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Zinc Management Strategy to Increase Growth and Seed Yield of Kabuli Chickpea (*Cicer kabulium* L.)

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ABSTRACT

A field experiment was conducted during *rabi* 2007-08 on clay loam soil to study the effect of soil and foliar application of zinc sulphate on growth and seed yield of *kabuli* chickpea. The results revealed that all the growth parameters, yield attributes, seed and haulm yields of kabuli chickpea were significantly increased with increasing levels of soil application and foliar application of zinc. The highest seed yield was recorded with the application of 25 kg $ZnSO_4$ ha^{-1} in combination with 0.5% $ZnSO_4$ spray twice. Higher dose of zinc (37.5 kg $ZnSO_4$ ha^{-1}) showed a decling trend in seed yield and other characters studied.

Key words : Growth, Kabuli chickpea, Seed yield, Zinc.

Chickpea is a major pulse crop of India and accounts for nearly 40% of the total pulse production. It is a protein rich supplement to cereal based diets where people are vegetarians or cannot afford animal protein. It has a very important role in human diet in India. In India, it is grown in 5.65 m ha producing 4.15 m t annually with a productivity of 740 kg ha^{-1} (2006-07). In Andhra Pradesh, it is grown in an area of 5.29 lakh ha with annual production of 6.28 lakh tons and productivity of 842 kg ha^{-1} (Ministry of Agriculture, 2009).

Kabuli chickpea (*Cicer kabulium* L.) has a good demand for consumption due to high nutritive value and fairly free from antinutritional value. Its cultivation is rapidly expanding in Prakasam (Dt) of A.P. for the last 3 or 4 years by replacing tobacco, cotton and other commercial crops in view of their eroding profitability. Its productivity is poor due to imbalanced nutrition. Nutritional disorders, especially deficiency of zinc is known to affect chickpea productivity. Hence, the present investigation has carried out to study the effect of soil and foliar application of zinc sulphate on growth and seed yield of kabuli chickpea.

MATERIAL AND METHODS

A field experiment was conducted during *rabi* 2007-08 on clay loam soil (a farmer's field) of Cheruvana Uppalapadu village, Naguluppalapadu Mandal, Prakasam district, Andhra Pradesh. The soil was slightly alkaline in reaction (pH 8.3), high in available nitrogen (560 kg N ha^{-1}), low in available phosphorus (12 kg P_2O_5 ha^{-1}), high in available potassium (591 kg K_2O ha^{-1}) and deficient in available zinc (0.46 ppm). The treatments comprised of 4 levels of soil application of zinc (0, 12.5, 25.0 and 37.5 kg $ZnSO_4$ ha^{-1}) and 3 levels of foliar application of zinc (control i.e. water spray, 0.5 % $ZnSO_4$ spray once at 45 DAS and 0.5 % $Znso_4$ spray twice at 45 and 55 DAS). The trail was laid out in RBD with factorial concept and replicated thrice. Uniformly N, P and K @ 20, 50 and 30 kg ha^{-1} respectively was applied basally to all the plots. The crop was sown with a spacing of 30 cm X 10 cm on17-11-2007 and harvested on 22-2-2008.

RESULTS AND DISCUSSION

The results of the investigation revealed that the plant height, drymatter accumulation, number of primary and secondary branches per plant were significantly increased with increasing soil application of zinc upto 25 kg $ZnSO_4$ ha^{-1} (Table-1). Further, higher level of zinc application (37.5 kg $ZnSO_4$ ha^{-1}) recorded lower growth parameters. The increased growth of chickpea with 25 kg $ZnSO_4$ ha^{-1} might be due to balanced effect of zinc on root proliferation degree, diffusion of major nutrients and zinc in the soil as reported by Paramasivan *et al* (1992) and Dhillon *et al* (1993). The difference in growth characters between 25 and 37.5 kg $ZnSO_4$ ha^{-1} was not attained the level of significance. Similar effect was also reflected in case of yield (Table 1) as differences existed in respect of yield attributes like number of pods per plant and seed weight were not significant between 25 and 37.5 kg $ZnSO_4$ ha^{-1}. These favourable effects of zinc application on yield

Table1. Growth parameters, yield attributes and yield of chickpea as influenced by soil and foliar applications of Zinc Sulphate

