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EFFECT OF DIFFERENT LEVELS OF SULPHUR AND FYM ON YIELD AND SOIL NUTRIENT STATUS OF CHICKPEA

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Abstract

A field experiment was conducted during *rabi* 2013 in *Vertisol* at Instructional Farm of Indira Gandhi Agricultural University, Raipur (C.G.), India; to study the Effect of different levels of sulphur and FYM on yield and soil nutrient status of chickpea. The objectives of the study were to estimate the nutritional requirement, efficiency of fertilizer, soil test and organic source (FYM), to estimate the fertilizer requirement of chickpea crop based on soil test levels using INM approach. Chickpea crop required 0.47 kg S to produce one quintal of grain. Fertilizer and soil test efficiencies estimated were 12.06 and 21.53 per cent, respectively for sulphur. The FYM contribution for S nutrient were estimated as 1.93.

Key words : Soil test, *Vertisol*, chickpea, nutritional requirement, INM approach.

Introduction

India ranks Ist in Chickpea production. In India, chickpea is grown in area of 8.56 million ha with an annual production of 7.35 million tonnes and productivity 858 kg/ha (Anonymous, 2012). The fertilizer application practices based on targeted yield approach indicated the possibility of enhancing production potential of chickpea crop. The present study was undertaken to develop balanced fertilizer schedule with FYM application for desired yield targets of chickpea in *Vertisols* of Chhattisgarh State. The effective fertilizer recommendation should consider crop needs and nutrient already available in the soil. Continuous use of inorganic nutrients may adversely affect the physico-chemical properties of soil and thereby affect the crop yields. In order to sustain the yield and reduce the dependency on inorganic fertilizer use, conjunctive use of organic manures and fertilizers is essential.

Materials and Methods

A field experiment was conducted at the farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh, India) on soil test crop response correlation with chickpea (JG-130) during *rabi* season, 2013 in *Vertisol*. The soil of the experimental field comes under the soil order of *Vertisol*. This soil is locally known as *Kanhar* and identified as Arang II series. It is clayey in texture with 24.3% sand, 21.4% silt and 54.3% clay, dark brown to black in color, neutral to alkaline in reaction due to presence of lime concretion in lower horizon. The soil is deep to 1-1.5 meter. The structure varied from coarse angular blocky to massive and cloddy and in few cases from prismatic or columnar. Soil is represented as typical fine montmorillonitic, hyperthermic, udic chromustert. Some physico-chemical properties of experimental soil were 8.03 pH (1:2.5), 0.18 EC (dSm^{-1}), 36.32 CEC [Cmol (p^+) kg^{-1}], 5.80 organic C (g kg^{-1}), available N 238 kg ha^{-1}, available S 27.08 kg ha^{-1} 19.3 available P (kg ha^{-1}), 486 available K (kg ha^{-1}). A special field technique developed by Ramamurthy *et al*. (1967) was used for this study. The field was divided in to three equal long strips and denoted as L_0, L_1 and L_2. Prior to conducting the actual field experiment, a fertility gradient was created by applying the graded doses of N, S, P and K fertilizer for obtaining the appropriate variation in soil fertility in different strips. The source of S were used as Bentonite. Each strip was divided in to three equal sizes for three levels of FYM (0, 5 and 10 t ha^{-1}) and was treated as block. A representative sample of FYM applied was analysed for nutrient content and resulted as 0.40, 0.30 and 1.00 per cent N P and K, respectab ly. The 24 selected fertilizer treatments constituted 4 levels of each of S (0, 10, 20 and 30 kg ha^{-1}). These were distributed in each

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block of the strips having 8 treatments in each block. Soil samples were analysed for available S (0.15% $CaCl_2$ extractable-S).

Results and Discussion

Establishment of fertility gradient

Soil available nutrient : The range and mean values of available nutrient S (table 1) indicate that soil test S varied with different fertility strips although soil test S variations with respect to fertility strip were marginal.

Table 1 : Range and mean values of available S (kg ha^{-1}).

Soil nutrients	L_0	L_1	L_2	SD	CV %
0.15% $CaCl_2$ extractable -S	18.78-35.95 (25.38)	18.89-35.92 (27.38)	22.17-40.98 (28.10)	4.81	17.87

Crop yield : Table 2 gives the range and averages of chickpea yield in relation to different fertility strips. It was observed from the results that there was increasing trends in chickpea yields from L_0 to L_2 fertility strips due to increasing S level. Highest yield of 23.51 q ha^{-1} was observed in L_2 strip with a good response to the application of highest dose of fertilizer and 7.33 q ha^{-1} was observed in the L_0 strip without fertilizer (control).

