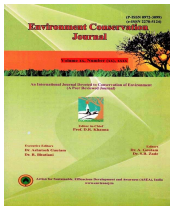
Environment Conservation Journal 23 (3):309-312, 2022

Journal homepage: https://www.environcj.in/

Environment Conservation Journal

ISSN 0972-3099 (Print) 2278-5124 (Online)



Influential role of organic sources on yield and economics of black gram [*Vigna mungo* (L.) Hepper]

Nallagatla Vinod Kumar ✉
Department of Agronomy, College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad, Karnataka, India.
M.B. Patil
Department of Agronomy, College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad, Karnataka, India.
B.T. Nadagouda
Department of Agronomy, College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad, Karnataka, India.
Ramesh Beerge
Department of Agricultural Engineering, College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad, Karnataka, India.

ARTICLE INFO

Received : 11 October 2021
Revised : 16 February 2022
Accepted : 21 February 2022

Available online: 29 May 2022

Key Words:
Black gram
Farm yard manure
Ghanajeevamrutha
Rhizobium
Vermicompost

ABSTRACT

Present study for investigating the role of organic amendments on the growth and production of the black gram (*Vigna mungo*). The findings of the research illustrate that, the application of vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB documented a significantly greater Dry matter yield (2740 kg/ha), number of pods/plant (19.33), number of seeds/pod (6.33), the grain yield (701.33 kg/ha), the haulm yield (2038.76 kg/ha) as compared to others and higher gross returns (₹. 54540 ha^{-1}), net returns (₹. 23083 ha^{-1}) and Benefit-Cost ratio (1.74) in black gram production.

Introduction

Blackgram (*Vigna mungo* (L) Heppear), being an excellent source of high-quality protein, is considered as one of the most important pulse crops in our country where it is cultivated in an area of 35.15 lakh ha producing 21.0 lakh tonnes with a productivity of 655 kg/ha which is low compared to other pulse crops owing to its cultivation on marginal lands known to be poor in fertility (Anon, 2018). It is known that the pulses play an important role in Indian agriculture for sustainable production, improvement in soil health and environmental safety. India is the largest producer and also consumer of pulses in the world and it is a cheaper source of protein to overcome malnutrition among vegetarians. However, the pulses are more responsive to organic manures. They contain a high percentage of quality protein nearly three times more than in cereals. But the indiscriminate and continuous use of chemical fertilizers has a deleterious effect on soil physical, chemical and biological properties thereby affecting the sustainability of crop production, besides causing environmental pollution. So, there is a scope to improve the productivity of pulses by enhancing the soil fertility and its productivity through increasing soil organic carbon, soil moisture storage capacity and adopting integrated nutrient management practices. The crop productivity under the organic production system can be enhanced by optimizing the nutrient requirement of the crop at different stages. Intensive farming techniques, together with the heavy use of chemical inputs over the last four decades, have led not only to a loss of natural ecosystem balance and soil health but also many hazards such as soil salinization, soil erosion, reduction in groundwater levels and desertification, pesticide and fertilization contamination, ecological damage, genetic erosion, redness. The soil and climatic conditions in the drylands are well adapted to organic farming. The real potential of organic

Corresponding author E-mail: *vinodnallagatla@gmail.com*
Doi: https://doi.org/10.36953/ECJ.9252177
This work is licensed under Attribution-Non Commercial 4.0 International (CC BY-NC 4.0)
© ASEA

farming can be witnessed in rainfed areas and where the soil organic matter and organic carbon content are lesser. Low soil fertility is a major constraint to achieving sustainable black gram production and productivity. Continuous usage of chemical inputs will deteriorate soil physical, chemical and biological health. Due to this, the present investigation was taken up to evaluate the role of soil organic amendments on crop growth and grain yield of blackgram.

