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EFFECT OF SULPHUR AND BIO-INOCULANTS ON GROWTH, YIELD AND QUALITY OF BLACKGRAM (*PHASEOLUS MUNGO* L.)

Atendra Kumar Gautam[1]*, Brajkishor Rajput[2*], Balkrishna Namdeo[3], Dheerendra Singh[3] and Ashok Kumar Verma[4]

[1]Department of Soil Science &Agri. chemistry, Rabindranath Tagore University, Raisen-464551 (M.P.) India

[2]Department of Soil Science &Agri. chemistry, Rabindranath Tagore University, Raisen-464551 (M.P.) India

[3]Department of Agronomy, Rabindranath Tagore University, Raisen-464551 (M.P.) India

[4]Department of Agri. Economics, Rabindranath Tagore University, Raisen-464551 (M.P.) India

*Corresponding author E-mail : atendragautam.mscag@gmail.com

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ABSTRACT

A field experiment was conducted during rainy season of 2023 and 2024 to study of the effect of sulphur and bio-inoculants on growth, yield and quality of blackgram. The highest sulphur level (60 kg/ha) applied to blackgaram (Pant Urad-31) proved the most beneficial with respect of enhanced al the growth and yield attributing characters, seed yield and seed quality. The maximum seed yield was 12.05 q/ha, seed protein 23.91% protein yield 288.1 kg/ha, seed carbohydrate 0.51%. amongst the biofertilizer treatment, *Rhizobium* + PSB performed the best with respect to all these parameters. The treatment interactions were found to be significant in case of all the parameters. The findings allude that 60 kg S/ha the dual biofertilizers may be applied to achieve maximum productivity and economical gain from blackgram cv. Pant Urad-31.

Key words : Bio-inoculants, Blackgram, Quality, Sulphur, Yield.

Introduction

Sulphur deficiency has been provocated in Indian soils due to increase in cropping intensity, use of high-yielding varieties and addition of sulphur-free fertilizers. This has adversely affected the yield of crops. The fact that crops require S and Pin the comparable amounts suggests that S deserves greater attention than that it received so far. Exploration of biofertilizers has opened the new possibilities to supplement chemical nitrogen and phosphatic fertilizers. Blackgram after seed inoculation with *Rhizobium leguminosarum* fixes 50-55 kg N/ha symbiotically (Marko *et al*., 2013). Similarly, phosphorus-solubilizing bacterial inoculation increased yield (Raj *et al*., 2014). Increasing cost of chemical fertilizers and their scarcity in Indian market has insisted upon to search out the efficacious effect of dual biofertilizers on blackgram. These are not only economical but also eco-friendly and pollution-free. In view of this fact, the present experiment was taken up to enhance the yield of blackgram in Raisen region of Madhya Pradesh.

Materials and Methods

The field experiment was conducted during rainy season of 2023 and 2024 at the Instructional Farm, RNT University, Raisen (M. P.), India. The soil of the experimental field was silty clay-loam having pH 7.6-7.8, electrical conductivity 0.42-0.47 dS/m, organic carbon 8.8-9.3 g/kg, available N 259-268 kg/ha, available P_2O_5 14.8-15.8 kg/ha, available K_2O 210-226 kg/ha and available S 7.70-8.19 ppm in both the years. The treatments comprised five sulphur levels (0, 15, 30, 45 and 60 kg/ha) and four treatments of biofertilizers (no biofertilizer, *Rhizobium* + phosphorus-solubilizing bacteria alone as well as in combination). The 20 treatment combinations were laid out in the field in a factorial randomized block design with three replications. Blackgram var. Pant Urad-31 was sown @ 20 kg/ha in rows 30 cm apart between 16 to19 July in both the years. An uniform dose of 20 kg N and 50 kg P_2O_5/ha was applied through diammonium phosphate as basal in all the treatments. Sulphur levels were applied through

elemental sulphur as basal. The seeds were inoculated with both the biofertilizers @ 20 g/kg seed mixed with FYM as per treatment. The crop was grown as per package of practices. The crop was harvested between 18 to 21 October in both the years. Seed protein was estimated by multiplying % N-content with 6.25 (A.O.A.C., 1997). Carbohydrate content in seed was estimated by the acid hydrolysis process and titration with Fehling's solution (Sadasivam and Manickam, 1996).

