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EFFECT OF ZINC APPLICATION ON YIELD AND NUTRIENT CONTENT IN CHICKPEA (*Cicer arietinum* L.)*

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ABSTRACT

Field experiments were conducted on Zn d efficient sandy loam soil (Typic Ustochrept) to assess the effect of Zn application (0,2.2 and 4.4 kg ha^{-1}) in three varieties (K-850, K-468 and T-3) of chickpea on yield, content and uptake of An and contents of P, Fe, Cu and Mn In grain and straw. Application of Zn significantly Increased the yield and content and uptake of Zn. Contents of P, Fe and Cu were decreased but Mn remained unaffected by added Zn. Varieties showed Variation in respect of yield potential, An content and uptake and content of other nutrients. Interaction of varieties and levels of An was non-significant on yield.

KEY WORDS : Chickpea, Zine nutrition.

Zine deficiency is becoming a common micronutrient deficiency in agricultural crops (Katyal,*et al.*,1980). Spectacular responses to application of Zn have been obtained in different cereal crops and fruit plants (Katyal and Agarwala, 1982). Information regarding the use of Zn in winter pluses in general and chickpea in particular is very limited. Thus, the present investigation was undertaken to study the effect of Zn application on yield, Zn content and uptake and content of nutrients In grain and staw of three varieties of chickpea *(Cicer arietimum* L.)

MATERIALS AND METHODS

A field experiment was conducted in a Zn deficient Indo-Gangtic alluvial soil (Typic Ustochrep) of Research Farm (Pura) of C.S.A. University of Agriculture and Technology, Karpur for two consecutive years commencing (1981 and 82). The experimental soil was sandy loam in texture with pH 7.7 and E.C. 0.30 mmhos/cm of 1 : 2.5 soil water ratio. It was low in alkaline permangnate extractable N (180.5 kg/ha) and DTPA-Zn (0.55 ppm), medium in available K_2O (156.9 kg/ha) but high in Olsen's-P (41.2 kg P_2O_5/ha) and other micronutrients like Fe, Mn, and Cu.

Treatments comparised of all combinations of three levels of Zn (0,2.2 and 4.4 kg ha^{-1}) and three important varieties of chickpea (K-850, K-468 and T-3) were evaluated in a randomised block design with four replications. Sowing was done in the month of October with a uniform application of 20 kg N, 40 kg P_2O_5 and 20 kg K_2O per hectare through urea, diammonium phosphate and muriate of potash respectively. Zinc was applied through $ZnSO_4$ 7 H_2O as per treatment at the time of sowing. Amount of S was balanced in all plots. Irrigation and other cultural operations were done as and when required. Yields of grain and straw were recorded after harvesting. Plant samples after thorough washing with degergent solution, de- mineralised water and glass distilled water in succession were dried first in a hot air oven and then in an over at 70°C for 12 hr and ground in a Wiley mill having all stainless steel components. Thereafter, plant samples were digested in di-acid mixture of nitric and perchloroic acids (Johnson and Ulrich, 1959). Content of Zn,

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Table 1. Yield of Grain and Straw of Chickpea

Treatments	Yield (q ha^{-1})				Grain yield response over control (%)		
	Grain		Straw				
	I	II	I	II	I	II	Mean
Effect of Zn (kg ha^{-1})							
Zn 0.0	23.1	27.0	24.8	28.5	-	-	-
Zn 2.2	25.8	30.3	27.3	32.7	11.7	12.6	12.2
Zn 4.4	26.2	30.8	28.6	33.6	13.4	14.1	13.8
C D 5%	1.5	0.6	2.3	0.7	-	-	-
Effect of variety (V)							
K - 850 (V_1)	24.1	28.5	25.4	30.2	9.2	9.7	9.4
K - 468 (V_2)	24.4	28.5	26.6	31.0	16.2	15.5	15.8
T - 3 (V_3)	26.6	31.1	28.7	33.7	13.0	14.9	13.9
C D 5%	1.5	0.6	2.3	0.7	-	-	-
Effect of combinations (V x Zn)							
V_1 Zn 0.0	22.7	26.8	23.9	27.3	-	-	-
V_1 Zn 2.2	24.5	29.2	25.2	31.4	7.9	9.0	8.4
V_1 Zn 4.4	25.1	29.6	27.2	32.0	10.6	10.4	10.5
V_2 Zn 0.0	22.0	25.8	23.7	27.8	-	-	-
V_2 Zn 2.2	25.6	29.8	27.9	32.1	16.4	15.5	15.9
V_2 Zn [illegible]	25.5	29.8	28.2	33.0	15.9	15.5	15.7
V_3 Zn 0.0	24.5	28.3	26.8	30.5	-	-	-
V_3 Zn 2.2	27.3	32.0	28.9	34.7	11.4	13.1	12.2
V_3 Zn 4.4	28.1	33.0	30.5	35.9	14.7	16.6	15.6
C D 5%	2.6	1.1	4.1	1.3	-	-	-
Interaction	NS	NS	NS	NS	-	-	-

I - 1981-82, II - 1982-83, NS - Not significant

Fe, Mn and Cu were determined with the help of atomic absorption spectrophotometer. Total P was detemined by Vandomolybdo phosphoric yellow colour method.

