm	78	23.5	1773
11.	IR 50	Control	88	17.1	2505
		2.5 ppm	86	17.6	1517
		5.0 ppm	88	15.2	1333
		10.0 ppm	92	15.0	1380
12.	NLR 9672	Control	92	20.1	1845
		2.5 ppm	96	19.7	1887
		5.0 ppm	96	20.1	1928
		10.0 ppm	94	19.6	1828
13.	CR 1009	Control	98	19.3	1891
		2.5 ppm	74	23.7	1732
		5.0 Ppm	86	21.7	1860
		10.0 ppm	88	22.5	1980
14.	KANNAGI	Control	84	20.3	1704
		2.5 ppm	78	19.6	1527
		5.0 ppm	92	18.0	1660
		10.0 ppm	86	19.4	1665
15.	KARUNA	Control	82	15.9	1292
		2.5 ppm	82	14.2	1306
		5.0 ppm	96	15.7	1504
		10.0 ppm	88	15.9	1398

Sl. No.	Varieties	Treatments	Germination %	Day Wt. (MG)	VI
16.	ASD 1	Control	74	26.8	1945
		2.5 ppm	76	24.1	1827
		5.0 ppm	78	23.4	1829
		10.0 ppm	70	25.3	1774
17.	ASD 15	Control	80	17.6	1390
		2.5 ppm	88	15.7	1365
		5.0 ppm	94	15.1	1418
		10.0 ppm	92	15 5	1418
18.	AS 781/1	Control	40	24.3	974
		2.5 ppm	44	17.1	734
		5.0 ppm	74	18.7	1357
		10.0 ppm	52	17.8	959
19.	AS 688	Control	94	19.9	1868
		2.5 ppm	88	21.5	1884
		5.0 ppm	90	18.8	1680
		10.0 ppm	86	19.2	1650
20.	AS 8106	Control	90	16 5	1482
		2.5 ppm	88	15.8	1390
		5.0 ppm	92	14 8	1355
		10.0 ppm	88	15.8	1394
21.	AS 11820	Control	86	18 8	1620
		2.5 ppm	98	17.2	1617
		5.0 ppm	92	18.1	1699
		10.0 ppm	82	20 1	1641
22.	TM 3320	Control	64	23.3	1490
		2.5 ppm	66	22.4	1282
		5.0 ppm	68	22.4	1512
		10.0 ppm	82	17.3	1420
23.	TM 3324	Control	76	24.4	1803
		2.5 ppm	80	21.0	1674
		5.0 ppm	86	21.2	1824
		10.0 ppm	86	21 2	1814

Dry Weight of seedling	Varieties	Zinc	Zinc X Varieties
CD	2.83	N.S.	N.S.
Vigour Index	**Varieties**	**Zinc**	**Zinc x Varieties**
CD	145.96	N.S.	N.S.

Table 2. Zinc content (ppm) of seed and seedlings of rice varieties

Sl. No.	Varieties	Seedling zinc treatment				Seed
		Control	2.5 ppm	5.0 ppm	10.0 ppm	No treatment
1.	ADT 31	115	116	130	296	11.4
2.	ADT 34	119	158	185	133	13.6
3.	ADT 35	121	169	113	200	17.7
4.	ADT 36	185	86	119	136	15.1
5.	T(N) 1	122	110	112	216	16.5
6.	AD 9246	112	130	108	303	12.2
7	AD 3488	106	85	139	84	11.8
8	IET 1722	76	89	110	176	11.6
9	IET 4786	99	112	114	318	10.3
10	IR 20	120	123	94	248	14.5
11	IR 50	117	126	134	240	15.5
12	NLR 9672	121	119	160	190	13.9
13	CR 1009	146	132	103	208	12.5
14	Kannagi	136	229	225	224	13.0
15	Karuna	170	287	121	192	14.5
16	ASD 1	121	125	261	188	13.2
17	ASD 15	125	195	156	320	12.7
18	ASD 781/1	134	123	114	158	16.9
19	AS 688	126	124	122	328	15.5
20	AS 8106	123	134	142	320	14.0
21	AS 11820	127	114	198	213	14.7
22	TM 3320	117	98	135	292	12.1
23	TM 3324	124	115	125	207	11.0

Varieties : SED : 2.88
CD : 5.71
Zinc : SED : 1.20
CD : 2.38
Zinc x Varieties : SED : 5.72
CD : 11.47

REFERENCES

AGARWALA, C. P., P. N. SHARMA and S. D. NAUTIYAL. 1971. Susceptibility of some high yielding varieties of wheat to deficiency of micronutrients in sand culture. *Proc. Int. Symp. Soil Fert. Evaln.* New Delhi. 1 : 1047-1064.

AGARWALA, C.P., P.N. SHARMA, S. D. NAUTIYAL and C.P. SHARMA 1978. Effect of zinc supply on the growth and activity of certain enzymes in barley grown in sand culture. *Indian J. Plant Physiol.* 21 : 181-994

AMBLER, J. E. and J. C. BROWN. 1969. Cause of differential susceptibility to zinc deficiency in two varieties of navy bean (*Phaseolus vulgaris* L.) *Agron. J.* 61 : 41-43.

CHAVAN, A. S. and N. K. BANERJEE. 1980. Iron-zinc interrelationship in a black foamy soil as studied on the rice crop *J. Indian Soc. Soil. Sci.* 28 : 203-205.

DANGARWALA, R. T. and B. K. PATER. 1981. Screening of rice varieties for susceptibility to zinc deficiency. *Gujarat Agri. Univ. Res. J.* 7 : 49-52.

TIWARI, K. N and A. N. PATHAK. 1982. Studies on the zinc requirement of different crops. *Exp. Agric.* 18 : 393-29.