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SOIL APPLICATION OF POTASSIUM AND SULPHUR AND EFFECT ON GROWTH AND YIELD COMPONENTS OF CHICKPEA (*Cicer arietinum* L.) UNDER SOUTH SAURASHTRA REGION OF GUJARAT

Jadeja, A.S., Rajani, A.V., Foram, Chapdiya, Kaneriy A, S.C. and Kavar, N.R.
Department of Agricultural Chemistry and Soil Science
Junagadh Agricultural University, Junagadh 362-001 (Gujarat), India
E-mail: jadejaamardipsinh99@gmail.com

Abstract: An field experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *rabi* season of 2014-15 to evaluate soil application of potassium and sulphur and effect on growth and yield components of chickpea (*Cicer arietinum* L.) under south Saurashtra region of Gujarat. The experiment comprising of four levels of potassium *viz.,* 0, 40, 60 and 80 kg K_2O ha^{-1} and sulphur *viz.*, 0, 20, 40, 60 kg S ha^{-1} and experiment was laid out in Factorial Randomized Block Design and replicated thrice. The results revealed that the growth, yield attributes and yields were significantly influenced by the various levels of potassium and sulphur. The application of potassium 60 and 80 kg K_2O ha^{-1} and sulphur 40 and 60 kg S ha^{-1} significantly increased the plant height, number of primary and secondary branches per plant, pods per plant, numbers of nodules, 100-seed weight, seed and stover yield.
Keywords: Cicer arietinum, Potassium, Sulphur.

INTRODUCTION

India is one of the major pulses growing country of the world, accounting roughly for one third of total world area under pulse cultivation and one fourth of total world production. Pulses occupy a key position in Indian diet and meet about 30 per cent of the daily protein requirement. Among the pulses; chickpea is a most important *Rabi* crop with high acceptability and wider use. India is the largest producer of chickpea in the world sharing 71.08 and 71.51 per cent of total area (11.55 m ha) and production (10.46 m tonnes), respectively (Singh, 2011).

The medium black calcareous soils of Saurashtra region in Gujarat are tended to decline in available potassium due to intensive cropping and gradually shifted towards negative K balance. The decreasing K availability in calcareous soil because of dominant black clay might be due to Ca^{+2} which limits the chances of K absorption. Simultaneously, the balance application of potassium not only gave higher yield but also improved the quality of economic produced. Sulphur plays an important role in enhancing the productivity and

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quality of chickpea. The importance of S in balance plant nutrition is realized with an increasing S deficiency in several areas due to intensive cropping and focus on high yielding varieties. In Gujarat, 17% of soils are deficient in available sulphur (Golakiya and Shobhana 2000). No work has been carried out on the effect of potassium and sulphur in chickpea in Saurashtra region. The potassium increases yield and quality of chickpea whereas, sulphur enhancing the productivity and quality of chickpea. Therefore, an experiment planned to know the effect of potassium and sulphur on yield and quality of chickpea and post harvest soil fertility.

MATERIALS AND METHODS

The experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *rabi* season of 2014-15. The soil of the experimental field was clayey in texture and alkaline in reaction (pH of 8.06 and EC of 0.41 dS m^{-1}). The soil was low in available nitrogen (244.20 kg ha^{-1}), medium in available phosphorus (28.80 kg ha^{-1}), medium in available potassium (218.45 kg ha^{-1}), medium in available sulphur (10.64 ppm), medium in iron (5.24 ppm), high in zinc (0.74 ppm), high in manganese (17.87 ppm) and high in copper (1.26 ppm). The experiment comprised of total sixteen treatment combinations in which four levels of potassium (0, 40, 60 and 80 K_2O kg ha^{-1}) and four levels of sulphur (0, 20, 40 and 60 S kg ha^{-1}) were laid out in Randomized Block Design having factorial concept with three replications. The fertilizer application was done with fixed doses of nitrogen at 20 kg ha^{-1} and phosphorus at 40 kg ha^{-1}. Potassium and sulphur application was done according to the treatments. The nutrients of N, P, K and S were applied by using sources of Urea, DAP, MOP and Cosavate (WG 90% S), respectively. The chickpea variety “Gujarat Gram-3” was planted in second week of October with spacing of 45 m × 10 m and seed rate of 60 kg ha^{-1}. The crop was raised with all the standard package of practices and protection measures also timely carried out as they required. The experimental data recorded for growth parameters, yield attributes and yield parameters were statistically analyzed for level of significance.

