INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 16, No. 4, p. 79-89, 2020

RESEARCH PAPER OPEN ACCESS

Influence of organic and inorganic fertilizers on the yield of blackgram

Noor-E-Zannat[1], A.K.M. Ruhul Amin[1], Rebaka Sultana[2*], Ruhul Amin[3], Parvin Akter Bithy[4], Chaity Dey Puja[2], Ishrat Alam[5]

[1]*Department of Agronomy, Sher-e-Bangla Agricultural University (SAU), Dhaka-1207, Bangladesh*

[2]*Department of Horticulture, Sher-e-Bangla Agricultural University (SAU), Dhaka-1207, Bangladesh*

[3]*Department of Entomology, Sher-e-Bangla Agricultural University (SAU), Dhaka-1207, Bangladesh*

[4]*Department of Agricultural Botany, Department of Entomology, Sher-e-Bangla Agricultural University (SAU), Dhaka-1207, Bangladesh*

[5]*Department of Soil Science, Sher-e-Bangla Agricultural University(SAU), Dhaka-1207, Bangladesh*

Key words: Organic fertilizers, 1000-seed weight, Yield, Blackgram.

http://dx.doi.org/10.12692/ijb/16.4.79-89 Article published on April 14, 2020

Abstract

Flower abortion and pod dropping are the main bottleneck for the expansion of blackgram production in Bangladesh. In view of partial solution on this problem an experiment was conducted to study the influence of different combinations of organic and inorganic fertilizer on yield of blackgram. Treatments consisted of two combined organic and inorganic varieties *viz.*, V_1= BARI Mash-2, V_2= BARI Mash-3, eight levels of fertilizers viz., F_0 = Control, F_1 = RDF, F_2 = 25% less than RDF + Vermicompost, F_3 = 50% less than RDF + Vermicompost, F_4 = 25% less than RDF + Poultry litter, F_5 = 50% less than RDF + Poultry litter, F_6 = 25% less than RDF + Mixed fertilizer, and F_7 = 50% less than RDF + Mixed fertilizer. The experiment was conducted following Randomized Complete Block Design (RCBD) with 3 replications. Results revealed that the yield of blackgram were significantly influenced by varieties and/or organic and inorganic fertilizers. Between two varieties, BARI Mash-3 gave the highest seed yield (1.83 t ha^{-1}). Among the fertilizer dose, F_2 gave the highest seed yield (1.84 t ha^{-1}) which was statistically similar to F1 (1.82 t ha^{-1}) and F_3 (1.79 t ha^{-1}). The highest seed yield (1.90 t ha^{-1}) was exhibited from V_2F_2treatment combination followed by V_2F_1 (1.87 t ha^{-1}). It can be concluded that the application of organic and inorganic fertilizer had a positive effect on BARI Mash-3 and 25% less than recommended dose of fertilizer + vermicompost or recommended dose of fertilizer can be suggested to cultivate this crop.

* **Corresponding Author:** Rebaka sultana ✉ rebekahort19@gmail.com

Introduction

Pulses are important crops in Bangladesh. They occupy an area of about 240 hectares with an annual production of 220 metric tons (BBS, 2010). Pulses are mainly the Rabi seasons crop but they are losing their area of cultivation each year due to increase in cultivation of wheat, vegetables and high yielding Boro rice with increasing facilities of irrigation. Blackgram (*Vigna mungo* L.) is an important pulse. It (Blackgram) contain a remarkable amount of proteins, minerals, vitamins and carbohydrates. Among the various pulses, Blackgram is one of important pulse which contains approximately 25-28% protein, 4.5-5.5% ash, 0.5-1.5% oil, 3.5-4.5% fiber and 62.65% carbohydrate on dry weight basis (Kaul, 1982). It contains Sulphur, amino acids, methionine and cysteine and also lysine which are excellent components of balanced human nutrition. Phosphorus is an important mineral element for grain legumes as it helps in root development, participates in synthesis of phosphate and phosphoproteins and takes part in energy fixing and releasing process in plants. Significant response of legumes to phosphate nutrition has been reported by several workers (Singh and Yadav, 2008). Pulses are suitable for cropping process as it needs less time or less term, less input and aridity tolerant quality.