RESULTS AND DISCUSSION

Grain and straw yield

Application of Zn increased the production of grain and straw significantly (Table 1). The dose 4.4 kg Zn ha^{-1} did not differ significantly over the lower dose 2.2 kg ha^{-1}. The mean increase in grain yield over control due to Zn addition was 13 per cent. Varieties varied in degree of responsiveness due to Zn. On the basis of mean values, Var. K-468 responded more (15.8%) followed by T-3 (13.9%) and K-850 (9.4%). The varieties also varied in yield, highest yield was observed in T-3 as compared to other varieties. These results corroborate the observations of Saxena and Singh (1977) and Rao Sharma (1982). Varietal difference for responsiveness due to Zn has been reported by Saxena and Singh (1970) and Reddy and Rao (1979). Interaction of factors on yield was non-significant in both the seasons.

Content and uptake of Zn

Zinc content (Table 2) in grain and straw increased significantly by applied Zn. The higher dose of Zn 4.4 kg ha^{-1} futher increased the content significantly except the content in straw in the first season. Zinc content was high in var. T-3 as compared to

Table 2. Zn Content and uptake by Chickpea

Treatments	Zn content (ppm)				Zn uptake (g ha^{-1})			
	Grain		Straw		Grain		Straw	
	I	II	I	II	I	II	I	II
Effect of An (kg ha^{-1})								
Zn 0.0	55.9	54.2	18.8	18.8	129.7	147.7	47.0	54.1
Zn 2.2	72.9	71.5	27.1	25.2	182.5	217.9	74.9	82.6
Zn 4.4	76.7	77.7	32.3	31.5	202.3	240.3	93.1	106.7
C D 5%	3.8	3.8	6.9	1.4	6.6	3.4	8.4	4.8
Effect of varieties (V)								
K - 850 (V_1)	60.8	60.2	19.2	19.3	144.0	147.4	49.4	59.0
K - 468 (V_2)	62.2	63.5	26.7	26.3	151.2	181.6	71.7	82.9
T - 3 (V_3)	82.5	79.7	32.3	29.8	219.2	249.9	93.9	101.6
C D 5%	3.8	3.8	6.9	1.4	6.6	3.4	8.4	4.8
Effect of combinations (V x Zn)								
V_1 Zn 0.0	46.3	44.8	12.5	13.3	105.8	123.9	29.9	36.1
V_1 Zn 2.2	62.5	60.5	22.5	22.8	141.3	176.6	57.1	71.5
V_1 Zn 4.4	73.8	75.3	22.5	21.8	185.0	222.6	61.3	69.5
V_2 Zn 0.0	56.5	55.0	20.0	18.8	123.3	141.8	47.1	52.2
V_2 Zn 2.2	65.0	68.3	22.5	24.5	164.4	202.9	62.3	78.5
V_2 Zn 4.4	65.0	67.3	37.5	35.8	165.1	200.1	105.7	117.9
V_3 Zn 0.0	65.0	62.8	23.8	24.3	160.1	177.4	64.1	74.0
V_3 Zn 2.2	91.3	85.8	36.3	28.3	240.7	274.2	105.3	97.9
V_3 Zn 4.4	91.3	90.5	36.9	37.0	256.9	289.2	112.3	132.8
C D 5%	6.5	6.6	11.6	2.9	11.4	5.9	14.6	8.3
Interaction	S	S	NS	S	NS	S	S	S

I = 1981-82, II = 1982-83, NS = Not significant, S = Significant

var. K-850 and K-468 which did not differ significantly. Uptake of Zn by grain and straw also increased significantly by increasing supply of Zn (Table 2). Significant varietal variations were observed for uptake which was the highest in T-3 and lowest in K-850. Interactive effects of Zn and varieties on content and uptake were also reflected in the results. Increased content and uptake of Zn as a result of Zn application have been reported by different workers (Malewar *et al.*, 1980; Shukla and Hansraj, 1980; Nelson, 1956; Kumar and Singh, 1979) in other pulse crops.

Content of P, Fe, Cu and Mn

The content of P, Fe, Cu and Mn in grain and straw is presented in Table 3. The effect of treatments are summarized below

Phosphorus : A significant decrease in P content of grain and straw was observed due to increasing application of Zn. Varieties showed significant variation in content and their interaction with Zn levels was not significant in both the seasons. Such reduction of P content has been reported in green gram (Devarajan *et al.*, 1980) and pigeonpea (Shukla and Hansraj, 1980). Varietal variation in P content is in consonance with the observations of Shukla and Hansraj 1974 and 1980).

