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CRITICAL LIMIT OF SOIL AND PLANT ZINC FOR BARLEY (*HORDEUM VULGARE* L.)

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Lower critical limits of Zn in plants and soils play a vital role in Zn fertilization. Several workers (Gupta *et al.*, 1981 a; Gupta and Mittal, 1981 and Takkar and Mann, 1975) established different critical limits of Zn for wheat, green gram and maize crops, respectively. Barley is an important crop, grown under limited moisture conditions and the present investigations were undertaken to establish critical limits of Zn in soils and plant for this crop.

Twenty soil samples (from 0-15 cm depth) were obtained from Aridisols of Haryana and analysed for pH, EC, $CaCO_3$ and organic carbon by standard methods (Chopra and Kanwar, 1976). The texture of the soils varied from sand to sandy loam, pH (1:2) 7.9 to 8.4, organic carbon 0.12 to 0.42 per cent, EC (1:2) 0.08 to 0.56 mmho/cm and DTPA extractable Zn varied from 0.15 to 1.70 ppm.

Barley was grown for 70 days in pots, each containing 4 kg soil given a basal application of 100, 50, 63, 10, 10 and 5 ppm of N,P,K, Fe, Mn and Cu, respectively. Zinc was applied at 5 ppm in the form of $ZnSO_4$, $7H_20$ against no zinc (0) in control. All the treatments were replicated thrice in a completely randomised design.

Zinc in soil was extracted by the method of Lindsay and Norvell (1978). The Zn in plant digest and soil extract was determined by Atomic Absorption Spectrophotometry and by calculating Bray's per cent yield:

$$\text{Bray's per cent yield} = \frac{\text{Yield without Zn application}}{\text{Yield with 5 ppm Zn application}} \times 100$$

Application of Zn enhanced the dry matter yield in most of the (Table 1). A significant increase in dry matter yield of barley was obtained at 5 ppm Zn over control. The response to Zn varied from soil to soil. Soils having low available Zn responded remarkably to Zn fertilization as compared to the soil with relatively high DTPA extractable Zn. The mean effect of soil and soil x Zn interaction was significant.

The Zn concentration in barley shoots varied from 9.83 to 22.57 and 16.7 to 26.7 ppm at 0 and 5 ppm Zn, respectively. Plants grown in control soils generally contained less than 15 ppm Zn. In general, increase in concentration in plants with Zn application was higher in soils having low available Zn. The values of coefficient of correlation between DTPA extractable Zn and Bray's per cent yield and Zn concentration were 0.85 and 0.55, respectively.

Table 1. Effect of Zn application on dry matter yield and Zn content (ppm) of barley

Soil No.	Location	Dry matter yield (g/pot) Zn applied (ppm) 0	5	Bray's per cent yield	Zn in barley (ppm) Zn applied (ppm) 0	5
1	Neolikalan	13.7	15.3	89.7	13.8	20.9
2	Salemgarh	16.1	16.4	98.1	15.0	16.9
3	Siswal	12.1	15.3	79.2	13.1	22.9
4	Adampur	10.4	13.8	75.3	12.7	19.1
5	Kohli	16.2	14.3	71.5	11.1	18.7
6	Fransi	9.8	14.7	66.6	11.1	19.5
7	Agroha	9.0	14.2	63.7	11.6	19.8
8	Nangthala	8.7	12.0	72.5	14.5	18.7
9	Ladhuri	12.3	11.5	106.9	14.5	19.2
10	Thaska	11.6	12.5	93.2	14.6	21.7
11	Ladwa	8.1	11.5	69.7	10.4	18.9
12	Kanwari	9.4	12.5	75.4	12.0	18.6
13	Sultanpur	11.7	14.8	78.8	9.8	22.8
14	Umra	9.6	14.1	67.7	13.1	17.9
15	Hansi	9.1	11.6	78.4	13.6	16.7
16	Satrob	11.4	9.1	125.9	22.5	26.7
17	Sikarpur	12.5	11.1	112.3	18.3	22.8
18	Raipur	13.3	11.8	112.3	16.7	22.6
19	Ludas	6.6	8.8	75.1	12.6	20.5
20	Dabra	14.2	14.0	100.9	16.1	21.4
	Mean for soil	11.0	13.0	--	13.8	20.1

	Yield	*Concenstration*
CD 5% Zn leavels mean		0.52
Soil mean	1.29	1.34
Soil X Zn	2.12	2 33

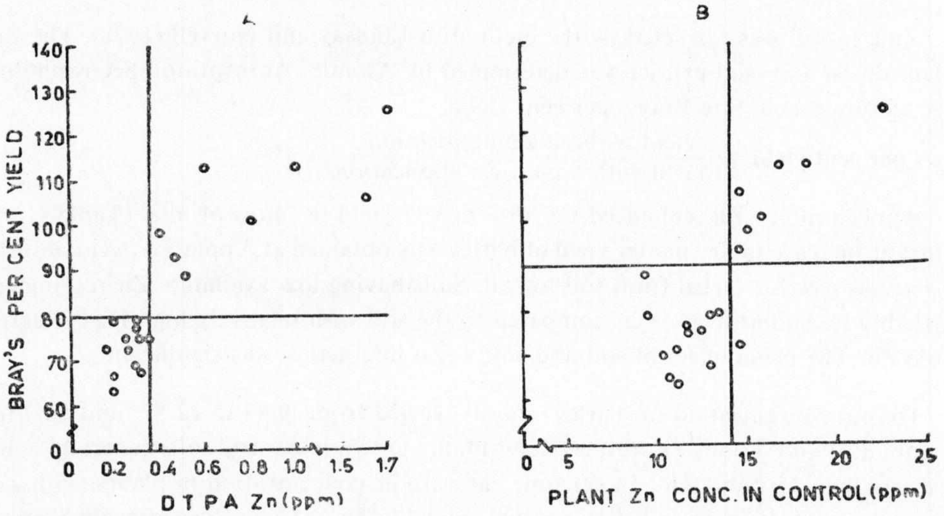

Fig. 1. Relationship between bray's per cent yield, and Zn. (A) Bray's per cent yield and DTPA Zn. (B) Bray's per cent yield and plant Zn concentration in control.

The critical limits of Zn in barley plants and soil were obtained by the procedure of Cate and Nelson (1965). Barley when grown in soils containing less than 0.35 ppm DTPA extractable Zn (Fig. 1A) responded to Zn application. Summation of percentage of soils above the critical level and the number of soils below the critical value gave an overall predictive value for DTPA extractant to be 95 per cent. Critical limit of Zn concentration in 10-week old barley plants was found to be 14.25 ppm (Fig. 1B). The value obtained for barley were on lower side as compared to other crops and did not correspond to the values reported by Aggarwala *et al.* (1977) for wheat crop.

The critical limit of DTPA extractable Zn for barley is quite low (0 - 35 ppm) against 0.56 ppm for pearl millet (Gupta *et al.*, 1981 b), 0.68 ppm for wheat (Gupta *et al.*, 1981 a, and 0.6 ppm for maize (Takkar and Mann, 1975). The low critical values of Zn in soil and plant suggest that barley could be grown without Zn fertilization in such Zn deficient soils where wheat, paddy and maize etc. would give poor yields.

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