*J. Agric. Res. Technol., 49 (2) : 333-338 (2024)*

# Studies on Effect of Seed Biopriming with MPKV Bacterial Consortium on Growth and Yield of Black Gram

D. S. Khade, D. R. Murumkar, V. M. Karade, C. T. Kumbhar and D. D. Sawale
Division of Plant Pathology and Agril. Microbiology, College of Agriculture Pune - 411 005 (India)
(Received : 12.02.2024 Accepted : 15.03.2024)

**Abstract**

The present investigation was conducted with the objective to study the inoculation effect of seed biopriming with MPKV bacterial consortium on growth and yield of black gram by using the MPKV bacterial consortium during *kharif* 2022 at the College of Agriculture, Pune. The results of the present investigation revealed that among the different biopriming treatments, seed biopriming with MPKV bacterial consortium + 75% RDF was found to be the most effective as it recorded significantly the highest germination (94.15%), plant height (44.54 cm and 61.45 cm) at floweing and harvest, root length (13.39 cm and 18.97 cm) at floweing and harvest, number of nodules (32.67 plant-1) at flowering, seed yield (9.97 q $ha^{-1}$) at harvest.

**Key words : MPKV Bacterial consortium, Black gram, germination, height, most effective, seed biopriming.**

Pulses are considered as one of the important food crop globally due to higher protein content. Pulse crops are an important group of crops in India, which is also responsible for yielding large financial gains by amounting for a large part of the exports. Pulses are the major sources of protein in the diet. Pulse are the major contributors to the dietary protein particularly to the vegetarian people and contribute the 14 per cent of the total protein to average Indian diet. Urad bean has the 24 per cent of total protein, 60 per cent of carbohydrate, 10.9 per cent of moisture, 1.4 per cent fat, 0.9 per cent fibre, 3.2 per cent minerals and vitamin viz. calcium 154 mg, phosphorus 385 mg, iron 9.1 mg and small amount of vitamin B complex. (Kanth *et al.*, 2021).

The yield of black gram is very poor as compared to many other legume crops (Siddikee *et al.*, 2019). One of the main causes of black gram's low productivity is poor soil fertility. Indian soils are medium to poor status within both available nitrogen and phosphorus (Shekhawat *et al.*, 2018). Nitrogen is considered one of the master nutrient that enhance the metabolic processes that rely on protein, which leads to an increase in the crop's vegetative, yield, and reproductive growth (Sumalatha *et al.*, 2018). Phosphorus is the most important alimentary element for pulse production and the application of phosphorous significantly affects nutritional quality and yield of pulses (Patel *et al.*, 2018). Despite applications of NPK, black gram shows signs of stagnation or low productivity (Jangir *et al.*, 2016).

Seed biopriming is useful in almost all crops around the world and is an environmentally friendly alternative to chemical components. Biopriming usually refers to use of beneficial micro-organisms which can survive under adverse environmental conditions. Beneficial microbes are applied to the soil and plant tissues directly or through seed inoculation, whereas soil application is preferred when there is risk of inhibitors or antagonistic microbes on the plant tissues. Seed priming, where seeds are hydrated to activate metabolism without actual

germination followed by drying, increases the germination, stand establishment and stress tolerance in different crops.

Black gram requires 20 kg N, 40 kg $P_2O_5$ for its growth. Due to increase in cost of chemical nitrogenous fertilizer, marginal farmers cannot afford the recommended fertilizer. Therefore, biological nitrogen fixation through microorganisms has been found very economical and advantageous (Javaid, 2009). Keeping this in view, the present study was proposed with the aim to see the effect of the bacterial consortium on the growth and yield of black gram.

## Material and Methodology

Present investigations was carried out during 2022-2023 on the field of Biological Nitrogen Fixation Scheme and Department of Plant Pathology, College of Agriculture Pune-05.

**Seeds :** The seeds of black gram variety AKU-10-1 (Black gold) required for the experiment were obtained from the Department of Agronomy, College of Agriculture, Pune

**Collection of bacterial consortium :** The required MPKV bacterial consortium and reference strain of Bacillus subtilis was collected from the department of plant pathology and agriculture microbiology MPKV Rahuri.