Material and Methods

A field experiment was conducted during kharif-2019 at the College of Agriculture, Vijayapur, Karnataka, India. The texture of soil at the experimental site was clayey in nature with a p*H* of about 7.82 with low organic carbon of 0.57 %. The soil is with low N (262 kg/ha), medium P_2O_5 (32.5 kg/ha) and with higher K_2O (390 kg/ha) content respectively. The experimental location contains about 12 treatments consisting of organic amendments laid out in Randomized Completely Block Design with three replications. The black gram variety TAU-1 was sown with a spacing of 45 cm x 10 cm. The recommended dose of phosphorus for black gram was enriched with various combinations of soil organic amendments with equal proportions depending on the amount of P in them. The organic manures *viz.*, Farm yard manure, Vermicompost, Ghanajeevamrutha in the required quantity were applied uniformly as per the treatments and incorporated into the soil three weeks before sowing. The quantity of organic manures was worked out equivalent to the recommended dose of fertilizer (nitrogen and phosphorus fertilizers per hectare) (20-50-0).

Treatment details includes: T_1: Application of Farm Yard Manure + vermicompost based on 100 % RDP, T_2: Application of vermicompost + ghanajeevamrutha based on 100 % RDP, T_3: Application of FYM + ghanajeevamrutha based on 100 % Recommended Dose of Phosphorus, T_4: Application of FYM + vermicompost based on 50 % RDP, T_5: Application of vermicompost + ghanajeevamrutha based on 50 % RDP, T_6: Application of FYM + ghanajeevamrutha based on 50 % RDP, T_7: Application of FYM + vermicompost based on 100 % RDP + *Rhizobium* + PSB, T_8: Application of vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB, T_9: Application of FYM + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB, T_{10}: Application of FYM + vermicompost based on 50 % RDP + Rhizobium + PSB, T_{11}: Application of vermicompost + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB, T_{12}: Application of FYM + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB.

Ghanajeevamrutha was prepared by using the following ingredients. Initially, 50 kg cow dung was spread on the polythene sheet. Black jaggery 1 kg was pounded to powder and added to cow dung and mixed well. Horsegram flour (1 kg) was added slowly to the mixture with hand mixing to avoid formation of lumps. One and half handful of fertile soil was added to the above mixture and mixed thoroughly until it became homogenous. Then measured quantity of cow urine (2.5 l) was added to the above mixture and this mixture was allowed to dry under the shade for 6-7 days. After a week, ghanajeevamrutha was applied to soil @ 500 kg/ha at the time of sowing as per the treatments.

Five plants from the representative plots in the field were chosen from which all yield attributes and yield were calculated *i.e*. mention now all Gross returns were calculated based on the market price of the product during the harvest and were expressed in rupees per hectare (Rs/ ha). While the net returns were calculated by deducting the cost of cultivation from gross return per hectare and were expressed in rupees per hectare (Rs/ha).

Results and Discussion

It is seen that among the organic manures application vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB resulted in higher yield attributing and grain yield characters. The application of vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + Phosphorus Solubilizing Bacteria recorded a higher number of pods per plant (19.33), number of seeds per pod (6.33), haulm yield (2038.67 Kg/ha) and grain yield (701.33 Kg/ha) compared to other treatments. However, the increased grain yield and yield attributing characters of black gram by application of organic manures might attribute to prolonged and unfluctuating availability of major nutrients during the entire crop growth period and inclusion of

Table 1: Effect of organics on no. of pods/ plant, no. of seeds/ pod, no. of branches and plant dry matter yield (kg/ha) in black gram variety TAU-1.

