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Yield, Quality and Post Harvest Nutrient Status of Chickpea as Influence by Application of Sulhur and Phosphorus Fertilizer Management

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Abstract- A field experiment was conducted at the College Agronomy Farm, B.A. College of Agriculture, Anand, Gujarat during ***rabi*** season 2002-03 on loamy sand soil. The experiment was conducted to study the effect of sulphur, phosphorus fertilization and PSB inoculation on growth and yield of chickpea (GC-2). It was consisting of combination of three levels of sulphur and four phosphorus management treatments. The experiment was laid down in Factorial Randomized Block Design (FRBD-2) with four replications. The results revealed that application of sulphur and phosphorus fertilization with PSB inoculation gave significant effect on yield, protein content, nitrogen content, sulphur content and post harvest soil nutrients status. From the yield and economic point of view, it is concluded that for securing maximum yield the chickpea crop should be fertilized with 20 kg S ha^{-1} and 25 kg P_2O_5 ha^{-1}+ PSB and also maintained soil health.

Index Terms- sulphur, phosphorus, PSB and chickpea

I. INTRODUCTION

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. Phosphorus is known to play beneficial role in legume growth by promoting extensive root development and nodulation. Phosphorus dissolving micro organisms have a capacity to render insoluble form of phosphate more available to plants, besides metabolic products of soil microbes, such as organic acids and humic substance form complex with Aluminium and iron compounds thereby reducing further fixation. Sulphur has their role in growth and development of legumes. Phosphorus and sulphur reported synergistic effect on crop growth.

II. MATERIALS AND METHODS

A field experiment was conducted at the College Agronomy Farm, B.A. College of Agriculture, Anand, Gujarat 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, no 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-2) with four replications. One common application of 25 kg N ha^{-1} was given to all the treatments as starter dose.

Effect of sulphur

Application of sulphur with rate of 20 kg S ha^{-1} gave maximum grain (807 kg ha^{-1}) and straw yields (1996 kg ha^{1}), which was remain at par with the treatment of S_2 (40 kg S ha^{1}). Sulphur besides improving vegetative growth it activates certain photolytic enzymes and co-enzymes (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.

Further, result reveled that (Table-1) application of sulphur @ 40 kg S ha^{-1} were gave higher % N in grain, Protein % and S content. While, sulphur application gave not significant effect on P content (%) of chickpea grain. The increasing N, S and protein content in grain might be due to synergistic effect of both N and S which increased their availability in the soil (Ramkala and Gupta, 1999) and an increasing in protein content obtained with S_2 was mainly owing to greater absorption of N and S by chickpea grain. Since both nutrient are closely linked with protein metabolism and their relation is synergistic (Aulakh and Pasrich, 1983).The increasing in grain protein content is expected.

Data presented in Table-1 indicated that significantly higher available nitrogen, available phosphorus and available sulphur were observed under sulphur treated plots over no sulphur application. In general, the residual available status of nitrogen and phosphors in soil after crop harvest showed considerable improvement over initial levels irrespective of the treatments. It may be concluded that growing of chickpea enhanced the soil fertility status due to heavy leaf drop and leaf over root system coupled with nitrogen fixation. The acid secreted by the nodule bacterial increase the available soil phosphorus by dissolving the acid soluble phosphorus.

Effect of Phosphorus management

Perusal of data presented in Table-1 indicated that Grain (899 kg ha^{-1}) and straw (2074 kg ha^{-1}) yields were significantly affected by application of phosphorus management treatments. Treatment P_3 (25 kg P_2O_5 ha^{-1}+ PSB) gave better results as compared to rest of phosphorus management treatments (Table-01). 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). It also might be due to combine effect of significant increasing in growth attributing characters as well as N and S content in grain and there by their uptake by plant. Phosphorus is known to play beneficial role in legume growth promoting extensive root development and nodulation there by better nutritional environment for growth and finally the grain and straw yields. (Singh *et.al.*,1984).

