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Research Article

Effect of Sulphur Levels and Varieties on Growth, Yield and Quality of Soybean (*Glycine max* L.)

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ABSTRACT

A field experiment was conducted to evaluate the effect of Sulphur levels and varieties on growth, yield and quality of soybean. Experiment comprised 12 treatment combination involving four soybean varieties (JS- 2034, JS- 2029, JS- 2068 and RVS-2001-04) and three Sulphur levels (0, 25 and 35 kg/ha) treatment in randomized block design with factorial concept replicated thsoybean during kharif season of 2020-21 at Instructional Farm of Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.). Statistical analysis of the results revealed that individually soybean variety of RVS-2001-04 and sulfur application at 35 kg S/ ha reported to have maximum plant height (46.78 cm), number of branches per plant (9.00) at maximum crop growth stage, number of pods per plant (33.53), length of pod (4.88 cm), number of seeds per pod (3.73), seed index (10.57 g), seed (16.67 q/ha) & straw yield per hectare (33.84 q/ha) and oil content (21.60 %). It was concluded from the results that application of Sulphur @ 35 kg/ha for soybean variety of RVS-2001-04 improved yield and yield components of soybean.

Keywords: *Soybean, Sulphur, Test weight, Pod, Seed index, Straw yield.*

INTRODUCTION

Soybean (*Glycine max* L. Merrill), is an introduced and commercially exploited crop in India. It has highest protein 40 %, oil 20 %, rich in lysine and vitamins A, B and D and also rich in mineral salts. Soybean is preferable for human nutrition due to its high protein content and it is a good source of isoflavones and therefore it helps in preventing heart diseases, cancer. Soybean oil is the leading vegetable oil in the world and is used in many industrial applications including biodiesel. The crop is called as “Golden Bean” or “Miracle crop” of the 21st century because of its high nutritional value and myriad form of uses. Soybean was grown in a small way for the past many decades in India, but since 1972 the area sown to the crop has increased substantially.

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Currently, in India area under soybeans, production and productivity of soybean are 110.65 lakh hectares, 86.42 lakh mt and 1.28 mt/ ha (Directorate of Economics and Statistics, 2015-16). The Madhya Pradesh is known as "Soybean state". It occupies 3rd place among the nine oil seed crops of India. The total area under soybean crop grown in India during kharif- 2017 was 10.25 million hectares with production of 8.35 million tonnes and productivity 814 kg/ha. In Madhya Pradesh, soybean is an important kharif legume and grown during kharif- 2017 in 5.01 million hectares, with production of 4.20 million tonnes. The average productivity was 823 kg/ha (Anonymous, 2017).

Sulphur is one of the essential nutrients required for the plant growth. It is now assuming importance next to the major nutrients i.e., nitrogen, phosphorus and potassium. Intensive cultivation with high yielding varieties, use of high analysis NPK fertilizers and limited manuring have resulted in emergence of secondary and micronutrient deficiencies in soils. Among secondary nutrients, deficiency of sulphur (S) was reported by Ghosh et al. 2012. Sulphur deficiency in soils of Indian states varies from 5 to 83 per cent with overall mean of 33 to 41 per cent16.

Sulphur is the fourth major plant nutrient after nitrogen, phosphorus and potassium for Indian agriculture. It is essential for synthesis of amino acids, proteins, oils, a component of vitamin A and activates enzyme system in plant. Three amino acids *viz.*, methionine (21% S), cysteine (26% S) and cystine (27%S) contain S which are the building blocks of proteins. About 90% of Sulphur is present in these amino acids. Sulphur is also involved in the formation of chlorophyll, glucosides and glucosinolates, activation of enzymes and sulfhydryl (SH-) linkages that are the source of pungency in oilseeds. Adequate Sulphur is therefore very much crucial for oilseed crops.

The selection of improved soybean varieties with better yield potential and wide range of adaptability to soil and environmental conditions is of prime importance in increasing soybean production. Improved varieties, if sufficiently provided with the essential macro and micro nutrients may result in further increase in yield. Different varieties respond differently to nutrients due to their variable physiological behaviour and hence differ in yield and yield components. Thus, the varieties are equally important for realization of the potential yield of this crop. The present study was planned to estimate the exact application rates of Sulphur and suitable variety and its impact on growth and yield of soybean.

