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Effect of sulphur and phosphorus management on growth and yield of chickpea

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ABSTRACT : A field experiment was conducted to study the effect of sulphur, phosphorus fertilization and PSB inoculation on growth and yield of chickpea (GC-2) during *Rabi* season of the year 2002. The results revealed that sulphur application significantly influenced growth and yield attributing characters over control treatments *viz.*, plant height, number of branches plant^{-1}, number of nodules plant^{-1}, dry weight of nodules plant^{-1}, number of pods plant^{-1}, grain yield plant^{-1}, grain and straw yields. While, maximum improvement in yield attributes was achieved upto application of 20 kg S ha^{-1}. Phosphorus management treatment either through application of 25 kg P_2O_5 ha^{-1} or combine application of 25 kg P_2O_5 ha^{-1} + PSB gave significant results on growth and yield attributes. Application of 20 kg S ha^{-1} and 25 kg P_2O_5 ha^{-1} + PSB to chickpea recorded maximum grain yield.

Key Words : Sulphur, Phosphorus, PSB, Chickpea

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Pulses are considered as an important part of food crop occupying a unique position in agriculture and also an important component of food grain crops because of their high nutritive value. Pulses also have inherent capacity to fix atmospheric nitrogen and adaptability to a wide range of agro-ecological, cropping system and management ability. Chickpea occupies third position among the grain legumes. India is a premiere chickpea growing country accounting 76 per cent of total area and production of the world.

Phosphorus is known to play beneficial role in legume grown by promoting extensive root development and nodulation. Phosphate dissolving micro organisms has capacity to render insoluble forms of phosphorus more available to plant, besides, metabolic products of soil microbes such as organic acids and humic substance from complexes with Fe and Al compounds thereby reducing further fixation. Concentration of sulphur in the plants range from 0.1 to 0.4 per cent. Sulphur is call the fourth major nutrient because crops, in general required sulphur just slightly less than phosphorus. Phosphorus and sulphur are reported to have synergistic effect on productivity of crops. Sulphur being the constituent of some amino acid, promotes the bio synthesis of protein.

RESEARCH PROCEDURE

A field experiment was conducted at the College Agronomy Farm, B.A. College of Agriculture, Anand during *Rabi* season 2002-03 to study the Influence of sulphur, phosphorus fertilization and PSB inoculation on growth and yield of chickpea (GC-2) under middle Gujarat condition. The soil of experimental plot was loamy sand in texture having good draining with 7.9 pH. The soil was low in organic matter and available nitrogen, medium in available phosphorus and high in potassium. The experiment comprised of combination of three levels of sulphur application *viz.*, S_0: 0 kg S ha^{-1}, S_1 : 20 kg S ha^{-1} and S_2 : 40 kg S ha^{-1} and four phosphorus management treatment *viz.*, P_0 : No phosphorus, number PSB, P_1 : PSB inoculation, P_2 : 25 kg P_2O_5 ha^{-1}, P_3 : 25 kg P_2O_5 ha^{-1} + PSB. The experiment was tried in Factorial Randomized Block Design (FRBD) with four replications. One common application of 25 kg N ha^{-1} was given to all the treatments as starter dose. The value of S.Em.± and co-efficient of variation (C.V. %) was also worked out.

RESEARCH ANALYSIS AND REASONING

Effect of Sulphur levels :

The results obtain from the present investigation

presented in Table 1 revealed that application of sulphur with rate of 20 kg S ha^{-1} gave maximum grain (807.31 kg ha^{-1}) and straw yields (1996.25 kg ha^{-1}). Maximum seed yield under treatment S_2 might be due to its pivotal role in regulating the metabolic and enzymatic processes including photosynthesis, respiration and legume *Rhizobium* symbiotic nitrogen fixation which reflected in increased in yield. The other reason might be due to improving vegetative growth it activates certain photolytic enzymes and co-enzymes and also in carbohydrate metabolism (Bixby and Beaton, 1970). Thus, these bio-activities of sulphur might have played important role in improving yield attributing characters and total yield of chickpea. It also might be due to role of chlorophyll synthesis by increasing the activity of herematin enzyme consequently more photosynthetic occurs which translocated from leaves to sink site (pods and grain) resulting into robust pods and grain.

An appraisal of data (Table 2) indicated that application of sulphur did not give significant effect of plant population of chickpea at 20 DAS. Treatment S_2 (40 kg S ha^{-1}) recorded significantly higher plant height at 25 DAS, grain yield $plant^{-1}$ and dry weight of nodules $plant^{-1}$. While, application of sulphur 20 kg S ha^1 (S_1) recorded significantly high plant height at 50 DAS, at harvest, number of effective branches $plant^{-1}$, number of effective nodules $plant^{-1}$, and numbers of pods $plant^{-1}$ over the rest of sulphur levels. The increase in the vegetative growth could be attributed might be to role played by sulphur in the formation of disulphide linkages which are associated with structural characteristic of the protoplasm (Bixby and Beaton, 1970).

