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Effect of Zinc Management on Yield, Nutrient Uptake and Economics of Kabuli Chickpea (*Cicer kabulicem L*)

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ABSTRACT

A field experiment was conducted on clay loam soil in farmer's field of Cheluvanuppalapadu village, Nagulappalapadu Mandal, Prakasam (Dt.), Andhra Pradesh during *rabi* 2007-08 to study the effect of soil and foliar application of Zinc sulphate on seed yield nutrient uptake and economics of kabuli chickpea (Cv LBeG-7). The highest yield was recorded with the application of 25 Kg $ZnSO_4$ ha^{-1} in combination with 0.5% $ZnSO_4$ spray twice at 45 DAS and 55DAS. Higher dose of Zinc (37.5Kg $ZnSO_4$/ha^{-1}) showed a decline trend in seed yield. The uptake of N, P and Zn was significantly influenced by soil application of zinc upto 25 kg $ZnSO_4$ ha^{-1} at maturity. The maximum uptake of N, P, K and Zn was recorded by 0.5% $ZnSO_4$ spray twice (at 45 and 55DAS) at maturity. Application of 25Kg $ZnSO_4$ ha^{-1} through soil in combination with 0.5% $ZnSO_4$ foliar spray twice (at 45 and 55 DAS) recorded highest B:C ratio 1: 2.98 and net returns (Rs. 59,037 per hectare).

Key words : Economics, Kabuli chickpea, Nutrient Uptake, Yield.

Chickpea is one of major growing countries of the world, accounting for 62% of the world production (Reddy, 2009). It has a very important role in human diet in India. In Andhra Pradesh, it is grown in 5.29 lakh ha with annual production of 6.28 lakh tones and productivity of 842 Kg ha^{-1} during rabi 2006-07 (Ministry of Agriculture, 2009). *Kabuli* chickpea is growing by the farmers interest due to high market price. It has a good demand for consumption due to its high nutritive value and fairly free from anti-nutritional factors. The chickpea is mainly raised on residual soil moisture and relative humidity during winter season. The productivity of *Kabuli* chickpea is poor which may be due to imbalanced nutrition especially zinc fertilization. Zinc is the major component of several enzymes, influencing the synthesis of proteins, auxins and photosynthetic activity. It also increases plant's resistance to affect chickpea productivity. Therefore, the present investigation is undertaken to study the effect of zinc management on yield, nutrient uptake and economics of *Kabuli* chickpea.

MATERIAL AND METHODS

A field experiment was conducted during rabi 2006-07 in farmer's field in Cheluvanuppalapdu village, Nagulappalapadu Mandal, Prakasam (Dt.), Andhra Pradesh. The soil of experimental field was clay loam with pH 8.3, high in available nitrogen (560kg ha^{-1}), low in phosphorous (12kg ha^{-1}), high in available potassium (591kg ha^{-1}) and low in available zinc (0.46 ppm). The mean maximum and minimum temperatures during crop growth period ranged from 30.0^{0}C to 35.7^{0}C and 18.3^{0}C to 26.4^{0}C respectively with a total rainfall of 41.14 mm received in two rainy days. The experiment comprised of 12 treatments with 4 levels of soil application of zinc (0, 12.5, 25 and 37.5kg $ZnSO_4$ 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 DAS and 55 DAS). The trail was laid in RBD with factorial concept and replicated thrice. The variety LBeG-7 of *Kabuli* chickpea was sown on 17-11-07 with a spacing of 30x10cm and the crop was harvested on 22-02-08. The uptake of N,P,K and Zn was estimated from destructive samples of five randomly selected plants each time. The same samples were utilized for recording yield and other post observations. Data collected from the experiment was analysed statistically by using analysis of variance technique as described by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

The seed and haulm yields of chickpea were significantly influenced by soil and foliar applications of zinc (Table 1). The highest seed and haulm yields were recorded with the application of 25kg $ZnSO_4$

Table 1. Yield, Nutrient Uptake and Economics of *Kabuli* chickpea as influenced by Soil and foliar applications of Zinc Sulphate