MATERIALS AND METHODS

The experiment was carried out at Instructional Farm, Faculty of Agriculture, AKS University, Satna (M.P.) during *kharif* season 2020-21. The experiment was conducted in randomize complete block design having Factorial concept with three replications. Different rates of Sulphur and varieties will be allocated to the plots as per treatments. Seed rate used as 80 kg/ha for transplanting with 30.0 cm row to row distance with 10.0 cm plant to plant. The treatments were 4 soybean varieties viz., V_1= JS- 2034, V_2= JS- 2029, V_3= JS- 2068 and V_4= RVS-2001-04, while three Sulphur levels were tested are S_1- 0 kg/ha, S_2- 25 kg/ha and S_3- 35 kg/ha. The gross and net plot size was 4.60 m x 3.20 m and 4.0 m x 3.0 m, respectively. The fertilizers grades were applied as per treatments. Nutrient, phosphorus was applied at the rate of 60 kg/ha, as basal dressing during land preparation in the experimental plot. MOP was applied during the final land preparation at the rate of 40 kg/ha. Full recommended dose of nitrogen @ 20 kg/ha was applied at the time of sowing. All the other agronomic practices were applied uniformly to all the treatments. The experiment will be consisting of the following factors along with their respective levels.

RESULTS AND DISCUSSION

Data regarding plant height and number of branches per plant are reported in Table- 1. Statistical analysis of the data revealed that

maximum plant height (86.53 cm) and number of branches per plant (20.80) at maximum crop growth stage of 90 DAS were recorded in the soybean variety of RVS-2001-04 while, lowest values were noted with soybean variety of JS-2034. However, application of Sulphur @ 35 kg/ha gave maximum plant height (82.21 cm) and number of branches per plant (20.18).

Data regarding number of pods per plant, length of pod, number of seeds per pod, seed index, seed & straw yield per hectare and oil content of soybean are reported in Table- 1 and maximum values were observed in the soybean variety of RVS-2001-04 and increasing rate of Sulphur @ 35 kg/ha while, lowest values were noted with soybean variety of JS- 2034 and without application of Sulphur. Statistical analysis of the data for interaction effect revealed that maximum plant height (46.78 cm), number of branches per plant (9.00) at maximum crop growth stage, number of pods per plant (33.53), length of pod (4.88 cm), number of seeds per pod (3.73), seed index (10.57 g), seed (16.67 q/ha) & straw yield per hectare (33.84 q/ha) and oil content (21.60 %) recorded under the treatment combination consisting that soybean variety of RVS-2001-04 sown with application of S @ 35 kg/ha. While, lowest values were observed in the soybean variety of JS- 2034 sown with without application of Sulphur @ 0 kg/ha.

Soybean varieties differed significantly with respect to growth parameters like plant height, number of leaves and number of branches, almost at all the growth stages. This might be due to fast growth habit of variety RVS-2001-04 which increased plant height, dry matter production branching and leaves. The fast increase in plant height in the early stage of plant growth may be attributed to the higher number of leaves producing higher food material for growth of the plant. In fact, higher leaf area was responsible for preparing more photosynthates which increased cell division and resulted in rapid growth of the plants. The later stage of plant growth, plant height became slow which may be due to the fact that plants started entering from vegetative to the reproductive phase of growth and development and the dry matter production were concentrated in reproductive parts of plant. Similar result was reported by Lallu et al. (2010), Kumari et al. (2012), Abhinaw et al. (2017), Yadav et al. (2018).

The increase in plant growth in the treatment of application of Sulphur @ 35 kg/ha might be due to genetic character of cultivar with sufficient quantity of nutrient might have improved the soil physical, chemical properties and leading to the adequate uptake of nutrients by the plants which might have promoted the maximum volume of plant while the minimum plant growth was due to non-availability of balanced nutrition. These result to be in agreement with the findings of Pachauri et al. (2012), Rao et al. (2013), Katiyar et al. (2014) and Vishal et al. (2017). The effect of macro & micro-nutrient plays important role to increase plant height (cm), number of branches, number of leaves, fresh weight (g), dry weight (g) of plant (Vishal et al., 2017). Such enhancement effect might be also attributed to the favorable influence of these nutrient on metabolism and biological activity and stimulatory effect on photosynthetic pigments and enzymatic activity which in turn increase vegetative growth of plants.

The probable reason for enhanced seed yield and yield attributes may be due to cumulative effects of varietal characters and sufficient quantity of nutrient on vegetative growth which ultimately lead to more photosynthetic activities while, application of nutrient levels enhances carbohydrate and nitrogen metabolism of pectic substances, as well as improve the water metabolism and water relation in the plants. The variation in yield attributes of RVS-2001-04 variety may be due to genetic characteristics among different genotypes under present investigation. These findings are in agreement with the findings of Yogesh et al. (2017), Biswas et al. (2019) and Neenu et al. (2020).