Iron : Content of Fe was more in straw then grains. Increasing application of Zn caused significant reduction of Fe content. Significant variations were observed in the tested varieties for Fe content. Significant interactive effects of Zn and varieties are

Table 3 : Content of total P (%) and Fe, Mn and Cu (ppm) in chickpea

Treatments	Grain				Straw			
	P	Fe	Cu	Mn	P	Fe	Cu	Mn
				1981/82				
Effect of Zn (kg ha^{-1})								
Zn 0.0	0.31	172	10.3	29.5	0.09	392	11.6	17.3
Zn 2.2	0.26	164	10.2	29.0	0.07	344	11.1	18.8
Zn 4.4	0.22	151	9.2	32.7	0.06	313	11.0	18.0
C D 5%	0.02	4	0.8	2.0	0.01	18	NS	1.1
Effect of varieties (V)								
K - 850 (V_1)	0.29	186	9.4	31.3	0.07	339	13.2	14.8
K - 468 (V_2)	0.19	147	10.0	29.8	0.06	317	11.8	18.7
T - 3 (V_3)	0.31	154	10.2	30.0	0.09	393	8.5	20.7
C D 5%	0.02	4	NS	NS	0.01	18	0.9	1.1
Effect of combinations (V x Zn)								
V_1 Zn 0.0	0.33	200	10.7	30.0	0.09	388	14.8	12.5
V_1 Zn 2.2	0.30	193	7.5	29.0	0.07	325	12.7	17.5
V_1 Zn 4.4	0.25	165	10.0	35.0	0.06	305	12.5	14.5
V_2 Zn 0.0	0.23	155	10.0	27.5	0.08	358	12.5	19.5
V_2 Zn 2.2	0.19	150	12.5	29.0	0.06	308	10.5	19.0
V_2 Zn 4.4	0.17	136	7.5	33.0	0.06	285	12.5	17.5
V_3 Zn 0.0	0.38	162	10.0	31.0	0.11	430	7.5	20.0
V_3 Zn 2.2	0.31	151	10.5	29.0	0.09	400	10.5	20.0
V_3 Zn 4.4	0.25	151	10.0	30.0	0.07	350	8.0	22.0
C D 5%	0.04	8	1.4	3.4	0.11	30	1.1	1.9
Interaction	NS	S	S	NS	NS	NS	S	S
				1982/83				
Effect of Zn (kg ha^{-1})								
Zn 0.0	0.33	169	11.3	31.7	0.09	396	12.1	18.0
Zn 2.2	0.29	153	10.7	29.9	0.07	355	10.7	18.6
Zn 4.4	0.22	145	10.2	32.3	0.06	338	11.3	17.9
C D 5%	0.01	2	NS	1.4	0.01	6	1.0	NS
Effect of Zn (kg ha^{-1})								
K - 850 (V_1)	0.29	168	10.0	31.9	0.07	343	12.5	14.2
K - 468 (V_2)	0.21	151	11.9	30.3	0.07	323	11.8	18.7
T - 3 (V_3)	0.31	148	10.2	31.6	0.08	424	9.8	21.6
C D 5%	0.01	2	1.0	NS	0.01	6	1.0	1.3
Effect of combiinations (V x Zn)								
V_1 Zn 0.0	0.34	184	10.8	35.5	0.08	391	14.0	12.0
V_1 Zn 2.2	0.29	162	9.7	29.5	0.07	326	11.5	15.5
V_1 Zn 4.4	0.24	160	9.5	30.8	0.05	313	12.0	15.0
V_2 Zn 0.0	0.26	165	12.5	27.5	0.08	348	12.7	21.5
V_2 Zn 2.2	0.20	146	12.8	30.0	0.07	320	10.7	18.0
V_2 Zn 4.4	0.16	141	10.5	33.5	0.05	300	12.0	16.5
V_3 Zn 0.0	0.37	159	10.5	32.0	0.11	451	9.5	20.5
V_3 Zn 2.2	0.30	151	9.5	30.3	0.08	421	9.8	22.0
V_3 Zn 4.4	0.26	136	10.5	32.5	0.06	401	10.0	22.3
C D 5%	0.03	3	1.8	2.5	0.01	10	1.7	2.2
Interaction	NS	S	NS	S	NS	S	NS	S

NS = Not significant, S = Significant

also indicated in results. Similar reduction in content of Fe in grains of lintil, were observed by Sakal *et al.* (1980).

Copper and Managanese : Content of Cu tended to decrease while that of Mn remained unaffected by application of Zn. Varietal variations were observed for content of Cu and Mn in straw and these in grain did not very markedly. Interactive effects were also revealed except Cu content in second season.

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EFFECT OF VESI CULAR - ARBUSCULAR MYCORRHIZAL FUNGI ON GROWTH AND NUTRITION OF CHICKPEA

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ABSTRACT

Chickpea was inoculated with **Glomus fasciculatum, Glomus constrictum** and **Gigaspora calospora** in sterilized soil in pots. Plants inoculated with all the three mycorrhizal fungi showed an increased plant dry weight and total phosphorus uptake over uninoculated sterilized soil. Increase of growth was correlated with intensity of infection.

KEY WORDS : Mycorrhizal Fungi, Chickpea.

Chickpea *(Cicer arietinum* L.) is an important grain legume in India. Vesicular-arbuscular mycorrihizal (VAM) fungi occur on a wide range of crop plants, (Hayman, 1978). The role of VAM in plant growth and nutrient uptake is well established, (Tinker, 1982). A major part of the beneficial effect of VAM is attributed to their role in phosphorus uptake and translocations.