Further, results revealed that (Table-1) application of phosphorus management treatment found significant effect on N, P and S content in grain of chickpea. Application of 25 kg P_2O_5 ha^{-1}+ PSB (P_3) recorded significantly highest N and P content, while in case of sulphur content it was remain at par with application of 25 kg P_2O_5 ha^{-1} (P_2).This was due to adequate application of phosphorus to the crop might have induced increased root growth and nodulation resulting in increased absorption and availability of N, P and S upper soil layer. Phosphorus management treatment had also significantly influenced on protein content in grain. The effect was similar to that of N content in grain. Increasing protein content in respective treatment was mainly on account of significant increase in N content and also more absorption of sulphur by chickpea grain. Since, both nutrients are closely linked with protein metabolism and their relationship is synergistic (Aulakh and Pasricha,1983).

Post harvest nutrient status of soil was significantly influenced by phosphorus management treatment (Table-1). Significantly the maximum post harvest nutrient status were observed under P_3 (25 kg P_2O_5 ha^{-1}+ PSB) treatment. It was only due to in general the residual available status of nitrogen and phosphorus in soil after crop harvest showed considerable improvement over initial status it may be concluded that growing of chickpea enhanced the soil fertility status due to heavy leaf drop and leaf over root system coupled with nitrogen fixation. The acid secreted by the nodule bacterial increase the available soil phosphorus by dissolving the acid soluble phosphorus (Jain and Singh 2003).

III. CONCLUSION

From the study it could be concluded that yield, quality parameters and post harvest soil nutrient status were significantly influenced by application of sulphur and phosphorus fertilizations with PSB inoculation. Application of 20 kg S ha^{-1} with 25 kg P_2O_5 ha^{-1}+ PSB was produced more yield. From the yield and economic point of view, it is concluded that for securing higher yield the chickpea crop should be fertilized with 20 kg S ha^{-1} and 25 kg P_2O_5 ha^{-1}+ PSB and also maintained soil health.

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Table-1 : 1 Effect of sulphur and phosphorus management treatments on yield, grain quality parameters, post harvest soil nutrient Stuatus.

Treatment	Grain yield (kg/ha)	Straw yield (kg/ha)	N % content	Protein content (%)	P %	S %	Post harvest soil nutrient status (kg ha^{1})		
							P_2O_5	K_2O	S
Sulphur Levels (S)									
S_0 (0 kg S ha^{1})	720	1862	2.76	17.27	0.36	0.27	223.85	45.10	20.68
S_1 (20 kg S ha^{1})	807	1996	2.90	18.14	0.36	0.29	231.26	47.76	22.75
S_2 (40 kg S ha^{1})	783	1985	3.37	21.6	0.37	0.31	233.77	47.71	25.31
S.Em.±	10.75	10.67	0.09	0.56	0.005	0.004	0.43	0.50	0.399
C.D. (P=0.05)	30.94	30.71	0.26	1.62	NS	0.013	1.24	1.45	1.15
Phosphorus management (P)									
P_0 = No phosphorurs and No PSB	614	1803	2.48	15.50	0.34	0.26	225.98	42.76	19.65
P_1 : PSB alone	714	1890	2.70	16.91	0.36	0.28	228.51	45.71	21.84
P_2 : 25 kg P_2O_5 ha^{-1}	855	2023	3.26	20.38	0.37	0.30	230.05	47.93	24.06
P_3 : 25 kg P_2O_5 ha^{-1}+ PSB	899	2074	3.60	22.50	0.39	0.31	233.97	51.02	26.10
S.Em.±	12.41	12.32	0.10	0.65	0.006	0.005	0.45	0.58	0.461
C.D. (P=0.05)	35.72	35.47	0.30	1.87	0.016	0.015	1.44	1.67	1.33
C.V. %	5.57	2.19	11.90	11.92	5.39	6.18	3.75	4.30	6.97