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Research Article

Influence of Biofertilizers and Varieties on Growth, Yield and Quality of Black Gram (*Vigna mungo* L.)

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ABSTRACT

To study the effect of bio-organics and varieties on the growth and yield of black gram, an experiment was conducted at the instructional farm of the Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during the Kharif season of 2020-21. The experiment consisted of a randomized block design having a Factorial arrangement with three replications. In this experiment, 12 treatment combinations including four levels of bio-organics and treatments were B_1- PSB 10 ml/kg seed, B_2- ZSB 10 ml/kg seed, B_3- Rhizobium10 ml/kg seed and B_4- Vermicompost @ 3 t/ ha, while three black gram varieties were tested are V_1- IPU-2-43, V_2- PU-31 and V_3- Pratap-1. During the course of the study, it was found that bio-organics and different varieties significantly affected plant height, number of branches per plant, number of pods per plant, number of grains per pod, test weight, grain & Stover yield and protein content of black gram. Higher plant height (41.01 cm) and the number of branches per plant (6.53) at the maximum crop growth stage of 60 DAS were recorded under the application of Vermicompost @ 3 t/ha in combination with black gram variety of IPU- 2-43. Similarly, it resulted in the maximum number of pods per plant (26.67), the number of grains per pod (6.33), test weight (37.43 g), grain yield (11.30 q/ha), stover yield (29.70 q/ha) and protein content (23.83 %) recorded under same treatment combination of an application of Vermicompost @ 3 t/ha in combination with black gram variety of IPU- 2-43.

Keywords: *varieties, Bio-organics, Branches, Pod, Test weight, Stover yield.*

INTRODUCTION

Blackgram is scientifically known as *Vigna mungo* L. and it is commonly known as urd in India. It is an efficient cover crop fits well in this system. In Madhya Pradesh, it occupies an area of 935.0 thousand ha with a production of 562.0 thousand tonnes and a productivity of 601.07 kg/ha (Anonymous, 2017). Black gram is primarily a rainy season crop, but with the development of early maturing varieties, it has also proved to be an ideal crop for the spring and summer seasons.

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It is tolerant to drought and can be grown successfully on drained loamy to sandy loam soil in erratic rainfall areas. After picking of pods, black gram plants may be used as green fodder or green manuring. Besides these, the black gram crop also enriches soil by fixing atmospheric nitrogen.

Several factors are responsible for low productivity of black gram, among them imbalance fertilization and terminal stress are important ones. To enhance the productivity of this crop, use of balanced fertilization by application of NPK along with bio-organics/biofertilizers*viz*., PSB, ZSB, *Rhizobium* and Vermicompost are of great importance.

The sole use of inorganic fertilizers with suboptimal doses of organics deteriorates soil fertility leading to a reduction in crop production and its sustainability. For sustainable crop production, it is necessary to use organics and bio-fertilizers consistently leading to improvement in soil biota for the transformation of organics in available nutrients and essential soil enzymes important to crops. Bio-fertilizers are the products containing viable cells of different microorganisms essential for plant growth. Nutrients in the soil are available through elemental transformations, solubilization, fixation, and other mechanisms. Bio-fertilizer helps to supply N and P through fixation and solubilization respectively and acts as a supplement to inorganic fertilizer in an eco-friendly manner. The application of biofertilizer with beneficial microbes improved the leaf chlorophyll, plant nutrient uptake, and grain protein content in black gram. Hence, the use of chemical N and P fertilizer can be minimized by 50 percent and improve black gram yield with the supplement of 5 ton /ha of bio-organic fertilizer (Gite et al., 2021).

Recently, many early durations dwarf varieties have been evolved with high yield potentials as well as responsiveness to high levels of fertilizer, bio-organics as well as biofertilizers. The present study was planned to estimate the suitable bio-organics and black gram variety and its impact on growth and yield of black gram.