Treatment	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Nutrient uptake (kg ha^{-1}) at maturity				Available soil zinc (kg ha^{-1}) after harvest of the crop	Net returns (Rs ha^{-1})	Cost: Benefit ratio
			N	P	K	Zn			
Soil application (Kg $ZnSO_4$ ha^{-1})									
0.0	2282	2970	45.5	5.42	36.4	5.22	0.40	43431	1:2.90
12.5	2514	3443	55.0	6.86	49.5	6.09	0.31	47749	1:2.70
25.0	2746	3703	63.4	8.01	55.0	7.77	0.28	52052	1:2.70
37.5	2528	3572	62.7	7.91	50.6	7.75	0.30	44658	1:2.70
SEm±	52.3	81	2.15	0.13	0.94	0.24	0.01	—	—
CD(0.05)	153	237	6.3	0.40	2.8	0.71	0.05	—	—
Foliar application 0.5% $ZnSO_4$ spray)									
No application (Water spray)	2120	2933	42.0	4.77	39.0	2.23	0.36	37178	1:2.10
One spray at 45 DAS	2531	3441	57.7	7.03	48.8	8.63	0.33	47318	1:2.70
Two sprays at 45 and 55 DAS	2902	3891	74.2	9.36	56.0	9.26	0.28	56422	1:3.10
SEm±	45.3	70	1.86	0.11	0.81	0.21	0.01	—	—
CD(0.05)	133	206	5.5	0.35	2.4	0.61	0.04	—	—
Interaction	Significant	NS	NS	NS	NS	NS	NS	—	—
SEm±	90.7							—	—
CD(0.05)	266	NS	NS	NS	NS	NS	NS	—	—

Table 2. Interaction effect of Soil and foliar application of zinc sulphate on seed yield (kg ha^{-1}) of *Kabuli* Chickpea

Foliar application (0.5% $ZnSO_4$ spray)	Soil application (kg $ZnSO_4$ ha^{-1})				Mean
	0	12.5	25	37.5	
No application (Water spray)	1656	2143	2560	2120	**2120**
One spray at 45 DAS	2490	2537	2632	2464	2531
Two sprays at 45 and 55DAS	2649	2861	3046	3000	2902
Mean	2282	2514	2746	2528	
Interaction					
SEm±	90.7				
CD(0.05)	266				

Table 3. Economics of different treatments of soil and foliar application of zinc sulphate on chickpea

Treatment	Seed yield (kg ha^{-1})	Gross returns (Rs ha^{-1})	Cost of cultivation (Rs ha^{-1})	Net returns	CBR
S_1F_1	1656	43056	15347	27709	1:1.80
S_1F_2	2490	64740	15892	48848	1:3.51
S_1F_3	2699	70174	16437	53737	1:3.51
S_2F_1	2143	55718	17073	38645	1:2.26
S_2F_2	2537	65962	17618	48344	1:2.74
S_2F_3	2861	74386	18127	56259	1:3.10
S_3F_1	2560	66560	18799	47761	1:2.54
S_3F_2	2632	68432	19344	49088	1:2.54
S_3F_3	23046	79196	19889	59307	1:2.98
S_4F_1	2120	55120	20525	34595	1:1.68
S_4F_2	2464	64064	21070	42994	1:2.04
S_4F_3	3000	78000	21615	56385	1:2.61

Cost of seed material : Rs. 23 Kg^{-1}
Cost of labour : Rs. 100 day^{-1}
Cost of produce : Rs. 26 kg^{-1}
Cost of $znso_4$: Rs. 30 kg^{-1}
Cost of foliar application : 200 $labour^{-1}$

TREATMENT DETAILS :

S_1F_1 No application (NA *i.e* $ZnSO_4$ to soil)
S_1F_2 NA + 0.5 % $ZnSO_4$ Spray Once (At 45 DAS)
S_1F_3 NA + 0.5 % $ZnSO_4$ Spray Twice (At 45 DAS and 55DAS)
S_2F_1 NA + 12.5 kg $ZnSO_4$ ha^{-1}
S_2F_2 12.5 kg $ZnSO_4$ + 0.5 % $ZnSO_4$ Spray Once (At 45 DAS)
S_2F_3 12.5 kg $ZnSO_4$ + 0.5 % $ZnSO_4$ Spray Twice (At 45 DAS and 55DAS)
S_3F_1 NA + 25 kg $ZnSO_4$ ha^{-1}
S_3F_2 25 kg $ZnSO_4$ ha^{-1} + 0.5 % $ZnSO_4$ Spray Once (At 45 DAS)
S_3F_3 25 kg $ZnSO_4$ ha^{-1} + 0.5 % $ZnSO_4$ Spray Twice (At 45 DAS and 55DAS)
S_4F_1 NA + 37.5 kg $ZnSO_4$ ha^{-1}
S_4F_2 37.5 kg $ZnSO_4$ ha^{-1} + 0.5 % $ZnSO_4$ Spray Once (At 45 DAS)
S_4F_3 37.5 kg $ZnSO_4$ ha^{-1} + 0.5 % $ZnSO_4$ Spray Twice (At 45 DAS and 55DAS)

