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Effect of potassium and sulphur on the productivity, nutrient uptake and quality improvement of chickpea

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ABSTRACT

A field experiment was carried out during *rabi* season in the Entisol soil with neutral reaction at the Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, during 1998 – 2000 under irrigated condition to evaluate the effect of potassium and sulphur on the productivity, nutrient uptake and quality improvement of chickpea. Highest seed yield of chickpea (1.38 t ha^{-1}) was obtained when the crop was treated with 25 kg K along with 40 kg S ha^{-1} which was closely followed (1.30 t ha^{-1}) with the application of 12.5 kg K and 40 kg S ha^{-1}. Increased uptake of nutrients by the crop was obtained with the treatment receiving higher dose of potassium (25 kg K ha^{-1}) along with higher dose of sulphur (40 kg S ha^{-1}). The experimental results also revealed that maximum protein content in the seeds of chickpea (23.25 %) was obtained with 25 kg K ha^{-1} (K_2) with 40 kg S ha^{-1} (S_2)

Key words: Chickpea, potassium, sulphur, productivity, nutrient uptake, quality improvement

Chickpea (*Cicer arietinum*) is the most important pulse crop in India, a good source of protein, which is deficient in the diet of Indian people. So, the pulses are important constituent of Indian diet and supply a major part of the protein requirement. Pulse crops not only supply the protein but also enrich the soil through symbiotic nitrogen fixation. But majority of farmers usually grow pulses in marginal land with reduced rate of fertilizer application and mostly without the applications of potassium and sulphur. Potassium mainly effects the nodulation of pulse crop thus increases the seed yield through better fixation of nitrogen. Sulphur, in chickpea, mainly influences the protein content. Sulphur helps towards conversion of nitrogen into protein in pulse crops. Sulphur also improves the S containing amino acid in crop and thus enhances the protein content (Das *et al.*, 1975). Hence, an attempt was made to study the effects of potassium and sulphur on the productivity, nutrient uptake and quality improvement of chickpea.

MATERIALS AND METHODS

The field experiment was conducted at Bidhan Chandra Krishi Viswavidyalaya Farm, Mohanpur, Nadia, West Bengal (23° N latitude, 89° E longitude and 9.75 M above mean sea level) during the rabi season during 1998 – 2000 in sandy clay loam soil. The experimental soil was neutral in reaction having 0.065% total N, 16.80 kg ha^{-1} available phosphorus, 198 kg ha^{-1} available potassium and 16.5 kg ha^{-1} sulphur. The experiment was laid out in Factorial Randomized Block Design with three levels of potassium and sulphur (0, 12.5, 25.0 kg K and 0, 20, 40 kg S ha^{-1}). The recommended doses of nitrogen and phosphorus for chickpea were : 20 kg ha^{-1} and 30 kg ha^{-1} respectively applied to all the plots. Full dose of all the fertilizers was applied before sowing at the time of final land preparation. The seeds of chickpea cv 108 were sown @ 75 kg ha^{-1} in the first fortnight of November with 30 cm rows apart rows and 15 cm within the rows 5 – 6 cm depth of soil.

RESULTS AND DISCUSSION

Effect of potassium and sulphur on the seed yield

Dry matter accumulation at harvest, number of pods per plant, test weight and seed yield increased significantly with the application of higher doses of both potassium (25 kg ha^{-1}) and sulphur (40 kg ha^{-1}) as compared to without potassium and sulphur applications (Table 1). The highest seed yields of 1.163 t ha^{-1} and 1.252 t ha^{-1} were obtained during 1998 and 1999 respectively with 25 kg potassium ha^{-1}, which were significantly higher than without potassium (K_0). Similarly, higher seed yields of 1.051 and 1.068 t ha^{-1} during 1998 and 1999 respectively were recorded with the application of higher doses of sulphur (40 kg ha^{-1}). Seed yield of chickpea was higher with the application of higher doses of potassium and sulphur might be due to improved yield components

and nodulation of the crop. This was also reported by Mondal *et al.* (2001).

Effect of potassium and sulphur on the nutrient uptake by chickpea

Maximum uptakes of N, P, K and S by chickpea (82.56 kg, 8.90 kg, 75.63 kg and 35.46 kg respectively (Table – 2) were recorded with the treatment of higher dose of potassium (K_2) receiving 25.0 kg K ha^{-1}. Similarly, higher uptakes of N, P, K and S by chickpea (71.51 kg N, 73.91 kg P, 7.53 kg K and 36.8 kg S respectively (Table – 2) were observed under the treatment receiving 40 kg S ha^{-1}. Uptake of nutrients was drastically reduced when the crop was not fertilized with potassium and sulphur. This result is corroborated with the finding of Mondal and Chettri (1998).

Effect of potassium and sulphur on the quality of seed

Application of potassium and sulphur to chickpea crop increased the potassium and sulphur contents of plant which showed significant positive and close correlation with protein content of chickpea. The higher potassium and sulphur contents were observed when chickpea was treated with 25 kg K ha^{-1} (K_2) alongwith 40 kg S ha^{-1} (S_2) in addition to N and P and this resulted in higher protein content in the seeds of chickpea (23.25%). Protein content is increased due to the fact that S amino acids are the main constituents of protein formation. This findings are in agreement with the findings of Arora and Luthra (1971).

Interaction effect between potassium and sulphur on seed yield (t ha^{-1}) of chickpea

The seed yield of chickpea differed significantly due to the interaction effect between potassium and sulphur during both the years. Maximum seed yield (1.32 t ha^{-1}) was recorded with 25.0 kg K ha^{-1} alongwith 40 kg S ha^{-1} (K_2S_2) in 1998 and 1999 respectively.