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 bio-organics and black gram varieties will be allocated to the plots as per treatments. Seed rate used as 20 kg/ha for transplanting with 25.0 cm row to row distance. The treatments were B_1- PSB 10 ml/kg seed, B_2- ZSB 10 ml/kg seed, B_3- *Rhizobium*10 ml/kg seed and B_4- Vermicompost @ 3 t/ ha, while three black gram varieties were tested are V_1- IPU-2-43, V_2- PU-31 and V_3- Pratap-1. The gross and net plot size was 5.0 m x 3.50 m and 4.0 m x 3.0 m, respectively. The fertilizers grades were applied as per treatments. Full recommended dose of nitrogen, phosphorus and potassium at the rate of 20 kg N/ha, 60 kg P_2O_5/ha and 60 Kg K_2O /ha, respectively was uniformly applied to each plot as basal dose before sowing. Required quantity of healthy, bold, unbroken and fully developed seeds of black gram variety was inoculated separately with PSB, ZSB *and Rhizobium* biofertilizers @ 10 ml/ kg seeds before sowing of the crop. Vermicompost (as per treatment) was applied prior to cross ploughing and thoroughly incorporated in soil with the help of cultivator as per treatments before sowing. All the other agronomic practices were applied uniformly to all the treatments.

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 (38.99cm) and number of branches per plant (6.42) at maximum crop growth stage of 60 DAS were recorded in plots treated with the application of Vermicompost @ 3 t/ha. Black gram cultivar of IPU-2-43gave maximum plant height (37.15cm) and number of branches per plant (5.95). The interaction

effect between various sources of bio- organics and black gram cultivars was found to be significant and maximum plant height (41.01cm) and number of branches per plant (6.53) at maximum crop growth stage of 60 DAS were recorded under the application of Vermicompost @ 3 t/ha in combination with black gram variety of IPU- 2-43.

The growth parameters recorded periodically have exhibited interesting architectural variation due to different bio-organics. Growth and development of black gram, which is characterized by determine growth habit of crop were studied periodically. The vegetative and reproductive development of the crop culminating into economic yield was the terminal outcomes of growth, which was affected by continuously interaction acquiring between environment and plant physiological process.

Better supply of nitrogen and organic carbon through optimum mineralization due to presence of bio- organics viz., Vermicompost made the bacteria active thereby promoting better nodule growth and higher nitrogen fixation.Application of 100 % RDF with combined application of Vermicompost @ 3 t/ ha made vigorous growth due to more addition of inorganic fertilizer which would be evident from the data on higher plant height and branches as compared with those fertilized with other treatment combinations. This might be due to favourable function of nitrogen being a major structural constituent of cell helps in stimulating the cell division and cell enlargement, which increased the plant height. Similar results are in accordance with the findings of Patel (2012) and Rajesh and Arun (2017).

These nutrients improve root nodulation and provided the congenial soil environment for plant rhizosphere increases nitrogen fixation and phosphorous solubilization, increased more growth there by increased the above parameters of plant. The continuous availability of nutrients resulted in more nutrient uptake by plant ensures more dry matter accumulation at all growth stages. Similar combined beneficial effect of organic manures and inorganic fertilizers on growth parameters was recorded by Das et al. (2012), Vipul and Ajay (2019) and Sai and Swami (2020).

The differences in growth characters due to varieties may be attributed to their inherent characteristics and adaptability to soil and climatic conditions. The results are in close Conformity with the findings of Govardhan et al. (2017). The marked variation in growth between varieties could be ascribed to their differential genetic milieu and capabilities to exploit available growth inputs (above and below ground) for overall growth and development. In fact, the growth parameters among the varieties are genetically governed. Such type of observations among the black gram varieties have also been reported by Dhakal et al. (2016) and Akhila et al. (2017).

Statistical analysis of the data revealed that maximum number of pods per plant (26.67), number of grains per pod (6.33), test weight (37.43 g), grain yield (11.30 q/ha), stover yield (29.70 q/ha) and protein content (23.83 %)were recorded under the treatment combination of Vermicompost @ 3 t/ha in combination with black gram variety of IPU-2-43.

The combined application of NPK rates with Vermicompost to the black gram increased availability of major nutrients to plant due to enhanced early root growth and cell multiplication leading to more absorption of other nutrients from deeper layers of soil ultimately resulting in increased plant growth attributes and finally increased crop growth rate. The increase in yield attributes with the application of bioorganic in increasing rate might be due to higher availability of balanced plant nutrients throughout the crop period specially at critical stages of plant, favourable C:N ratio, better utilization of nitrogen for reproductive growth rather than for vegetative growth, functional role of nitrogen in the plant body i.e. in multiplication, cell elongation and tissue differentiation.

