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Response of Rice to Zinc Application in Calcareous soils of Varying Available Zinc Content.

Micronutrients delineation work conducted in Bihar under All India Coordinated Scheme of Micronutrients in soils and Plants indicated that more than 75% soils in calcareous belt of north Bihar are deficient in available Zn (Anonymous, 1973). Zinc deficiency symptoms have been observed on many crops (Sakal, 1977; Sakal and Singh. 1979). Most of the farmers of this belt are not fully conversant with this malady. Hence a multilocational trial on zinc response was conducted on farmers field taking rice variety 'Jaya' as a test crop.

Ten multilocational trials on rice response to zinc application were conducted on farmers field in 5m × 4m plots. 'Jaya' was grown as test variety. Zinc was applied @ 0, 12.5 and 25 kg zinc sulphate/ha. Treatments were replicated six times in a randomized block design, A basal dose of 100 kg N, 60 kg P_2O_5 and 40 Kg K_2O was applied through urea, DAP and M. P. respectively. Half of N, and the entire P, K and Zn were given at puddling. The remaining N was top dressed in two split doses, one at tillering and second at panicle initiation stage.

The initial soil samples from all the sites were analysed for pH (1 : 2.5 soil/water ratio) by glass electrode (Jackson, 1967), free $CaCo_3$ by titration method (Richards, 1954) and available Zn by DTPA - extractlon method (Lindsay and Norvell, 1969) with atomic absorption spectrophotometer (Varian Techtron, AA-120). The pH, $CaCo_3$ and DTPA-extractable Zn of soils presented in Table 1. The crop was harvested at full maturity and the grain and straw yields were recorded.

Deficiency of Zn was exhibited two weeks after transplanting in all the control plots except at Ajanakot and Basantpur where DTPA-extractable Zn was 0.72 and 0.80 ppm rcspectively. At Lahladpur and Haridampur severe Zn deficiency was exhibited in control plots than at the other sites. The availability of Zn in soil was negatively correlated with pH ($r = -0.571^*$) and $CaCo_3$ ($r = -0.764^{**}$) content. The magnitude of response was related with available Zn in soil. The soils low in available Zn gave higher degree of response than those high in available Zn content. The available Zn in these soils ranged from 0.30 ppm (Lahladpur) to 0.80 ppm (Basantpur) and the corresponding yield response (grain + straw) at optimum Zn level (12.5 kg $ZnSo_4$/ha) was 23.00 and 2.62 q/ha respectively (Table 2). The grain yields at Ajanakot and Basantpur were non significant. This indicates that a soil testing 0.72 ppm and above in available Zn content did not resdond to Zn application. However, the application of Zn significantly increased the straw production at 12,5 kg Zn So_4/ha. The yield response (grain + straw) was found to be negatively correlated with available Zn in soil where the 'r' value was -0.656*.

The yield response in kg per kg of applied zinc sulphate has also been worked out as presented in Table 2. The yield response per kilogram of applied zinc sulphate ranged from 20.96 kg (Basantpur) to 184.00 kg (Lahladpur) and the corresponding DTPA-extractable soil Zn was 0.80 and 0.30 ppm respectively. This clearly demonstrates that a soil which is quite deficient in available Zn gave more yield response to per kilogram of applied zinc sulphate than a soil which is inherently supplied with adequate amount of Zn. Application of Zn significantly increased the grain yield in all the soils testing below 0.72 ppm. Hence this may be considered as the critical level of available Zn in these soils which is quite near to 0.75 ppm as worked out under pot experiments for the calcareous soils of north Bihar (Anonymous, 1980). The results of present investigation vividly indicate the significance of soil available Zn for profitable response to zinc application.

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TABLE 1. The pH, $CaCO_3$ and Available Zn Content of Experimental Soil

Village	Soil pH	$CaCO_3$(%)	DTPA-extractable Zn (ppm)
Haridaspur	8 6	35.2	0 40
Lahladpur	9.0	39.7	0.30
Kantikasba	8.5	38.3	0.40
Madhubani	8.6	36.5	0.40
Patahi	8.4	38.9	0.36
Sonebarsa	8.6	36.2	0.40
Haridampur	8.8	38.5	0.32
Ajanakot	8.7	33.5	0.72
Madhopur	8.4	37.3	0.56
Basantpur	8.2	34.8	0.80

TABLE 2. Grain and straw yields of rice as influenced by graded levels of zinc application in a multilocational trial.

Village	Grain yield (q/ha)					Straw yield (q/ha)					Yield (grain+straw) response (q/ha) at optimum $ZnSo_4$ level	Yield response in Kg per Kg Zn SO_4 applied.
	Zinc levels (Kg Zn SO_4/ha)				C. D. at	Zinc levels (Kg Zn SO_4/ha)				C. D. at		
	0	12.5	25	Mean	5%	0	12.5	25	Mean	5%		
Haridaspur	14.63	17.24	19.00	16.95	2.10	26.88	32.50	35.88	31.75	4.30	8.23	65.84
Lahladpur	15.63	22.13	23.38	20.38	2.39	25.00	41.50	41.63	36.04	3.50	23.00	184.00
Kantikasba	14.25	16.75	18.00	16.33	2.43	25.75	30.00	31.13	28.96	3.80	6.75	54.00
Madhubani	13.00	14.75	15.75	14.50	2.02	21.88	26.13	28.25	25.42	5.07	6.00	48.00
Patahi	9.50	11.38	12.25	11.04	2.11	16.25	20.38	21.75	19.46	2.04	6.01	48.08
Sonebarsa	14.50	16.75	17.25	16.17	1.61	24.50	29.75	31.25	28.50	2.48	7.50	60.00
Haridampur	23.25	28.95	30.50	27.57	2.95	41.38	48.63	51.38	47.13	5.87	12.95	103.60
Ajanakot	29.13	30.13	31.38	30.21	N.S.	51.25	53.63	57.25	54.04	3.49	6.00	24.00
Madhopur	15.50	17.88	19.25	17.54	1.95	25.50	30.38	32.25	29.38	2.84	7.26	58.08
Basantpur	17.00	18.13	18.25	17.79	N.S.	29.13	31.75	32.25	31.04	2.16	2.62	20.96