Treatments	Plant height (cm) at 90 DAS	Drymatter accumulation (kg ha^{-1}) at maturity	Primary branches (No plant^{-1}) at maturity	Secondary branches (No plant^{-1}) at maturity	Pods (No.per plant) at maturity	Seed weight (g 100 seeds^{-1})	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
Soil application (kg $ZnSo_4$ ha^{-1})								
0	52.9	3187	2.1	4.2	28.5	25.4	2282	2970
12.5	55.9	4119	2.4	4.6	31.8	26.5	2514	3443
25.0	56.2	4302	2.5	4.9	33.2	26.8	2746	3703
37.5	55.7	4085	2.4	4.8	32.2	26.6	2528	3572
SEm±	0.49	54.8	0.07	0.09	0.63	0.54	52.3	81
C D (0.05)	1.5	160	0.2	0.3	1.9	NS	153	237
Foliar application (0.5 % $ZnSo_4$ spray)								
No application	52.9	3447	2.1	4.3	29.6	24.7	2120	2933
One spray at 45 DAS	54.9	4085	2.3	4.5	31.1	26.0	2531	3441
Two sprays at 45 and 55 DAS	57.7	4238	2.7	5.2	33.5	28.1	2902	3891
SEm±	0.43	47.5	0.06	0.08	0.55	0.47	45.3	70
C D (0.05)	1.3	139	0.2	0.2	1.6	1.4	133	206
Interaction	NS	NS	NS	NS	NS	NS	Sig	NS
C.V. (%)	2.7	4.2	9.1	6.0	6.1	6.2	6.2	7.1

Table 2. Seed yield (kg ha^{-1}) of chickpea as influenced by soil and foliar applications of zinc sulphate.

Foliar application (0.5% $ZnSo_4$ spray)	Soil application (kg $ZnSo_4$ ha^{-1})				
	0	12.5	25.0	37.5	Mean
No application	1656	2143	2560	2120	2120
One spray at 45 DAS	2490	2537	2632	2464	2531
Two sprays at 45 and 55 DAS	2699	2861	3046	3000	2902
Mean	2282	2514	2746	2528	
	Soil	Foliar	Interactions		
SEm±	52.3	45.3	90.7		
CD(0.05)	153	133	266		

attributes and yield are in confirmity with the findings of Katyal *et al* (2004), Ashok *et al* (2005) and Shukla (2007). Haulm yield (Table -1) was also significantly higher with 25 kg $ZnSO_4$ ha^{-1} where a mean increase of 24.7 % haulm yield was recorded over control. This might be due to increased drymatter accumulation, increased plant height and number of primary as well as secondary branches per plant with 25 kg $ZnSO_4$ ha^{-1} (Table-1). Similar results were also reported by Sangwan and Raj (2004), Ashok *et al* (2005). Soil application of 25 kg $ZnSO_4$ ha^{-1} higher haulm yield than that of 37.5 kg $ZnSO_4$ ha^{-1} but both these two treatments remained statistically identical. These findings infer that the application of 25 kg $ZnSO_4$ ha^{-1} might be the optimum dose for obtaining higher seed and haulm yields of chickpea as compared to 37.5 kg $ZnSO_4$ ha^{-1} application. These results corroborate with the findings of Nilam Kanase *et al* (2008).

The plant height, drymatter accumulation number of branches per plant were minimum with the control (i.e.water spray) and maximum with 0.5% $ZnSO_4$ spray twice at 45 and 55 DAS. In general, all the growth parameters studied were significantly increased with increasing levels of foliar application of zinc. Foliar spray of 0.5% zinc sulphate of 45 DAS once recorded significantly higher plant height, drymatter accumulation and number of branches per plant over control. This increase in growth characters of chickpea crop due to foliar application of zinc sulphate might be due to the fact that zinc nutrient might have played an important role in the production of IAA by increasing its content and there by increased the growth characters.

Application of 0.5% $ZnSO_4$ spray twice resulted in maximum number (33.5) of pods per plant, seed weight (28.1g), the highest seed yield (2902 kg ha^{-1}) and haulm yield (3891 kg ha^{-1}) over remaining treatments (i.e.0.5% $ZnSO_4$ spray once and control). The increase in seed yield and haulm yield of chickpea due to 0.5% ZnSO4 foliar spray may be due to accumulative effect of growth characters and also yield attributes (Table1). Similar results were also reported by Verma *et al* (2004).

Soil application of 25 kg $ZnSO_4$ ha^{-1} in combination with foliar spray of zinc twice (45 and 55 DAS) proved significantly superior to rest of the treatment combinations except 37.5 kg ZnSO4 ha^{-1} with foliar application twice at 45 and 55 DAS (Table-2). This increase in seed yield could be ascribed to overall improvement in plant growth, vigour and sufficient production of photosynthates through increased leaf area index and chlorophyll content of leaves due to foliar nutrition of zinc.

Thus, the present investigation showed that application of 25 kg $ZnSO_4$ ha^{-1} through soil in combination with 0.5 % $ZnSO_4$ foliar spray twice (45 and 55 DAS) was the most suited combination of soil and foliar application of zinc to *kabuli* chickpea crop in realizing higher growth and seed yield.

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