Results and Discussion

Growth parameters : Application of sulphur up to 60 kg/ha increased the plant height, branches/plant, significantly (Table 1). This might be owing to additional supply of sulphur nutrient which resulted in acceleration of cell elongation and cell division similar to that of nitrogen. Sulphur, being a fourth major nutrient, might have played an important physiological role by enhancing cell multiplication, elongation, expansion and chlorophyll biosynthesis which, in turn, increased the assimilate production. Dual inoculation (*Rhizobium*+PSB) brought about significantly higher all the growth parameters against the single inoculation of biofertilizers. This may be because of their increased proliferation of N- Fixing as well as P-solubilizing bacteria in the biosphere and the sufficient supply of N and P nutrients to them for their increased functions required for better plant growth and development. These results corroborate with those of Pandey *et al*. (2023), Singh *et al*. (2017), Singh and Singh (2017), Saket *et al*. (2017), Kumawat *et al*. (2014) and Das *et al*. (2017).

Yield and yield components : The factors which are directly responsible for ultimate grain production *viz*., pods/plant, grains/pod, 1000-grain weight and seed weight/ plant were increased almost significantly due to increased supply of sulphur up to 60 kg/ha (Table 1). The grain yield was 12.05 q/ha and harvest index 38.37%. This might be as a result of maximum plant growth associated with greater accumulation of carbodydrates, protein and their translocation to the reproductive organs under increased supply of sulphur. These results are, in close agreement with those of Kumar and Singh (2011) and Misra *et al*. (2011).

Seed inoculation with *Rhizobium* + PSB enhanced the yield and yield components significantly over the individual seed inoculation. Dual biofertilizers with 60 kg S/ ha further increased all these parameters synergistically. Under this treatment interaction, blackgram plants synthesized more photosynthesis and the storage organ (grain) was better developed. These results agree with those of Singh *et al*. (2015), Nyekha *et al*. (2015), Saket *et al*. (2017), Singh and Singh (2017), Naragund *et al*. (2020).

Table 1 : Growth, yield yield-attributes and quality of blackgram as influenced by sulphur levels and biofertilizers (mean of two years).

Treatments	Plant height (cm)	No. of branches / plant	Pods/ plant	Seeds /pod	1000-grain weight (g)	Seed weight/ plant (g)	Grain yield (q/ha)	Harvest index (%)	Seed protein (%)	Carbohy-drate content (%)
Sulphur levels (kg/ha)										
0	22.5	7.9	30.8	8.0	50.9	3.48	9.32	35.27	20.32	0.35
15	22.6	8.4	32.6	8.2	52.5	3.87	10.18	36.61	21.45	0.39
30	23.0	8.5	34.5	8.3	52.4	3.77	10.78	37.58	22.54	0.44
45	22.9	9.1	34.6	8.3	52.9	4.10	11.35	37.95	23.34	0.48
60	23.6	9.4	37.2	8.5	55.1	4.35	12.05	38.37	23.91	4.51
C.D. (5%)	**0.27**	**0.11**	**4.60**	**0.1**	**2.04**	**0.33**	**0.68**	**NS**	**0.41**	**0.020**
Biofertilizers										
No. biofertilizers	21.3	7.6	29.3	7.4	49.5	3.62	9.48	36.65	21.79	0.38
Rhizobium bacteria	23.4	8.8	34.6	8.2	52.3	3.75	10.81	39.27	22.20	0.47
PSB (P-solubilizing bacteria)	22.1	7.9	32.7	8.4	52.7	3.66	10.33	35.60	22.32	0.39
Rhizobium+ PSB	25.2	10.5	39.1	9.9	56.5	4.43	12.32	36.16	22.95	0.54
CD (P=0.05)	**0.24**	**0.12**	**4.14**	**0.16**	**1.88**	**0.30**	**0.62**	**2.36**	**0.37**	**0.018**

Grain quality : The highest level of sulphur (S_{60}) resulted in maximum seed protein 23.91% and seed carbohydrate 0.51%. Similarly dual biofertilizers also recorded maximum seed quality (Table 1). Dual biofertilizers parameters along with 60 kg S/ha further improved all these. The response of this combination in improving seed quality may be attributed to its significant role in regulating the photosynthesis, root enlargement and better microbial activities (Kumar and Singh, 2009). The present findings are in close conformity with those of Marko *et al*. (2013), Raj *et al*. (2014), Saket *et al*, (2017) Singh *et al*. (2017) and Pandey *et al*. (2023).

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