Application of recommended dose of fertilizers in combination with Sulphur levels, @ 35 kg/ha significantly increased number of

pods per plant, number of seeds/pods, seed, stover yields and test weight increased of soybean over lower doses. Flocculation of soil and availability of all macronutrients making the soil and crop production sustainable one. Application of recommended dose of NPK with Sulphur levels, @ 35 kg/ha helps in enhancing the availability of major nutrients in soils resulting consequent availability to plants by reducing soil pH at micro sites, chelating action of organic acids produced by them and intraphyl mobility in the fungal filaments. The increased yield attributes and yield might be due the increased supply of almost all plant essential nutrients by translocation of the photosynthates accumulated under the influence of the nutrients. Further, the translocation and production of photosynthates in the economic sinks, resulted in increased grain, stover and biological yields. Similar finding has also seen reported by Upadhyay et al. (2018), Gautam et al. (2019) and Sonam et al. (2020).

During maturation of oilseeds, an increase in oil content occurs concurrently with a decrease in the quantity of carbohydrate present which suggests that carbohydrates in seeds are being converted in fat. When the nutrients are supplied in adequate amount, the oil content and oil yield also increased in soybean seed. Combined nutrient application recorded in enhancing the oil content leading to higher oil yield as a result of enhanced seed yield. Similar findings were reported by Sah et al. (2013), Neha et al. (2014) and Verma and Dawson, (2018).

Table 1: Effect of Sulphur Levels and Varieties on Growth, Yield and Quality of Soybean

Treatment	Plant height (cm)	Number of branches per plant	Number of pods per plant	Length of pod (cm)	Number of seeds per pod	Seed index (g)	Seed yield (q/ha)	Straw yield (q/ha)	Oil content (%)
	Effect of soybean varieties								
V_1	38.36	5.58	14.33	2.20	1.80	8.33	10.82	24.99	18.24
V_2	43.67	6.33	17.80	2.89	2.36	9.65	12.13	27.39	19.67
V_3	41.88	6.16	16.91	2.66	2.29	9.60	12.07	26.93	18.97
V_4	44.72	7.33	25.58	3.67	2.87	10.11	14.55	30.56	20.45
S. Em±	1.47	0.52	2.23	0.29	0.38	0.56	0.60	1.78	0.63
CD	4.32	1.52	6.55	0.86	1.12	1.64	1.75	5.24	1.86
	Effect of Sulphur								
S_1	37.98	5.30	14.18	1.83	1.47	8.55	9.69	23.48	18.13
S_2	43.52	6.55	19.55	3.12	2.65	9.78	13.24	28.96	19.63
S_3	44.98	7.20	22.23	3.61	2.87	9.94	14.26	29.97	20.24
S. Em±	1.70	0.60	2.58	0.34	0.44	0.65	0.69	2.06	0.73
CD	4.99	1.76	7.56	0.99	1.29	1.90	2.02	6.04	2.14
	Interaction effect between varieties and Sulphur								
V_1S_1	31.53	4.80	11.73	1.45	1.07	5.94	8.61	22.87	17.49
V_1S_2	41.48	5.93	15.47	2.45	2.13	9.51	11.36	24.86	18.58
V_1S_3	42.07	6.00	15.80	2.71	2.20	9.52	12.50	27.25	18.65
V_2S_1	40.94	5.47	14.93	1.89	1.93	9.37	9.83	23.81	18.34
V_2S_2	43.86	6.53	17.67	3.26	2.40	9.75	12.61	28.88	19.99
V_2S_3	46.21	7.00	20.80	3.53	2.73	9.84	13.94	29.49	20.69
V_3S_1	38.37	5.20	14.80	1.65	1.60	9.36	9.75	23.17	18.23
V_3S_2	42.41	6.47	17.13	3.00	2.47	9.59	12.56	28.34	18.67
V_3S_3	44.86	6.80	18.80	3.32	2.80	9.84	13.92	29.29	20.03
V_4S_1	41.06	5.73	15.27	2.32	1.27	9.51	10.56	24.08	18.46
V_4S_2	46.33	7.27	27.93	3.79	3.60	10.26	16.42	33.75	21.29
V_4S_3	46.78	9.00	33.53	4.88	3.73	10.57	16.67	33.84	21.60
S. Em±	0.85	0.30	1.29	0.17	0.22	0.32	0.34	1.03	0.37
CD	1.76	0.62	2.67	0.35	0.46	0.67	0.71	2.14	0.76

REFERENCES

Anonymous (2017). Soybean: Area, Production and Yield during 2016- 17, SOPA Databank.

Amrendra, Y., Singh, A. K., Chaudhari, R., & Mishra, S. R. (2018). Effect of planting geometry on growth and yield of mustard [*Brassica juncea* (L.)] varieties. *Journal of Pharmacognosy and Phytochemistry*, *7*(3), 2624-2627.