**Biopriming of seed with bacterial consortium :** The bacterial consortium and reference strain of Bacillus subtilis as per treatment was taken. Then 25 gm of each bacterial consortium and reference strain of Bacillus subtilis was taken into beaker separately and made up the volume to 1000 ml. by adding water. The black gram seeds was soaked in the solution of bacterial consortium and reference strain separately for 12 hours before sowing. Then seeds was taken out from solution and kept for drying for 30 min in shade. Then sowing of the experiment was carried out in the field.

**Observation recorded :** The observations on seed quality parameters *viz*. seed germination percentage (%), shoot length (cm) and root length (cm) was taken. Moreover, the plant growth observations *viz*. plant height and root length at flowering and harvesting stage, no. of nodules plant$^{-1}$ and seed yield was recorded.

**Treatment details :** The black gram seeds were inoculated before sowing as $T_1$ - Seed biopriming with MPKV bacterial consortium @ 25g kg$^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF, $T_2$ - Seed biopriming with MPKV bacterial consortium @ 25g kg$^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF, $T_3$ - Seed biopriming with MPKV bacterial consortium @ 25g kg$^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF, $T_4$ - Seed biopriming with reference strain @ 25g kg$^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF, $T_5$ - Seed biopriming with reference strain @ 25g kg$^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF, $T_6$ - Seed biopriming with reference strain @ 25g kg$^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF and $T_7$ - Untreated control.

## Results and Discussion

The present investigation was conducted to study the effect of seed biopriming with MPKV bacterial consortium on growth and yield of black gram by using the bacterial consortium during *kharif* 2022 at the College of Agriculture, Pune. The results obtained in the investigation are presented in this chapter.

**Inoculation Effect of Seed Biopriming with MPKV Bacterial Consortium on Seed Germination of Black gram :** The results in respect of germination of black gram as influenced by seed biopriming with MPKV

bacterial consortium are presented in Table 1. Among different inoculation treatments, $T_2$ i.e. seed biopriming with MPKV bacterial consortium + 75% RDF recorded significantly highest germination (94.15%) over untreated control (84.17%) and was found statistically at par with rest of the treatments.

**Inoculation Effect of Seed Biopriming with MPKV Bacterial Consortium on Plant Height of Black gram at Flowering and Harvest Stage :** The results in respect of plant height of black gram at flowering and harvest stage as influenced by seed biopriming with MPKV bacterial consortium are presented in Table 2 Among different inoculation treatments, $T_2$ i.e. seed biopriming with MPKV bacterial

**Table 1.** Effect of seed biopriming with MPKV bacterial consortium on germination percentage of black gram

| Treatment | Germination (%) |
|---|---|
| $T_1$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 93.13 |
| $T_2$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 94.15 |
| $T_3$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 92.30 |
| $T_4$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 90.60 |
| $T_5$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 91.23 |
| $T_6$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 88.60 |
| $T_7$ - Untreated control | 84.17 |
| SE(m) ± | 1.80 |
| CD at 5% | 5.56 |

**Table 2.** Effect of seed biopriming with MPKV bacterial consortium on plant height (cm) of black gram at flowering and harvest stage

| Treatment | Plant height (cm) | |
|---|---|---|
| | Flowering | Harvest |
| $T_1$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 42.72 | 59.10 |
| $T_2$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 44.54 | 61.45 |
| $T_3$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 39.50 | 56.90 |
| $T_4$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 37.66 | 52.82 |
| $T_5$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 38.45 | 54.75 |
| $T_6$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 35.82 | 51.60 |
| $T_7$ - Untreated control | 29.98 | 48.31 |
| SE(m)± | 1.56 | 1.22 |
| CD at 5% | 4.80 | 3.75 |

consortium + 75% RDF was found to be the most effective as it recorded significantly highest plant height at flowering (44.54 cm) and harvest stage (61.45 cm) of the crop over rest of the treatments, however it was statistically at par with $T_1$ i.e. seed biopriming with MPKV bacterial consortium + 100% RDF for plant height at flowering (42.72 cm) and harvest stage (59.10 cm). The lowest plant height at flowering (29.98 cm) and harvest stage (48.31 cm) of the crop was noticed in the untreated control plot.

