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Effect of different sources of phosphorus and sulphur on growth and yield of *kharif* groundnut (*Arachis hypogaea* L.)

Kiran U. Lande[1*], Ghotmukale A.K[2],Mane S.G[3] and Waghmare S.S[3]
Department of Agronomy, College of Agriculture, Latur- 413512
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.
Email id- kiranlande741@gmail.com

ABSTRACT
A field experiment was conducted during kharif 2018 at Experiment Farm, Agronomy Section,Oilseeds Research Station, Latur (MS) to study the Effect of different sources of phosphorus and sulphur on growth and yield of kharif groundnut (Arachis hypogaea L.).Groundnut crop grown in kharif season produced significantly higher growth characters, yield attributes, seed yield and also higher gross and net monetary returns with higher B:C ratio was obtained due to 50 kg Phosphorus through SSP + 5 tonnes FYM ha^{-1} *(*T_2*) and followed by application of 50 kg Phosphorus through DAP + 5 tonnes FYM ha*$^{-1}$ *(*T_3*).*
Keywords *–Phosphorus, Sulphur, Groundnut*

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INRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the most important leguminous oilseed crop belonging to family Fabaceae (Leguminosae) and sub family Papilionaceae. The commercially cultivated groundnut varieties belong to the species *viz*., hypogaea (verginia or runner), fastigiata (Valencia) and vulgaris (spanish). Groundnut is also known as peanut, monkey nut, earth nut, etc. and supposed to be originated from Brazil. India is third largest oil producing country in the world next to USA and China. In Indian farming groundnut accounts for 45 per cent of the total cropped area and 55 per cent of the total area under oilseed production. The area under groundnut cultivation in the world is 25.67 million hectare and production is 42.31 million tonnes and productivity of 1648 kg ha^{-1}.India ranks first in the world for area and production. The area, production and productivity of groundnut in the country during the year 2017 was 5.33 million hectare, 7.46 million tonnes and 1400 kg ha^{-1}, respectively. The total area in Maharashtra was 0.35million hectares with production 0.42 million tonnes and productivity was 1148 kg ha^{-1}. The total area in Latur district was 53 hectares with production of 18 tonnes and productivity of339 kg ha^{-1} reported by Anonymous [1]. Phosphorus is an important primary nutrient and enhances root growth there by facilitating absorption of water and nutrients from deeper layers. Phosphorus stimulates not only root growth but also hastens the maturity of oilseed crops. The groundnut crop requires judicious supply of phosphorus for its normal growth and development. The total amount of phosphorus taken up by groundnut crop is relatively small amounting to 0.4 kg available phosphorus to produce 100 kg of pods reported by Reid and Cox [4]. Sulphur is identified as a key element for increasing the production of oilseeds by increasing the uptake of various macro and micro nutrients in groundnut reported by Singh [6]. There are large numbers of sulphur sources available in the country and their efficiency in crops like groundnut needs to be evaluated. Inoculations with an effective Sulphur Oxidizing Rhizobium (SOR) strain increased yield as well as oil content of groundnut through convey the additional sulphur demand of plant by increasing the availability. The importance of sulphur particularly in oilseeds crop has never been in greater evidence than today.

MATERIAL AND METHODS

A field experiment was conducted during *kharif* 2018 at Experiment Farm, Agronomy Section, Oilseeds Research Station, Latur. The soil was clayey in texture, low in available nitrogen (189.92 kg ha^{-1}), medium in phosphorus (21.18 kg ha^{-1}), medium in potassium (280.16 kg ha^{-1}) and slightly alkaline in reaction (8.04 pH). The experiment was laid out in Randomized Block Design with 7 treatments replicated thrice. The treatments were T_1- Control, T_2- 50 kg Phosphorus through SSP + 5 tonnes FYM ha^{-1},T_3- 50 kg Phosphorus through DAP + 5 tonnes FYM ha^{-1}, T4- RDF + 20 kg Sulphur through Gypsum (10 kg at the time of sowing and 10 kg at the time of peg formation.), T_5 - RDF + 20 kg Sulphur through elemental sulphur, T_6- RDF + 20 kg Sulphur through $ZnSO_4$, T_7 - RDF+ 20 kg Sulphur through $FeSO_4$.The gross and net plot size was 5.4 m x 4.2 m and 4.8 m x 3.6 m respectively. FYM was applied before sowing as per treatments. Sowing was done on 8th July, 2018. The recommended dose of fertilizer was applied as per treatments through Urea and S.S.P. The crop was harvested on 13th October 2018.

RESULT AND DISCUSSION

Growth and growth attributes

The data presented in Table No.1 revealed that the growth attributes *viz*., plant height, number of branches per plant, leaf area per plant and dry matter accumulation per plant were influenced significantly due to different sources of phosphorus and sulphur. The application of 50 kg phosphorus through SSP + 5t FYM ha^{-1} (T_2) produced significantly higher plant height which was at par with application of 50 kg phosphorus through DAP + 5t FYM ha^{-1} (T_3) and RDF + 20 kg sulphur through gypsum (T_4) of groundnut as compared to other treatments. The increase in growth attributes may be due to better uptake and translocation of plant nutrients to growing plants, adequate supply of nutrients resulted in higher production of photosynthate and their translocation to sink, which ultimately increased the plant growth and growth attributes. Similar result reported by Panwar and Singh [2], Shelke *et al.* [5] and Singh *et al*. [7].The positive effect with the application of 50 kg phosphorus through SSP + 5t FYM ha^{-1} (T_2) followed by T_3 i.e. application of 50 kg phosphorus through DAP + 5t FYM ha^{-1} and RDF + 20 kg sulphur through gypsum (T_4) produced maximum number of branches at all growth stages of crop. The increase in growth under these treatments might be attributed due to the adequate supply of nutrients with which the crop was ultimately favoured better environment for proper growth and development. These result are in conformity with the Rao and Shaktawat [3], Panwar and Singh [2], Shelke *et al.* [5] and Singh *et al*. [7].