Treatments	No. of pods per plant	No. of seeds per pod	No. of branches	Dry matter (kg/ha)
T_1: Application of FYM + vermicompost based on 100 % RDP	14.67	5.33	4.67	2317.33
T_2: Application of vermicompost + ghanajeevamrutha based on 100 % RDP	15.67	5.67	5.33	2441.33
T_3: Application of FYM + ghanajeevamrutha based on 100 % RDP	15.00	5.33	5.00	2350.00
T_4: Application of FYM + vermicompost based on 50 % RDP	7.33	4.67	2.67	1792.33
T_5: Application of vermicompost + ghanajeevamrutha based on 50 % RDP	9.00	5.00	3.33	1923.67
T_6: Application of FYM + ghanajeevamrutha based on 50 % RDP	8.33	4.00	3.00	1837.00
T_7 Application of FYM + vermicompost based on 100 % RDP + *Rhizobium* + PSB	17.00	6.00	5.33	2497.33
T_8: Application of vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB	19.33	6.67	6.33	2740.00
T_9 : Application of FYM + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB	18.00	6.33	5.67	2570.00
T_{10}: Application of FYM + vermicompost based on 50 % RDP + *Rhizobium* + PSB	10.33	4.67	3.33	2017.33
T_{11}: Application of vermicompost + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB	13.00	5.00	4.33	2224.33
T_{12}: Application of FYM + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB	11.67	5.00	3.67	2105.33
SEm±	0.61	0.40	0.23	67.66
CD (p=0.05)	1.79	1.17	0.69	198.44

Note: FYM - Farm Yard Manure., RDP - Recommended Dose of Phosphorus (50 Kg/ha), PSB – Phosphorus Solubilizing Bacteria

Table 2: Effect of organics on grain yield (kg/ha), haulm yield (kg/ha) in black gram variety TAU-1.

Treatments	Grain yield (kg/ha)	Haulm yield (kg/ha)
T_1: Application of FYM + vermicompost based on 100 % RDP	610.00	1707.33
T_2: Application of vermicompost + ghanajeevamrutha based on 100 % RDP	634.00	1807.33
T_3: Application of FYM + ghanajeevamrutha based on 100 % RDP	622.00	1728.00
T_4: Application of FYM + vermicompost based on 50 % RDP	408.33	1390.33
T_5: Application of vermicompost + ghanajeevamrutha based on 50 % RDP	491.33	1432.33
T_6: Application of FYM + ghanajeevamrutha based on 50 % RDP	411.00	1426.00
T_7 Application of FYM + vermicompost based on 100 % RDP + *Rhizobium* + PSB	659.33	1838.00
T_8: Application of vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB	701.33	2038.67
T_9 : Application of FYM + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB	680.00	1890.00
T_{10}: Application of FYM + vermicompost based on 50 % RDP + *Rhizobium* + PSB	537.00	1480.33
T_{11}: Application of vermicompost + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB	592.67	1631.67
T_{12}: Application of FYM + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB	573.00	1532.33
SEm±	30.54	60.81
CD (p=0.05)	89.60	178.37

Table 3: Influence of different organic sources on cost of cultivation, gross returns, net returns and benefit cost ratio of black gram.

Treatments	Cost of cultivation (₹)	Gross returns (₹)	Net returns (₹)	B:C
T_1: Application of FYM + vermicompost based on 100 % RDP	29320	45280.70	15961	1.54
T_2: Application of vermicompost + ghanajeevamrutha based on 100 % RDP	31320	46963.75	15644	1.50
T_3: Application of FYM + ghanajeevamrutha based on 100 % RDP	29320	45635.50	16316	1.56
T_4: Application of FYM + vermicompost based on 50 % RDP	20020	25538.00	5518	1.21
T_5: Application of vermicompost + ghanajeevamrutha based on 50 % RDP	23320	28327.50	5008	1.28
T_6: Application of FYM + ghanajeevamrutha based on 50 % RDP	20120	27386.50	7267	1.36
T_7 Application of FYM + vermicompost based on 100 % RDP + *Rhizobium* + PSB	29378	49417.00	20039	1.68
T_8: Application of vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB	31378	54461.00	23083	1.74
T_9 : Application of FYM + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB	29378	50727.50	21350	1.73
T_{10}: Application of FYM + vermicompost based on 50 % RDP + *Rhizobium* + PSB	19549	32585.00	13036	1.67
T_{11}: Application of vermicompost + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB	23349	31478.50	8130	1.35
T_{12}: Application of FYM + ghanajeevamrutha based on 50 % RDP + *Rhizobium* + PSB	20149	35505.50	15357	1.76