**Inoculation Effect of Seed Biopriming with MPKV Bacterial Consortium on Root Length of Black gram at Flowering and Harvest Stage :** The results in respect of root length of black gram at flowering and harvest stage as influenced by seed biopriming with

**Table 3.** Effect of seed biopriming with MPKV bacterial consortium on root length (cm) of black gram at flowering and harvest stage

| Treatment | Root length (cm) | |
|---|---|---|
| | Flowering | Harvest |
| $T_1$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 12.65 | 17.77 |
| $T_2$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 13.39 | 18.97 |
| $T_3$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 11.94 | 16.26 |
| $T_4$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 10.57 | 15.62 |
| $T_5$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 11.05 | 16.09 |
| $T_6$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 10.31 | 14.96 |
| $T_7$ - Untreated control | 8.53 | 12.64 |
| SE(m)± | 0.34 | 0.87 |
| CD at 5% | 1.05 | 2.67 |

**Table 4.** Effect of seed biopriming with MPKV bacterial consortium on number of nodules $plant^{-1}$ of black gram

| Treatment | Number of nodules $plant^{-1}$ |
|---|---|
| $T_1$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 29.67 |
| $T_2$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 32.67 |
| $T_3$ - Seed biopriming with MPKV bacterial consortium @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 25.33 |
| $T_4$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 100% RDF | 21.33 |
| $T_5$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 75% RDF | 23.67 |
| $T_6$ - Seed biopriming with reference strain @ 25g $kg^{-1}$ seed in 1 litre water for 12 hrs. before sowing + 50% RDF | 19.33 |
| $T_7$ - Untreated control | 13.67 |
| SE(m) ± | 1.98 |
| CD at 5% | 6.11 |

MPKV bacterial consortium are presented in Table 3. Among different inoculation treatments, $T_2$ i.e. seed biopriming with MPKV bacterial consortium + 75% RDF was found to be the most effective as it recorded significantly highest root length at flowering (13.39 cm) and harvest stage (18.97 cm) of the crop over rest of the treatments, however it was statistically at par with $T_1$ i.e. seed biopriming with MPKV bacterial consortium + 100% RDF for root length at flowering (12.65 cm) and harvest stage (17.77 cm) of the crop. The lowest plant height at flowering (8.53 cm) and harvest stage (12.64 cm) of the crop was noticed in the untreated control plot.

**Inoculation Effect of Seed Biopriming with MPKV Bacterial Consortium on Number of Nodules plant$^{-1}$ of Black gram :** The results in respect of number of nodules per plant as influenced by seed biopriming with MPKV bacterial consortium are presented in Table 4. Among different inoculation treatments, $T_2$ i.e. seed biopriming with MPKV bacterial consortium + 75% RDF was found to be the most effective as it recorded significantly highest number of nodules (32.67 plant-1) over rest of the treatments, however it was statistically at par with $T_1$ i.e. seed biopriming with MPKV bacterial consortium+ 100% RDF for number of nodules (29.67 plant$^{-1}$). The lowest number of nodules (13.67 plant$^{-1}$) was noticed in the untreated control plot.

**Inoculation Effect of Seed Biopriming with MPKV Bacterial Consortium on Seed Yield of Black gram :** The results in respect of seed yield of black gram as influenced by seed biopriming with MPKV bacterial consortium are presented in Table 5. Among different inoculation treatments, $T_2$ i.e. seed biopriming with MPKV bacterial consortium + 75% RDF was found to be the most effective as it recorded significantly highest seed yield (9.97 q ha$^{-1}$) over rest of the treatments, however it was statistically at par with $T_1$ i.e. seed biopriming with MPKV bacterial consortium + 100% RDF for seed yield (8.95 q ha$^{-1}$) of black gram. The lowest seed yield (6.77 q ha$^{-1}$) was noticed in the untreated control plot.

Bansal (2009) reported that presowing inoculation of mungbean seeds with different inoculants (*Rhizobium*, PGPR and PSB) alone or in combination, significantly increased the seed yield over uninoculated control. Moreover, Qureshi *et al.* (2011) studied that co-inoculation of *R. phaseoli* and *B. megaterium* enhanced the seed yield of mungbean in comparison with controls. Furthermore, Argaw (2012), Tarafder *et al.* (2016), Cao *et al*. (2016) and Jaybhay *et al*. (2017) reported significant increase in seed yield in different legume crops due to seed inoculation of Rhizobium, PGPR and PSB alone or in combination. Ghadge and Murumkar (2020) reported that seed inoculation of soybean with consortium of Rhizobium, PSB and KMB + 75% RDF significantly increased the seed yield in comparison with uninoculated control. Results of the present investigation are in agreement with results of these researchers.