Table 1 : Effect of sulphur and phosphorus management treatment on yield attributing characters, grain and straw yields of chickpea

Treatments	No. of pods per plant	Grain yield / plant (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
Sulphur levels (S)				
S_0 (0 kg S ha^1)	15.58	11.23	720.20	1861.85
S_1 (20 kg S ha^1)	21.93	14.41	807.31	1996.25
S_2 (40 kg S ha^1)	20.36	14.19	783.35	1985.51
S.Em.±	0.16	0.46	10.75	10.67
C.D. (P=0.05)	0.456	1.37	30.94	30.71
Phosphorus management (P)				
P_0 = No phosphorurs and No PSB	16.72	11.14	614.09	1803.45
P_1 : PSB alone	19.48	13.05	713.92	1890.03
P_2 : 25 kg P_2O_5 ha^{-1}	19.39	13.68	854.60	2023.93
P_3 : 25 kg P_2O_5 ha^{-1} + PSB	21.58	15.22	898.54	2074.06
S.Em.±	0.18	0.55	12.41	12.32
C.D. (P=0.05)	0.527	1.58	35.72	35.47
C.V. %	3.28	14.33	5.57	2.19

Table 2 : Effect of sulphur and phosphorus management treatment on growth attributing characters of chickpea

Treatments	Plant population at 20 DAS	Plant height			No. of branches / plant	No. of nodules/ plant	Dry wt. of nodule /plant (mg)
		25 DAS	50 DAS	At harvest			
Sulphur levels (S)							
S_0 (0 kg S ha^1)	6.71	16.62	27.29	36.61	18.33	14.66	28.80
S_1 (20 kg S ha^1)	6.23	17.62	29.74	39.59	20.02	17.50	28.95
S_2 (40 kg S ha^1)	6.81	19.51	27.29	39.17	18.44	17.40	30.15
S.Em.±	0.23	0.13	0.46	0.45	0.39	0.48	0.36
C.D. (P=0.05)	NS	0.378	1.34	1.28	1.12	1.39	1.05
Phosphorus management (P)							
P_0 = No phosphorurs and No PSB	6.85	15.57	26.80	35.93	18.16	12.18	27.24
P_1 : PSB alone	6.61	17.12	27.17	37.83	17.73	15.25	29.71
P_2 : 25 kg P_2O_5 ha^{-1}	6.10	19.00	29.67	39.55	19.73	19.24	30.11
P_3 : 25 kg P_2O_5 ha^{-1}+ PSB	6.78	19.98	28.79	40.51	20.09	19.42	30.12
S.Em.±	0.27	0.15	0.54	0.51	0.45	0.56	0.42
C.D. (P=0.05)	NS	0.437	1.54	1.48	1.30	1.60	1.21
C.V. %	-	2.93	6.61	4.63	8.25	11.66	4.98

Effect of phosphorus management :

Date presented in Table 1 reveled that grain yield plant^{-1} (15.22 g), grain (898.54 kg/ha) and straw (2074.06 kg/ha) yields were significantly affected by application of 25 kg P_2O_5 ha^{-1}+ PSB (P_3) gave better results as compared to rest of phosphorus management treatments. The increasing in grain and straw yields due to PSB inoculation may be attributed to solubilization of native (insoluble) or applied P in soil by bacteria and thus making it available for the plant use (Ahmad and Jha, 1997). Which in turn helps to put forth profuse growth and produced more yield attributes such as plant height, number of pods plant^{-1}, and grain yield plant^{1}. It also might be due to combine effect of significant increasing in growth attributing characters, it also plays important role in legume growth by promoting extensive root development and nodulation and thereby ensuring better nutritional environment growth and finally grain and straw yields.

Application of 25 kg P_2O_5 ha^{-1}+ PSB (P_3) recorded significantly higher plant height at 25 DAS and at harvest, number of branches plant^{-1}, No of nodules plant^{-1}, dry weight of nodules plant^{-1} and number of pods plant^{-1}. While, treatment P_2 (25 kg P_2O_5 ha^{-1}) recorded significantly higher plant height at 50 DAS (Table 2). It might be due to crop phosphobacteria dissolved insoluble P in the soil, making it available to crop plants for profuse root and vegetative growth and growth promoting substances (Dixit *et al.*,1983).

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