Vermicompost helps in enhancing the activity of microorganism in soils resulting in

enhanced solubility of nutrients and their 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 attributing characters 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 sources of Vermicompost. Further, the translocation and accumulation of photosynthates in the economic sinks, resulted in increased grain, Stover and biological yields. Similar findings have also been reported by Bhadu et al. (2018), Chhetri and Sinha (2018), Pankaj et al. (2019) and Kalaiyarasi et al. (2019).

The marked increase in most of the yield attributes in variety IPU- 2-43could be ascribed to overall improvement in crop growth as evident from higher dry matter accumulation at successive stages as well as concentration and uptake of nutrients. These subscribes greater availability of photosynthates and nutrients matching with demand for initiation and growth of each reproductive structures. The yield-attributing characters were found to deviate up to significant extent due to different varieties. This type of variations may be owing to variations in the genetic buildup of the varieties. In fact, it is very difficult the inherit all the desirable characters in one variety although efforts are being made in this direction. Such type of variability in the yield-attributing characters in the black gram varieties have been reported by many research workers *viz*., Akhila et al. (2017), Dash and Rautary (2017) and Mondal and Sengupta (2019).

As regard the protein content in grains, it was significantly higher under the application of 100 % RDF with combined application of Vermicompost @ 3 t/ ha as compared to rest of the treatments. It was owing to higher N-content in grains. These results are in collaboration with the finding of Pramanick et al. (2013).

Table 1: Effect of Bioorganics and Varieties on Growth and Yield of Black Gram

Treatment	Plant height (cm)	Number of branches per plant	Number of pods per plant	Number of grains per pod	Test weight (g)	Grain yield (q/ha)	Stover yield (q/ha)	Protein content (%)
	Effect of bio-organics							
B_1	35.75	5.58	21.71	4.69	33.25	6.30	18.89	20.28
B_2	35.04	4.98	19.51	4.47	31.95	5.27	16.86	19.67
B_3	36.20	6.13	22.44	5.00	34.28	7.88	22.19	21.59
B_4	38.99	6.42	25.33	5.80	36.39	10.22	27.73	23.69
S. Em±	0.83	0.20	0.62	0.19	0.37	0.37	0.89	0.72
CD	2.43	0.58	1.82	0.56	1.09	1.09	2.62	2.13
	Effect of varieties							
V_1	37.15	5.95	23.02	5.20	34.52	8.23	22.84	21.96
V_2	36.08	5.52	21.48	4.82	33.42	6.49	20.09	20.92
V_3	36.26	5.87	22.25	4.95	33.96	7.53	21.33	21.05
S. Em±	0.95	0.23	0.72	0.22	0.43	0.43	1.03	0.84
CD	2.80	0.67	2.10	0.65	1.26	1.26	3.03	2.46
	Interaction effect betweenbio-organics and varieties							
B_1V_1	36.04	5.73	21.87	4.87	33.48	6.66	19.21	20.48
B_1V_2	35.25	5.33	20.87	4.53	32.65	6.29	18.45	20.02
B_1V_3	36.28	6.20	22.67	5.07	34.51	8.67	23.98	23.52
B_2V_1	41.01	6.53	26.67	6.33	37.43	11.30	29.70	23.83
B_2V_2	35.57	5.40	21.47	4.53	33.04	5.67	18.45	20.13
B_2V_3	34.85	4.33	18.47	4.40	31.36	4.05	16.02	19.41
B_3V_1	36.13	6.07	22.20	4.93	33.93	7.37	20.88	20.56
B_3V_2	37.77	6.27	23.80	5.40	35.36	8.87	25.00	23.55
B_3V_3	35.64	5.60	21.80	4.67	33.24	6.56	19.01	20.23
B_4V_1	35.02	5.27	19.20	4.47	31.85	5.47	16.11	19.58
B_4V_2	36.19	6.13	22.47	5.00	34.39	7.60	21.70	20.68
B_4V_3	38.18	6.47	25.53	5.67	36.36	10.49	28.49	23.69
S. Em±	0.48	0.11	0.36	0.11	0.22	0.21	0.52	0.42
CD	0.99	0.24	0.74	0.23	0.45	0.45	1.07	0.87

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