Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 611-613
Received: 03-03-2020
Accepted: 07-04-2020

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Assessment of organic and inorganic source of nutrients on yield and yield traits of black gram (*Vigna mungo* L.)

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Abstract
The present study was undertaken to assessment of organic and inorganic source of nutrients on yield and yield traits of black gram (*Vigna mungo* L.) cultivar "I PU-42". An investigation was taken up during *kharif* season of 2018 at Suresh GyanVihar University, school of Agriculture Research Farm, Department of Agronomy, Jaipur (Rajasthan). The experiment was laid down in randomized block design (RBD), consisting of eight treatments which were replicated thrice for comparing the performance of cultivar "I PU-2 43" treated with different levels of organic and inorganic source of nutrients that were applied individually as well as in combination. The results indicates that treatment T_6 that consists of 50%recommended doses of fertilizers (RDF) in combination with 50% vermicompost (VC)were far better than rest of treatments under study. It recorded significantly highest number of pods plant^{-1} (49.60), numbers of grains pod^{-1}(5.53), 1000 grain weight (36.76 gm), harvest index (45.39%), grain yield (7.53 q ha^{-1}) and straw yield (13.97 q ha^{-1}) over rest of the treatments.

Keywords: Black gram, organic and inorganic nutrients

Introduction
Nutrients available (NPK) in plants can be added either by applying organic or inorganic forms of fertilizers or both in combination. The organic and inorganic forms of fertilizers are available through a variety of sources *viz*., organic matter/manures, bio fertilizer, green manures and chemical fertilizers. Both organic and inorganic fertilizers provide plants with the nutrients needed to grow healthy and strong. However, each contains different ingredients and supplies these nutrients in different ways. Organic fertilizers work over time to create a healthy growing environment, while inorganic fertilizers provide rapid nutrition. Determining which is better for your plants depends largely on the needs of your plants and your preferences in terms of cost and environmental impact. Organic fertilizers contain only plant- or animal-based materials that are either a byproduct or end product of naturally occurring processes, such as manures, leaves, and compost. Inorganic fertilizer, also referred to as synthetic fertilizer, is manufactured artificially and contains minerals or synthetic chemicals. For example, synthetic nitrogen fertilizers are typically made from petroleum or natural gas. Phosphorus, potassium and other trace elements in inorganic fertilizers are often mined from the earth. Organic fertilizers release nutrients only when the soil is warm and moist, which tends to correspond with your plants' times of greatest need. However, they rely on soil organisms to break down organic matter, so nutrients are released more slowly than they are from inorganic fertilizers. This slow-release method reduces the risk of nutrient leaching, but it takes time to supply nutrients to plants. In contrast, inorganic fertilizers provide this nutrition in plant-ready form immediately. However, the concentration of nutrients increases the risk of burning the plant, and the rapid release of nutrients may leach them deeply into the soil and water table where plants cannot access them. Among inorganic/chemical fertilizers, urea is the main source of nitrogen, 100kg bag of urea contains approximately 46% of nitrogen. Besides urea, other sources of nitrogen applied through chemical fertilizers are DAP (18%N), calcium ammonium nitrate (28% N), ammonium sulphate (20% N) and ammonium phosphate (11% N). Chemical fertilizers which are used to fulfill the phosphorus and potassium requirements of plants includes DAP (20% P), ammonium phosphate (23% P), single super phosphate (7% P), triple super phosphate (20% P), MOP (60% K2O) and Potassium sulphate (40% K). On the other hand, vermicompost and FYM are the most commonly used organic fertilizers for improving soil quality and growth as well development of crop plants including urdbean.