## Conclusion

Among the different inoculation treatments, seed biopriming with MPKV bacterial consortium + 75% RDF was found to be the most effective as it recorded significantly highest germination, shoot length, root length, nodule per plant and seed yield of black gram. Also From the present investigation it can be concluded that seed biopriming with MPKV bacterial consortium + 75% RDF was found to be the most beneficial for getting higher seed yield of black gram with 25% saving of nitrogen and phosphorus dose of chemical fertilizers to black gram.

## Acknowledgment

The authors would like to thank Mahatma

Phule Krishi Vidyapeeth Rahuri, Biological Nitrogen fixation scheme and Department of Plant Pathology, College of Agriculture Pune for providing necessary research facilities.

## References

Argaw A. 2012. Evaluation of Co-inoculation of Bradyrhizobium japonicum and Phosphate Solubilizing Pseudomonas spp. Effect on Soybean (*Glyceine max* L. (Merr.)) in Assossa Area. Journal of Agricultural Science and Technology 14: 213-224.

Bansal, R. K. 2009. Synergistic effect of Rhizobium, PSB and PGPR on nodulation and grain yield of mung bean. Journal of food legumes 22(1): 37-39.

Cao, N. D., Duong, B. S., Nguyen, B. T. and Phan, V. H. L. 2016. Effects of rhizobia and phosphate-solubilizing Bacteria on soybean (*Glycine max*) cultivated on Ferralsols of daklak province, Vietnam. World Journal of Pharmaceutical Sciences 5(4): 318-333.

Ghadge, J. R. and Murumkar, D. R. 2020. Inoculation effect of consortium of Rhizobium, PSB and KMB on the growth and yield of soybean. International Journal of Current Microbiology and Applied Science 9(9): 1979-1993.

Jangir, C. K., Singh, D., Kumar, S. 2016. Yield and economic response of biofertilizer and fertility levels on black gram (*Vigna mungo* L.). Progressive research – an international journal 11: 5252-5254.

Javaid, A. 2009. Growth, nodulation and yield of black gram [*Vigna mungo* (L.) Hepper] as influenced by biofertilizers and soil amendments. Afr. J. Biotechnol 8: 5711-5717.

Jaybhay, S. A., Taware, S. P. and Philips, V. 2017. Microbial inoculation of Rhizobium and phosphate-solubilizing bacteria along with inorganic fertilizers for sustainable yield of soybean [*Glycine max* (L.) Merril]. Journal of Plant Nutrition 40(15): 2209-2216.

Kanth, A., Goswami, K. and Shukla, P. 2021. Nutritional quality evaluation of improved varieties of black gram (Phaseolus mungo). Pharm Innov J 10: 201-220.

Patel, B. N., Patel, K. H., Singh, N. and Shrivastava, A. 2018. Effect of phosphorus, FYM and bio-fertilizer on growth, yield attribute, yield and quality of summer green gram (*Vigna radiata* L.). Journal of pharmacognosy and phytochemistry 8(5): 1108-1112.

Qureshi, M. A., Shair, M. A., Iqbal, A., Ahtar, N. and Khan, A. 2011. Co-inoculation of phosphate solubilizing bacteria and rhizobia for improving growth and yield of mung bean (*Vigna radiata* L.). Journal of Animal and Plant Science 21(3): 491-497.

Shekhawat, A. S., Purohit, H. S., Jain, H. K. and Meena, R. H. 2018. Effect of phosphorus and bio-organics on quality and symbiotic efficiency of black gram (*Vigna mungo* L.). Journal of pharmacognosy and phytochemistry 7(2): 3419- 3422.

Siddikee, M. R., Sultana, R., Hasan, M., Rahman, T., Siddique, A. B. and Amin A. K. 2019. Effect of nitrogen sources on the yield of different black gram (Vigna mungo) varieties. Asian Research Journal of Agriculture 10(3): 1-8.

Sumalatha, G, Jebarathnam, T. G. 2018. Impact of biofertilizers on crop seeds. International Journal of Environmental and Agriculture Research 4(5): 55-57.

Tarafder, H. K., Dey, A. and Dasgupta, S. 2016. Co-inoculation of phosphate solubilizing bacteria and Rhizobia for improving growth and yield of mung bean (*Vigna radiata* L.). Asian Journal of Soil Science 11(1): 207-212.