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Short Communication

RESPONSE OF CHICKPEA TO LEVELS OF ZINC AND PHOSPHORUS

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Chickpea (*Cicer arietinum* L.) is the major pulse crop of India. At global level, it ranks fifth in terms of area and production under legumes. It is grown with less care and less manurial requirement. Application of phosphorus and zinc are increased the pulse production. The response of phosphorus and zinc depends upon many factors like climate, variety and soil type, pH, nutrient availability etc. during the growth. The requirement of phosphorus in leguminous crop like chickpea is higher than other crops for their root development and metabolic activities. In recent years, zinc deficiency has been aggravated in Indian soils due to tremendous increase in cropping intensity and adoption of cultivation of high yielding varieties. Zinc is essential for promoting certain metabolic reactions. It is necessary for the production of chlorophyll and carbohydrates. Zinc is directly or indirectly required by several enzyme systems, auxin and protein synthesis. Zinc is believed to promote RNA sysnthesis, which in turn is needed for protein production. At several places normal yield of crops could not be achieved despite judicious use of NPK fertilizers due to deficiency of micronutrients in soil, in general, that of Zn in particular. A favourable balance between phosphorus and zinc should be maintained for optimum growth of plant. The information on Zn and P relationship in an important crop like chickpea is not adequate; especially in situations where both the interacting nutrients (P and Zn) are deficient is soil. Hence, the present investigation was conducted to study the effect of zinc and phosphorus on growth, yield, uptake and quality of chickpea crop.

A field experiment was conducted during *rabi* 2010 - 2011 at M.G.C.G.V.V. farm, Chirakoot (M.P.). The experimental soil was sandy clay-loam in texture and laid out in factorial randomized design replicated three times. The treatment comprises 4 levels of zinc [0, 10, 20 and 30 kg Zn So_4 ha^{-1}] and five levels of phosphorus [0, 25, 40, 55 and 70 kg P ha^{-1}]. The experimental soil was sandy clay loam in texture, slightly alkaline in reaction, having electrical conductivity 0.3 dS/m at 25^0C. Soils were poor in available nitrogen (168 kg ha^{-1}), phosphorus (20 kg ha^{-1}), rich in available potash (370 kg ha^{-1}), DTPA Zn (0.45 mg ha^{-1}) and organic carbon (0.45 %). Before and after experiment, the soils samples were collected and analyzed for pH, electrical conductivity, and organic carbon, available N, P_2O_5, K_2O and DTPA-Zn were analyzed. After harvest of crop yield were recorded and uptake of zinc and phosphorus were determined. Protein content in seed was also determined as per standard procedure.

Table 1: Growth, yield, and quality of chickpea as affected by levels of zinc and phoaphorus

Treaments	Growth characters			Yield attributes		Yield (q ha^{-1})		Protein content (%)
	Plant height (cm)	Primary branches/plant	Secondary branches/plant	Pods /plant	Test weight (g)	Seed	Straw	
Zinc sulphate (kg ha^{-1})								
0	44.9	7.5	25.7	62.9	15.0	18.0	33.2	20.7
10	46.4	7.7	26.5	65.0	15.5	18.6	34.3	21.3
20	47.9	8.0	27.4	67.0	16.0	19.2	35.4	22.0
30	48.7	8.1	27.8	68.2	16.2	19.5	36.0	22.4
CD (P=0.05)	1.22	0.21	0.68	1.71	0.41	0.49	0.89	0.57
Phosphorus (kg ha^{-1})								
0	44.3	7.4	25.3	62.1	14.8	17.7	32.8	20.4
25	45.9	7.6	26.2	64.2	15.3	18.3	33.9	21.1
40	47.2	7.9	26.9	66.0	15.7	18.9	34.9	21.7
55	48.4	8.1	27.6	67.7	16.1	19.4	35.8	22.3
70	49.2	8.2	28.1	68.8	16.4	19.7	36.4	22.6
CD (P=0.05)	1.17	0.58	0.67	1.64	0.39	0.47	0.87	0.53

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Yield and growth characters like plant height, primary and secondary branches/plant, pods/plant, test weight and seed and straw yield of chickpea were significantly influenced by the dose of zinc and phosphorus. Increasing dose of zinc increases the growth and yield characters up to 30 kg Zn So_4 ha^{-1}. However, significant response was noted up to 20 kg Zn So_4 ha^{-1}. Similarly, application of phosphorus increases the characters up to 70 kg P_20_5 ha^{-1} but the significant response was noted up to 55 kg ha^{-1}. There was no significant difference between 20 and 30 kg zinc sulphate ha^{-1} and 70 and 55 kg P_20_5 ha^{-1} (Table 1). It might be the due to supply of both nutrient in soil and their synegestic effect on other nutrients increases the yield and growth character. The results confirm the findings of Pathak *et al.* (2003) and Karwasra and Kumar (2007).