Interaction effect between potassium and sulphur on nutrient uptake of chickpea

Interaction effect between potassium and sulphur was significant on nutrient uptake of the crop. The maximum N uptake (95.55 kg ha^{-1}), phosphorus uptake (10.00 kg ha^{-1}), potassium uptake (85.45 kg ha^{-1}) and sulphur uptake (37.55 kg ha^{-1}) were recorded when chickpea received 25 kg K ha^{-1} (K_2) alongwith 40 kg S ha^{-1} (S_2). Significantly lower uptake for all the nutrients was recorded when the crop was not fertilized with potassium and sulphur (Table – 4).

Table 1 Dry matter accumulation (g m^2) at harvest, yield attributes and yield (t ha^{-1}) of chickpea as influenced by potassium and sulphur in 1998 – 1999

Treatments	Dry matter accumulation (g m^{-2})		No of pods $plant^{-1}$		No of seeds pod^{-1}		Test wet (g) (100 seed wt.)		Seed yield (t ha^{-1})	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Levels of potassium (K kg ha^{-1})										
K_0	230.1	281.1	47.6	38.5	1.8	1.8	159.3	154.4	0.725	0.618
K_1	240.9	289.4	49.9	46.7	1.8	2.0	171.0	165.4	0.956	0.867
K_2	246.4	296.1	53.9	49.5	1.8	1.8	174.5	172.6	1.163	1.252
SEm (±)	1.03	4.93	1.73	0.61	0.4	0.09	0.66	0.68	0.023	0.018
CD (P = 0.05)	3.08	NS	5.18	1.82	NS	NS	1.97	2.03	0.068	0.053
Levels of Sulphur (S kg ha^{-1})										
S_0	236.9	276.8	43.7	36.3	1.7	1.7	161.3	156.0	0.790	0.774
S_1	239.1	292.8	51.4	46.4	1.8	2.0	168.1	167.5	1.003	0.895
S_2	241.4	297.1	56.2	51.9	2.0	2.0	171.4	170.9	1.051	1.068
SEm (±)	1.03	4.93	1.73	0.61	0.11	0.09	0.66	0.68	0.023	0.618
CD (P = 0.05)	3.08	14.77	5.18	1.82	NS	NS	1.97	2.03	0.068	0.053

K_0 = Without Potassium, K_1 = 12.5 kg k/ha, K_2 = 25 kg k/ha, S_0 = Without Sulphur, S_1 = 20 kg S/ha, S_2 = 30 kg S/ha.

Table 2 Nutrient uptake of chickpea (Pooled date of 1998 – 1999 and 1999 – 2000) (kg ha^{-1})

Treatments	Nutrients (kg ha^{-1})			
	N	P	K	S
Levels of potassium (K kg ha^{-1})				
K_0	50.60	45.86	3.73	31.86
K_1	61.33	63.36	6.83	34.71
K_2	75.63	82.56	8.90	35.46
SEm (±)	0.31	0.28	0.23	0.25
CD (P = 0.05)	0.92	0.83	0.689	0.749
Levels of Sulphur (kg S ha^{-1})				
S_0	50.35	50.78	5.05	29.96
S_1	65.70	67.10	6.88	35.27
S_2	71.51	73.91	7.53	36.86
SEm (±)	0.31	0.28	0.23	0.25
CD (P = 0.05)	0.92	0.83	0.689	0.743

Table 3 Protein content of seeds in relation to sulphur and potassium content of total plant of chickpea (2 year mean data)

Treatments	K content (%)	S content (%)	Protein content (%)
K_0S_0	1.63	1.02	18.90
K_0S_1	2.05	1.28	20.93
K_0S_2	2.15	1.31	21.88
K_1S_0	1.85	1.16	20.95
K_1S_1	2.33	1.28	22.20
K_1S_2	2.63	1.35	22.70
K_2S_0	2.28	1.21	20.85
K_2S_1	0.91	1.28	23.10
K_2S_2	3.05	1.31	23.25

Table 4 Interaction effect of potassium and sulphur on nutrient uptake of chickpea (kg ha^{-1}) (Pooled data of 1998 – 99 and 1999 – 2000)

Potassium (kg K ha^{-1})	Nutrient uptake of chickpea (kg ha^{-1})											
	N			P			K			S		
	Sulphur (kg ha^{-1})											
	S_0	S_1	S_2	S_0	S_1	S_2	S_0	S_1	S_2	S_0	S_1	S_2
K0	38.05	47.70	51.85	3.05	3.65	4.50	41.55	53.10	57.15	26.50	33.65	35.45
K1	50.05	65.70	74.35	4.95	7.45	8.10	49.25	62.80	71.95	31.00	35.75	37.40
K2	64.25	87.90	95.55	7.15	9.55	10.00	60.25	81.20	81.45	32.40	36.45	37.55
SEm (±)		0.50			0.28			0.54			0.44	
CD (P =0.05)		1.45			0.839			1.61			1.31	

REFERENCES

Das, S.K.; Chopra, P.; Chatterjee, S.R.; Abrol, Y.P. and Deb, D.L. (1975) Influence of sulphur fertilization on yield of maize and protein quality of cereals. *Fert. News.* **20**(3) : 30 – 32.

Mondal, S.S.; Sarkar, M. and Ghosh, A. (2001) Effect of potassium and sulphur on chickpea in relation of growth and productivity under irrigated and non-irrigated condition. Proc. of National Seminar on Frontiers of Crops Management, pp. 111 – 112, Feb. 1 – 3.

Mondal, S.S. and Chetteri, M. (1998) Integrated nutrient management for sustaining productivity and fertility under rice based cropping system. *Indian Journal of Agricultural Science,* **68**(7) : 337 – 340.

Arora, S.K. and Luthra, Y.P. (1971) *Pl. Soil,* **34**:9 – 96.