Ghosh, G. K., Sarkar, A. K., & Mondal, D. (2012). Efficacy of phosphor-gypsum as source of sulphur for mustard (Brassica juncea L). *Journal of Nuclear Agriculture and Biology 28*, 164-168.

Rao, K. T., Rao, A. U., & Sekhar, D. (2013). Effect of sources and levels of sulphur on groundnut. *Journal of Academia and Industrial Research*, *2*(5), 268-270.

Sah, D., Sewak, R., Singh, A. K., & Swami, S. (2013). Growth, yield and profitability of Indian mustard (*Brassica juncea* (L.) Czern & Coss) with different weed control measures and sulphur levels. *Agricultural Science Digest*, *33*(1), 15- 20.

Singh, A. K., Singh, H., Rai, O. P., Singh, G., Singh, V. P., Singh, N. P., & Singh, R. (2017). Effect of sowing dates and varieties for higher productivity of Indian mustard *(Brassica juncea* L.). *Journal of Applied and Natural Science*, *9*(2), 883 – 887.

Singh, S., Behera, T., Singh, R. K., & Rakshit, A. (2020). Impact of improved forms of Sulphur on NPK status of soil under mustard (*Brassica juncea* L.) cultivation. *International Journal of Chemical Studies*, *8*(2), 645- 648.

Soumik, B., Mukherjee, B., Munshi, A., Chongre, S., & Ray, M. (2019). Evaluation of Mustard Hybrid varieties in Gangetic Plains of West Bengal, India. *International Journal of Current Microbiology and Applied Sciences*, *8*(10), 585-590.

Susheel, G., Mishra, S. K., Pandey, H. P., Pathak, R. K., & Pandey, S. (2019). *International Journal of Advances in Agricultural Science and Technology*, *6*(11), 1-17.

Katiyar, A. K., Jat, A. S., & Singh, S. (2014). Response of sulphur fertilizers on the yield and oil content of mustard in sandy loam soils of Uttar Pradesh. *The Journal of Rural and Agricultural Research*, *14*(1), 52-54.

Kumari, A., Singh, R. P., & Yeshpal (2012). Productivity, nutrient uptake and economics of mustard hybrid (*Brassica juncea*) under different planting time and row spacing. *Indian Journal of Agronomy*. *57*(1), 61-67.

Lallu, R. S., Baghel, V. S., & Srivastava, S. B. L. (2010). Assessment of mustard genotypes for thermo tolerance at seed development stage. *Indian J. Plant. Physiol*. *15*(10), 36-43.

Neenu, S., Ramesh, K., Somasundaram, J., & Ramana, S. (2020). Varietal Influence on Phosphorus Uptake and Use Efficiency in Soybean at Varying Phosphorus Regimes in Vertisols of Central India. *International Journal of Current Microbiology and Applied Sciences*, *9*(6), 2743- 2753.

Neha, Dashora, L. N., Kaushik, M. K., & Upadhyay, B. (2014). Yield, nutrient content, uptake and quality of Indian mustard genotypes as influenced by Sulphur under Southern Rajasthan conditions. *Annals of Agriculture and Biological Research*, *19*(1), 81-84.

Pachauri, R. K., Trivedi, S. K., & Kumar, Y. (2012). Effect of sulphur levels on growth, yield and quality of Indian mustard genotypes and their economics. *Journal of Soils and Crops*, *22*(2), 258-263.

Upadhyay, P. K., Singh, D. P., Singh, M. P., & Srivastava, A. (2018). Effect of Phosphorus and Sulphur Level on Plant Growth and Dry Matter Production of Mustard (*Brassica juncea* L.). *Int. J. Pure App. Biosci*. *6*(6), 751-757.

Hemkalyan, V., & Joy, D. (2018). Yield and Economics of Mustard (*Brassica compestris* L.) as Influenced by Sowing Methods and Levels of Sulphur and Boron. *International Journal of Current Microbiology and Applied Sciences*, *7*(1), 380-386.

Kumar, V., Singh, V., Singh, S., & Tiwari, N. K. (2017). Effect of Macro-nutrients and Farm Yard Manure on Productivity and Profitability of Mustard (*Brassica juncea* L.) in Western Uttar Pradesh. *Asian Journal of Soil Science and Plant Nutrition*, *1*(3), 1-6.

Kumar, Y., Singh, R., Kumar, A., & Dhaka, A. K. (2017). Effect of growth and yield parameters on Indian-mustard genotypes under varying environmental conditions in western Haryana. *Journal of Applied and Natural Science*, *9*(4), 2093 -2100.