Quality

Protein content was significantly influenced by different doses of zinc and phosphorus (Table 1). Highest protein content was recorded at with 30 kg Zn ha^{-1} but it was at par with 20 kg Zn ha^{-1}. Similarly, highest protein content was recorded under 70 kg P ha^{-1} and it was at par with 55 kg P ha^{-1}. The beneficial effect of zinc and phosphorus levels on protein content may be due to the increase in cation exchange capacity of the roots which would enable to plant extracts more nutrients from soil. Pathak *et al.* (2003) reported similar findings.

Table 2: Nutrient uptake by crop and status of plants Zn in soil as affected by different levels of zinc and phosphorus

Treaments	Zinc uptake (g ha^{-1})	Phosphorus uptake (kg ha^{-1})	Available zinc (mg kg^{-1})	Available P_2O_5 (mg kg^{-1})	B:C ratio
Zinc Sulphate (kg ha^{-1})					
0	52.7	23.8	0.38	21.4	5.3
10	56.3	25.4	0.40	20.4	5.5
20	59.9	27.1	0.43	19.4	6.5
30	61.9	28.0	0.45	18.9	6.6**I**
CD (P=0.05)	2.98	1.35	0.024	0.85	-
Phosphorus (kg ha^{-1})					
0	57.1	23.2	0.47	18.1	5.5
25	58.1	24.8	0.44	19.1	5.7
40	58.2	26.2	0.41	20.1	6.4
55	58.1	27.6	0.39	21.1	6.5
70	57.1	28.5	0.37	21.6	6.6
CD (P=0.05)	NS	1.29	0.025	0.81	-

Nutrient status, uptake and balance sheet

Uptake of zinc and phosphorus significantly influenced by different zinc and phosphorus (Table 2). Increasing dose of zinc significantly increases the uptake of zinc by chickpea crop. It is well establish fact that the application of zinc in soil increases the uptake of zinc by plants. It is well established fact that the Zn present in water soluble, exchangeable and complexed fractions contributed maximum to the plant uptake. Results confirm the finding of Akay (2011). Uptake of zinc is not influenced by the increasing dose of phosphorus. It may be due to the fact that zinc had antagonistic effect with phoaphorus. Increasing dose of zinc increases the uptake of phosphorus. It may be due to inspite of antagonistic efeect higher yield iof chickpea increases the uptake of phosphorus. Phosphorus uptake increases with increasing level of phosporus. It is well establish fact that the application of P_2O_5 in soil increases the uptake of P by plants. Tomar and Tiwari (2005) also reported that application of P_2O_5 significantly increased uptake of phosphorus. Increasing dose of nitrogen increases the DTPA – Zn of Soil. However, it was decreases with increase in available phosphorus conent. On the other hand, available phosphorus has antagonistic effect with zinc. Highest build-up of Zinc was observed under 30 kg Zn So_4 ha^{-1} and 0 kg P_2O_5 ha^{-1}. Phosphorus build-up was recorded contrary to the zinc. Increasing dose of either zinc or phosphorus increases the benefic coat ration of chickpea. Zinc beyond 20 kg ha^{-1} and phosphorus beyond 40 kg ha^{-1} given high B:C ratio. The result confirms the finding of Singh *et al.* (2005) and Deshmukh *et al.* (2005). The highiest seed, straw yield and protein content of chickpea was recorded due to application of Zn So_4 @ 30 kg ha^{-1} and P_2O_5 @ 70 kg ha^{-1} but the significient response was up to Zn So_4 @20 kg ha^{-1} and P_2O_5 55 kg ha^{-1}. The maximum gross return, net return and B:C Ratio were highest under 30 kg ha^{-1} and 70 kh ha^{-1}.

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