ha^{-1} in combination with 0.5% $ZnSO_4$ spray twice. Higher dose of zinc (37.5kg $ZnSO_4$ ha^{-1}) showed a decline trend in seed and haulm yields. Hence, optimum dose of soil application of zinc (25kg $ZnSO_4$ ha^{-1}) in combination with 0.5% $ZnSO_4$ spray twice has a favourable effect on seed yield. The favourable effects of Zinc application on yield are in confirmity with the findings of Massod Ali and Shiv Kumar (2005). However, the interaction effect of seed yield was found significant (Table 2). Soil application of 25kg $ZnSO_4$ ha^{-1} in combination with foliar spray of zinc twice (45 and 55 DAS) proved significantly superior to rest of the treatments except 37.5kg $ZnSO_4$ ha^{-1} in combination with foliar spray twice (45 and 55 DAS).

In general, the uptake of N,P,K and Zn at maturity was significantly influenced by soil application of zinc upto 25kg $ZnSO_4$ ha^{-1} which proved significantly superior to rest of the treatments but remained statistically on par with 37.5kg $ZnSO_4$ ha^{-1}. These results were in conformity with the findings of Vikas Sharma and Vikas Abrol (2007) and Pedababu *et al* (2008). The uptake of N, P, K and Zn was recorded by 0.5% $ZnSO_4$ spray twice (at 45 and 55 DAS) and proved significantly superior to 0.5% $ZnSO_4$ spray once (at 45 DAS) and control. (i.e., water spray), which, inturn, also differed significantly with each other. This may be due to the increased concentration of zinc through foliar spray might have increased the dry matter accumulation, which inturn, might have increased the nutrient uptake of plant as a whole. Similar results were also reported by Gangwar and Singh (1994) and Pedababu *et al* (2008).

Available soil zinc after harvest of the crop decreased significantly with increasing levels of soil zinc application (Table 1). This might be due to higher uptake of plant nutrients by chickpea crop upto 25 kg $ZnSO_4$ ha^{-1} and excess application of 37.5kg $ZnSO_4$ ha^{-1} than the soil requirement in the experimental soil which clearly indicated that 25 kg $ZnSO_4$ ha^{-1} might have met the needs of the chickpea crop under balanced nutrition. The results are in conformity with the findings of Paramsiva *et al* (1992) and Dhillon *et al* (1993).

Among the soil and foliar application of treatments tried, soil application 25kg $ZnSO_4$ ha^{-1} in combination with 0.5 $ZnSO_4$ spray twice at 45 and 55DAS recorded optimum BCR (1:2.98) and highest net returns (Rs. 59,307 ha^{-1}) and relatively lower cost of cultivation (Rs. 19,889 ha^{-1}). Increasing the rate of soil application of zinc from 25kg $ZnSO_4$ ha^{-1} to 37.5kg $ZnSO_4$ ha^{-1} showed declining trend (Table 1). This might be due to lower seed yield obtained by higher dose of $ZnSO_4$ (i.e 37.5kg $ZnSO_4$ ha^{-1}) besides increase in higher cost of fertilizer per unit. Similar results were also reported by Mevada *et al* (2005) and Ashok *et al* (2005)

It can be concluded that soil application of 25kg $ZnSO_4$ ha^{-1} and foliar spray twice with 0.5% $ZnSO_4$ (45 and 55DAS) was the most suited combination of soil and foliar application of zinc to *Kabuli* chickpea crop in realizing highest yield, nutrient uptake and monetary returns.

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