Vermicompost, a natural organic fertilizer contains relatively higher amount of plant nutrients i.e. 0.6% N, 1.34% P and 0.4% K, compared to conventional organic manures such as FYM which is composed of 0.55%N, 0.20% P and 0.5% K (Ram *et al.*, 2007). Use of both FYM and vermicompost are best remedies for maintaining of soil health as well as productivity of crop plants along with the application of chemical fertilizers under non pesticide-practices of controlling insect pest and diseases by using bio-pesticides. Such practices to some extent will help to overcome the ill effect of continuous use of chemical pesticides and fertilizers. Thereby helps in preventing environmental pollution. It is now well realized that to protect soil health, use of judicious combination of organic and inorganic sources of nutrients is essential (Mohan and Chandaragiri, 2007). Integration of recommended dose of chemical fertilizers along with farmyard manure or vermicompost would result in better yield of black gram under rainfed condition. Slow and steady release of nutrients from organic and inorganic sources would increase the availability of nutrients which will result in translocation of more photosynthates from source to sink and finally improve the yield attributing characters. Keeping the above considerations, the present investigation was undertaken to study the effect of organic and inorganic sources of nutrients on yield and yield attributes of black gram and to find out the suitable organic and inorganic nutrient management for black gram.

Resources and Methods

The present investigation was carried out at Crop Research Farm, Department of Agronomy, School of Agriculture, Suresh GyanVihar University, Jaipur (Rajasthan) during *kharif* season of 2018 on sandy loam soil. The experimental site is situated in the eastern boundary of Thar Desert a semi-arid land of Rajasthan at an elevation of 431 meters above sea level with 26.90 North latitude and 75.70 East longitudes. The experiment consists of eight treatments including control which were tested under three replications by using randomized block design (RBD). Different levels of organic and inorganic sources of nutrients were used to test the performance of black gram cultivar "I PU-42". The various treatments used in present study includes T_0 (Control), T_1 (100% RDF), T_2(100% VC), T_3 (100% FYM), T_4 (50% FYM + 50% VC), T_5 (50% RDF + 50% FYM), T_6 (50% RDF + 50% VC) and T_7 (50% RDF + 25% FYM + 25% VC) Nutrient management was done through Urea, DAP, FYM and VC to supply the required nitrogen and phosphorus. Half dose of nitrogen in the form of inorganic source i.e., urea was applied after first irrigation and the second split dose at the time of pod formation whereas full dose of inorganic source of P_2O_5in the form of DAP and organic source in the form of FYM (5t ha^{-1}) and VC (2 t ha^{-1}) were applied as basal dressing to fulfil the recommended dosage of nitrogen @20kg $ha.^{-1}$ and 40kg phosphorus $ha.^{-1}$ of black gram. The data on yield and yield attributes were recorded in all the treatments and were analysed statistically

Observations and Analysis

It is an established fact that organic source of nutrients *viz*., FYM and vermicompost improve the physical, chemical and biological properties of soil including supply of almost all the essential plant nutrients for the growth and development of plants.

Perusal of data presented in Table.1 revealed that all rest of the treatments, the yield contributing characters under study showed significant variation when treated with different levels of organic and inorganic source of nutrients which were either applied individually or in combination. The maximum number of pods $plant^{-1}$ (49.60), number of grains pod^{-1} (5.53), 1000 grain weight (36.76 g) and harvest Index (45.39%) was recorded with treatment T_6 which was applied of 50% recommended dose of fertilizers (RDF) in combination with 50% vermicompost as compared to all other treatments and against minimum recorded in control. Our results are in conformity with Rathore *et al.* (2010) [9] Sheikh *et al.* (2012) [10]. Application of inorganic fertilizers makes availability of essential nutrients more quickly to crop plants whereas organic fertilizers especially vermicompost helps in enhancing the activity of microorganisms in soils which further helps to improve solubility of nutrients and their consequent availability to plants. Therefore combined effect of both organic and inorganic source of nutrients can have favorable effect in improving the yield attributes of any crop plant including black gram. Kumawat *et al.* (2013) [7], Kokani *et al.* (2014) [4].