nutrient rich organics *viz.* vermicompost, ghanajeevamrutha. The crucial role of *Rhizobium* in fixation of atmospheric nitrogen lies in the enhanced supply and translocation of N which influences the development of photosynthetic organs and PSB inoculation, solubilization of the insoluble P through the production of organic acids, accelerating the growth of the native *Rhizobium* population and playing an essential role in nodule formation in black gram. The results confirm to the research findings of Sailaja Kumari and Usha Kumari (2002) in cowpea crop and Wagadre *et al.* (2010) in green gram crop.

However, the application of organic supplements results in slow release of nutrients besides minimizing the loss of nutrients due to increased nutrient absorption as a result of increased cation exchange capacity which leads to a longer period of plant nutrients availability in adequate quantity thereby facilitating the plant for greater absorption of the required nutrients resulting in prominent growth, development and yield components. The organic matter supplementation improves the soil's physical properties such as improved structure, higher porosity, water holding capacity and lower bulk density and chemical properties such as improved soil organic carbon and greater availability of nutrients which promotes overall soil health and crop growth potential on a sustainability basis. Thus, based on the findings of this experiment it can be revealed that application of vermicompost + ghanajeevamrutha based on 100 % RDP + *Rhizobium* + PSB recorded significantly higher gross monetary returns (Rs. 54540/ha), net monetary returns (Rs. 23083/ha) and B:C (1.74) in blackgram production. The higher gross returns, net returns and the benefit cost ratio were obtained due to higher grain yield in T8 treatment over remaining treatments (Sharma *et al.,* 2010). The production cost for the black gram crop was higher with an increased quantity of FYM, vermicompost and ghanajeevamrutham application. So, the intensification of organic manures leads to a substantial and progressive increase of grain yield with a subsequent increase in gross and net monetary returns, which resulted in a higher benefit-cost ratio.

Conclusion

Organic manures plays a vital role in maintaining soil sustainability in the long term as they reduce nutrient losses and improve the organic matter content of the soil. The present study highlights the importance of organic manures for the supplementation of P fertilizers for the yield improvement in black gram and thus interprets that the nutrient availability, uptake and microbial load can be improved with the combined application of different organic manures like vermicompost, ghanajeevamrutha, FYM along with *Rhizobium* and PSB which in turn enhances the soil productivity.

Acknowledgement

I would like to express my sincere thanks to the University of Agricultural Sciences, Vijayapura for extending their support for the successful completion of Nallagatla Vinod Kumar research.

Conflict of interest

The authors declare that they have no conflict of interest.

References

Anonymous. (2018). Area, production and productivity of greengram database agriculture survey of India, ministry of Agriculture.

Piper, C. S. (1966). Soil and plant analysis, Academic Press, New York, pp. 47-77.

Kumari, M. S., & Kumari, K. U. (2002). Effect of vermicompost enriched with rockphosphate on growth and yield of cowpea (Vigna unguiculata L. Walp). *Journal of the Indian Society of Soil Science*, *50*(2), 223-224.

Sharma, S. N., & Prasad, R. (2010). Effect of different sources of phosphorus on summer mungbean (*Vigna radiata* L.) in alkaline soil of Delhi. *Indian Journal of Agricultural Sciences*, *79*(10), 782-789.

Wagadre, N., Patel, M.V., & Patel, H. K. (2010). Response of summer green gram (*Vigna radiata* L.) to vermicompost and phosphorus with and without PSB inoculation. State Level Seminar on “Organic Farming” Navsari, Gujarat. pp - 111-113.

Publisher's Note: ASEA remains neutral with regard to jurisdictional claims in published maps and figures.