Table 2 : Range and mean of grain yields of chickpea (Var JG-130) yield (q ha^{-1}).

Fertility strips	Grain yield (q ha^{-1})			SD	CV %
	Minimum	Maximum	Average		
L_0	7.33	22.21	15.56	4.21	27.07
L_1	9.09	22.44	16.39	3.81	23.23
L_2	10.19	23.51	17.10	3.99	23.33
All strips	**7.33**	**23.51**	**16.35**	**4.00**	**24.47**

Relationship between yield and nutrient uptake

The chickpea yields showed the close association with total S uptake. This relation was used to estimate the nutrient requirement for chickpea (table 3). The nutrient requirement (NR) is defined as the amount of nutrient required to produce per unit amount of yield. The nutrient requirement can be given by the regression co-efficient (b_1) of yield (Y) and total nutrient uptake (U).

$Y = b_1 U$ or $U = 1/b_1 * Y$

Where, $1/b_1$ give the NR.

Nutrient requirement and Development of basic parameters

Results presented in table 4 show the nutrient requirement (NR) for S (kg q^{-1}), efficiency of fertilizer (E_f), Soil test (Es) and FYM were estimated. The chickpea required about 0.47 kg S to produce one quintal of grain. Fertilizer efficiencies for S was less than soil test efficiency. Contrary to this, efficiency of FYM was found to be less with S.

Table 3 : Relation of chickpea yield (Y) with total nutrient uptake (U).

Nutrient	Chickpea	
	$Y = b_1 U$	R^2
S	Y = 2.131 U	0.99

Table 4 : Nutrient requirement, fertilizer, soil and FYM efficiencies.

Nutrient	NR (kg q^{-1})	Fertilizer Efficiency (%)	Soil Test Efficiency (%)	FYM Efficiency (%)
S	0.47	12.06	21.53	1.93

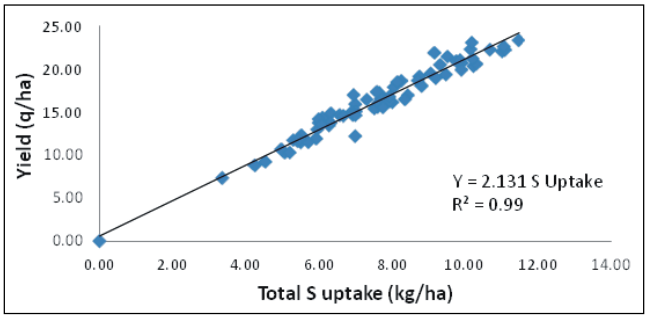

Fig. 1 : Relationship between chickpea grain yield and total S uptake.

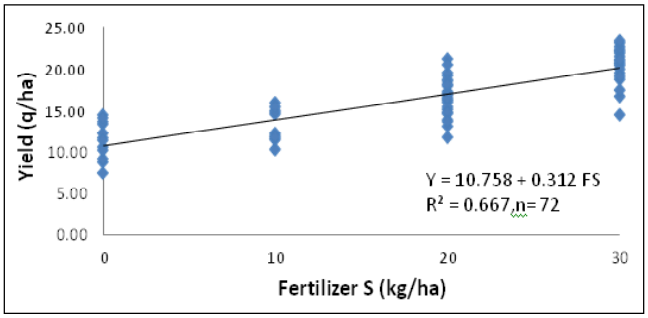

Fig. 2 : Chickpea grain yield response to fertilizer S application.

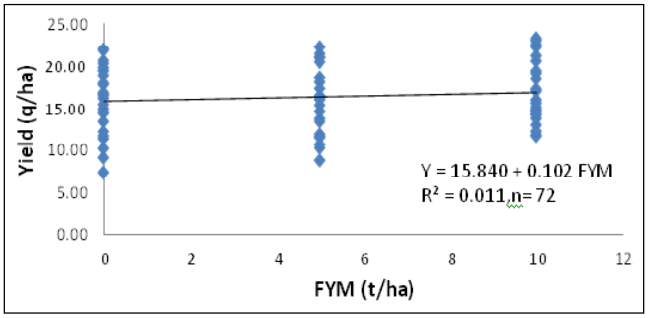

Fig. 3 : Chickpea grain yield response to FYM application.

In the present investigation, presence of adequate variability in chickpea grain yield and S uptake was observed due to operational range of soil test values. 0.15% $CaCl_2$ extractable-S were found to be the highest in strip III (L_2) followed by strip II (L_1) and least in strip I (L_0). The marked fertility gradient built up was reflected in terms of grain yield and nutrient uptake. Similar kind of trend for mean nutrient uptake was observed in the experiment. Mean nutrient requirement for producing one quintal of chickpea grain was 0.47 kg S.

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