The statistical analysis of data showed that there were significant differences between treatment and grain yield. Table 2 of black gram cultivar "I PU-2 43" showed significant differences when subjected to different levels of organic and inorganic source of nutrients. Significantly maximum grain yield (7.32 q ha^{-1}) was obtained on treatment T_6 when plots were treated with i.e., 50% RDF in combination with 50% vermicompost against significantly minimum (3.80 q ha^{-1}) recorded in control. However, it was statistically at par with treatment T_7 (50% RDF + 25% FYM + 25% VC). Kannan and Ganesan (2011) [3]. It is also a fact that nutrients in organic matters /manures are released to the plants via the activity of soil microbes. This must have occurred in a more efficient and continues manner when a combination of FYM and application of vermicompost was used. Yield is a dependent character that depends upon yield contributing characters. Therefore, any change in any yield contributing character will have direct impact on yield. As both inorganic and organic fertilizers provides readily availability of essential nutrients to crop plant thereby helps in enhancing yield attributes because optimum utilization of solar light and its conversion to starches through photosynthesis resulted higher grain number and weight that resulted in increased seed yield. Our results are in conformity with Patil *et al.*, (2014). Kumar *et al.* (2011) [6], Shukla and Tygi (2009) [11].

From the Table 2, it was observed that straw yield of black gram cultivar "I PU-2 43" when treated with different levels of organic and inorganic sources of nutrients showed significant variation. Significantly maximum fodder yield (13.97q ha^{-1}) was found with treatment T_6 (50% RDF + 50% VC) against significantly minimum in control (11. 29 q ha^{-1}). Similar findings were also reported by Prasad *et al.* (2015), Amruta, *et al.* (2015) [1], Kokani *et al.* (2015) [5] who observed maximum straw yield in black gram from the treatments with both organic and inorganic fertilizer combination.

Table 1: Effect of organic and inorganic source of nutrients on yield attributes of black gram (*Vigna mungo* L.)

Treatments		Number of pods $plant^{-1}$	Number of grains pod^{-1}	Test weight(gm) 1000 seeds	Harvest Index (%)
T_1	100% RDF	24.20	5.13	32.93	32.28
T_2	100% FYM	16.86	4.53	34.26	39.38

T_3	100% VC	20.86	4.40	33.50	33.28
T_4	50% FYM+ 50% VC	29.26	4.26	33.63	31.67
T_5	50% RDF + 50% FYM	32.93	4.33	33.70	33.59
T_6	50% RDF + 50% VC	49.60	5.53	36.76	45.39
T_7	50% RDF + 25% FYM + 25% VC	37.13	4.66	34.66	43.98
T_8	Control	17.80	3.66	31.50	35.89
F- test		S	S	S	S
S. Ed.(±)		1.54	0.28	1.27	4.15
C. D. (P = 0.05)		3.31	0.62	2.73	8.93

RDF=Recommended dose of fertilizers, VC= Vermicompost, FYM= Farmyard manure

Table 2: Effect of organic and inorganic source of nutrients on yield and economy of black gram (*Vigna mungo* L.)

Treatments		Grain yield(q/ha)	Straw yield(q/ha)
T_1	100% RDF	4.92	11.06
T_2	100% FYM	5.51	12.16
T_3	100% VC	5.50	12.59
T_4	50% FYM+ 50% VC	6.01	13.90
T_5	50% RDF + 50% FYM	5.35	12.97
T_6	50% RDF + 50% VC	7.32	13.97
T_7	50% RDF + 25% FYM + 25% VC	5.19	10.53
T_8	Control	3.80	11.29
F- test		S	S
S. Ed.(±)		100.46	141.20
C. D. (P = 0.05)		215.50	NS

RDF=Recommended dose of fertilizers, VC= Vermicompost, FYM= Farmyard manure

Conclusion

From the result narrated above it is concluded that treatment T_6 which consists of 50% recommended dose of fertilizers (RDF) in combination with 50% Vermicompost recorded significant improvement in enhancing yield and yield contributing characters of black gram cultivar "I PU-42" over rest of the treatments used in present investigation. It is therefore suggested and recommended that combination of organic and inorganic fertilizers should be adopted by farmers to sustain yield of black gram and soil health in Jaipur Rajasthan.

Acknowledgement

Above all we would like to prostrate for God, who gave patient and made our work successful. We are grateful to Prof. (Dr.) Sushil Kumar Sharma, Principal, School of Agriculture, Suresh Gyan University Jaipur Rajasthan, for providing precious guidance, enthusiastic support in terms of lab and land facility during the course of this research work.

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