RESULTS AND DISCUSSION

Growth, yield attributes and yields

Effect of potassium

The data revealed that the maximum plant height (50.93 cm) was obtained with potash application of 60 kg ha^{-1} which was statistically at par with application of 80 kg ha^{-1}. Maximum number of primary and secondary branches (2.66 and 15.99) per plant was recorded in 60 kg potash per hectare (Table 1). Potassium application increased the

availability of nitrogen and phosphorus (Sahai, 2004), which resulted in better plant growth and more number of branches per plant. Nodule formation was maximum with 60 kg being at par with 40 and 80 kg K_2O per hectare but significantly different with rest of the doses. These findings were also collaborated with Kurdali et al. (2002) in chickpea.

A perusal of data (Table 1) revealed that different levels of potassium exerted their significant influence on 100-seed weight and numbers of pods. Application of 60 kg K_2O ha^{-1} recorded significantly the higher 100-seed weight (23.57 g) and maximum number of pods per plant (109.75), which was remain statistically at par with 80 kg K_2O. Similar findings were recorded by Ali et al. (2008) who studied the effect of different potassium levels and reported that the number of pod per plant was influenced significantly by potassium application.

Seed yield affected significantly by potassium levels up to the 60 kg ha^{-1} and beyond that level the differences were remained on par (Table 1). The highest seed yield (2086 kg ha^{-1}) was obtained with 60 kg ha^{-1} K_2O, which might be due to better attributed to more number of pods per plant and number of seeds per pod. Similar result was concluded by Samiullah and Khan (2003). While, minimum seed yield (1704 kg ha^{-1}) was observed with no potash fertilizer. These results are in agreement with those of Ali *et al*. (2008) and Ganga *et al*. (2014).

EFFECT OF SULPHUR

The plant height (Table 1) showed that different levels of sulphur exerted their significant influence on plant height at harvest; the application of 60 kg S ha^{-1} significantly recorded with the higher plant height of 50.11 cm, which was found statistically at par with 40 kg S ha^{-1}. The application of 40 kg S ha^{-1} recorded significantly the maximum number of primary branches per plant (2.67) and secondary branches per plant (13.99) at harvest, which was also at par with 60 kg S ha^{-1} on secondary branches per plant. The application of 40 kg S ha^{-1} resulted in significantly the higher number of nodules per plant (21.13), which remained at par with 20 kg S ha^{-1} and 60 kg S ha^{-1} at 45 DAS. Similar result was also concluded by Surendra and Katiyar (2010), Bhatt and Jain (2012) and Kumar *et al.* (2014).

Like wise, application of 40 kg S ha^{-1} recorded significantly the higher number of pods per plant (96.33) and 100-seed weight (23.60 g), which was statistically at par with 60 kg S ha^{-1}. Application of 40 kg S ha^{-1} recorded significantly the highest seed yield (2060 kg ha^{-1}), which was remained at par with 20 kg S ha^{-1} and 60 kg S ha^{-1}. However, application of 60 kg S ha^{-1} recorded significantly the highest stover yield (5464 kg ha^{-1}). This result also in conformity with those of Patel *et al.* (2013) and Bohra (2014).

Conclusion

It can be concluded that for obtaining higher yield components with better qaulity of chickpea (*cv*. GJG-3) should be fertilized with potassium 60 kg K_2O ha^{-1} or 60 kg K_2O ha^{-1} and sulphur 40 kg S ha^{-1} or 60 kg S ha^{-1} in medium black calcareous soils of South Saurashtra region of Gujarat.

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Table 1: Effect of potassium and sulfur on growth and yield components in chickpea

Treatments	Plant height at harvest (cm)	Primary branches/plant	Secondary branches/ plant	Number of nodules/ plant at 45 DAS	Number of pod/ plant	100 seed weight (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})
Potassium levels (kg K_2O ha^{-1})								
K_0 – Control	45.78	2.03	9.24	18.50	60.17	22.26	1704	4757
K_1 – 40	47.65	2.22	11.15	20.66	69.17	22.68	1948	5172
K_2 – 60	50.93	2.66	15.90	21.92	109.75	23.57	2086	5262
K_3 – 80	49.01	2.65	15.82	21.90	103.33	23.20	2037	5515
S. Em ±	0.83	0.07	0.34	0.29	2.93	0.26	59.86	168.16
C.D. at 5%	2.41	0.19	0.97	0.85	8.45	0.76	172.89	485.68
Sulphur levels (kg S ha^{-1})								
S_0 – Control	47.05	2.07	11.90	20.03	67.92	22.39	1810	4808
S_1 – 20	47.01	2.33	12.65	20.75	82.58	22.21	1889	5075
S_2 – 40	49.20	2.67	13.99	21.13	96.33	23.60	2060	5359
S_3 – 60	50.11	2.50	13.57	21.08	95.58	23.50	2015	5464
S. Em ±	0.83	0.07	0.34	0.29	2.93	0.26	59.89	168.16
C.D. at 5%	2.41	0.19	0.97	0.85	8.45	0.76	172.89	485.68
C.V.%	5.98	9.54	8.92	4.89	11.84	3.67	10.67	11.25