Though the treatment of 50 kg phosphorus through SSP + 5t FYM ha^{-1} (T_2) recorded highest leaf area per plant but it was found at par with the treatment 50 kg phosphorus through DAP + 5t FYM ha^{-1}(T_3).Dry matter $plant^{-1}$(g) was the resultant of photosynthetic activity and its photo morphogenesis. The rate of increase in dry matter accumulation was slow up 45 days, rapid between 45 to 75 DAS and attained maximum at harvest. The application of 50 kg phosphorus through SSP + 5t FYM/ha (T_2) followed by T_3 i.e. application of 50 kg phosphorus through DAP + 5t FYM/ha produced higher dry matter $plant^{-1}$ (g).

Yield attributes and yield

Yield attributes *viz*., number of pods, dry weight of pods, seed yield per plant and seed yield (kg/ha) were significantly affected by different treatments (Table No.2). The application of 50 kg phosphorus through SSP + 5t FYM/ha (T_2) recorded significantly highest number of pods per plant, dry weight of pods per plant, seed yield per plant and seed yield (kg ha^{-1}) over rest of the treatments. Among various sources of phosphorus and sulphur the treatment where fertilizer is not applied (T_1) recorded significantly lowest number of pods per plant , dry weight of pods per plant, seed yield per plant and seed yield (kg ha^{-1}) over the treatment.The pod yield $plant^{-1}$ (g) seed yield $plant^{-1}$ (g) was significantly influenced by the various treatments. The application of 50 kg phosphorus through SSP + 5t FYM/ha (T_2) recorded higher pod and seed yield $plant^{-1}$ followed by application of 50 kg phosphorus through DAP + 5t FYM/ha (T_3). Higher level of these parameters could be attributed due to better uptake and translocation of plant nutrients to growing plants, adequate supply of nutrients resulted in higher production of photosynthate and their translocation to sink, which ultimately increased the plant growth and yield attributes. These result are in conformity with the results Panwar and Singh [2], Singh *et al*. [7].

Based on above studies it is concluded that among various sources of phosphorus and sulphur fertilizer application 50 kg phosphorus through SSP + 5t FYM/ha noticed as the major fertilizer in groundnut production.

Table 1. Plant height, number of branches plant^{-1}, leaf area plant $^{-1}$and dry matter plant $^{-1}$ influenced by various treatments.

Treatment details	Plant height (cm)	No. of branches plant^{-1}	Leaf area plant^{-1} (dm^2)	Dry matter plant^{-1} (g)
T_1-Control	24.47	5.43	3.13	21.00
T_2-50 kg phosphorus through SSP + 5t FYM/ha	33.00	7.20	4.37	33.00
T_3-50 kg phosphorus through DAP + 5t FYM/ha	31.45	6.33	4.31	29.60
T_4- RDF + 20 kg sulphur through gypsum	29.80	6.17	4.14	28.00
T_5- RDF + 20 kg sulphur through elemental sulphur	28.60	5.97	3.82	27.80
T_6 - RDF + 20 kg sulphur through $ZnSO_4$	28.00	5.77	3.78	27.40
T_7 - RDF + 20 kg sulphur through $FeSO_4$	27.50	5.50	3.27	24.30
SE±	1.36	0.33	0.25	1.45
C.D. at 5%	4.20	1.01	0.76	4.46
General Mean	**28.97**	**6.05**	**3.83**	**27.30**

***A.H- At harvest**

Table 2. Effect of Number of pods plant^{-1}, Dry weight of pods plant^{-1}, Seed yield plant^{-1} and Dry pods yield kg ha^{-1}on yield attributing characters

Treatments	Number of pods plant^{-1}	Dry weight of pods plant^{-1} (g)	Seed yield plant^{-1} (g)	Dry pods yield (kg ha^{-1})
T_1 –Control	13.67	6.55	4.43	1205
T_2 -50 kg phosphorus through SSP + 5t FYM/ha	22.67	11.69	9.03	2350
T_3-50 kg phosphorus through DAP + 5t FYM/ha	21.00	10.71	8.27	2052
T_4 - RDF + 20 kg sulphur through Gypsum	19.17	8.50	6.55	1937
T_5- RDF + 20 kg sulphur through elemental sulphur	18.67	8.17	6.06	1820
T_6 - RDF + 20 kg sulphur through $ZnSO_4$	18.17	7.49	5.80	1710
T_7 - RDF + 20 kg sulphur through $FeSO_4$	17.17	7.17	4.83	1648
SE±	1.18	0.33	0.35	111
C.D. at 5%	3.65	1.01	1.08	341
General Mean	**18.64**	**8.61**	**6.42**	**1817**

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