The yield potential of blackgram is very low because of the fact that the crop is mainly grown in rain fed conditions with poor management practices and also due to various physiological, biochemical as well as inherent factors associated with the crop. Apart from the genetic makeup, the physiological factor *viz*., insufficient partitioning of assimilates, poor pod setting due to the flower abscission and lack of nutrients during critical stages of crop growth, coupled with a number of diseases and pests (Mahala *et al*., 2001) were the reasons for the poor yield. Organic manures *viz*., FYM, vermicompost, poultry manure and oilcakes help in the improvement of soil structure, aeration and water holding capacity of soil. Further, it stimulates the activity of microorganisms that makes the plant to get the macro and micro-nutrients through enhanced biological processes, increase nutrient solubility, alter soil salinity, sodicity and pH. (Alabadan *et al*., 2009). Though, they contain relatively low concentrations of nutrients and handling them is labour intensive, there has been large increase in their use over inorganic fertilizers as nutrient source. Vermiculture biotechnology promises to user in the second green revolution' by completely replacing the destructive agro-chemicals which did more harm than good to both the farmers and their farmlands during the 'first green revolution' of the 1950-60's. Earthworms restore and improve soil fertility and boost crop productivity by the use of their excreta-'vermicast' (Arancon *et al*., 2004). Except on vermicompost, several research works on bacterial, mineral and organic fertilizers from various sources have already been done in Nepal (Maskey and Bhattarai, 1994). Poultry litter contains all the nutrients essential for plant growth and has an approximate 3-3-2 (N-P_2O_5-K_2O) fertilizer grade equivalent (Mitchell and Donald, 1995). The efficacy of poultry litter applications to enhance crop growth (yield and nutrient uptake) depends upon its nutrient availability. Application of Poultry Litter to cropland can also increase soil organic matter thereby improving soil quality and productivity (Kingery *et al*., 1994). The supply of phosphorus to legumes is more important than of nitrogen because, nitrogen is being fixed by symbiosis with Rhizobium bacteria. The beneficial effects of phosphorus on nodulation, growth, yield and general behavior of legume crop have been well established because it plays an important role in root development. Phosphorus application to legumes plays a key role in the formation of energy rich phosphate bonds, phospholipids and for development of root system (Tisdale *et al*., 1985). It also improves the crop quality and resistance to diseases. Reddy and Swamy (2000) reported that the Interaction of phosphorus with farmyard manure was significant with respect to seed yield of black gram. Economic analysis of the different treatments showed that the highest additional seed yield and net returns (Rs 3528 ha^{-1}) were associated with 26.2 kg P ha^{-1} + PSB inoculation + no farmyard manure. This treatment also gave a benefit: cost ratio of 2.69. Therefore, the present

experiment was aimed to find out the most promising combinations of organic and inorganic fertilizer on yield of blackgram.

Materials and methods

Experimental site

The experiment was carried out on the farm of Sher-e-Bangla Agricultural University, Sher-e-bangla Nagar. Dhaka, Bangladesh. The soil of the experimental site belongs to the general soil type, Shallow Red Brown Terrace Soils under Tejgaon Series. The experimental site was medium high land belonging of old Madhupur tract (AEZ-28) the experimental area was situated at 23°77′N latitude and 90°33′E longitude at an altitude of 8.6 meter above the sea level.

Experimental treatment and layout

The experiment comprised two factors such as factors A: Variety(2)-BARI mash-2 and BARI mash-3; and factors B: Organic and inorganic fertilizer (8)-F_0 = 0 (Control), F_1 = Recommended dose of fertilizer(RDF), F_2 = 25% less than Recommended dose of fertilizer (RDF) +Vermicompost, F_3 = 50% less than Recommended dose of fertilizer (RDF) +Vermicompost, F_4 = 25% less than Recommended dose of fertilizer (RDF) +Poultry litter, F_5 = 50% less than Recommended dose of fertilizer (RDF) +Poultry litter, F_6 = 25% less than Recommended dose of fertilizer (RDF) +Mixed fertilizer, F_7 = 50% less than Recommended dose of fertilizer (RDF) + Mixed fertilizer.The experiment was laid out in Randomize Complete Block Design (RCBD) with three replications. There were 16 treatment combinations. The total numbers of unit plots were 48. The size of unit plot was 2.4 m × 1.6 m. The distances between plot to plot and replication to replication were 0.50 m and 1.0 m, respectively.

Crop husbandry

The seeds of blackgram having more than 80% germination were sown by hand in 30 cm apart from lines and plant to plant distance was maintained 10 cm. The sowing depth was 3 cm and sown on 25 March, 2017.A pre- sowing irrigation was given on 18 March, 2017. The land was open with the help of a tractor drawn disc harrow on 22 March, 2017, then ploughed with rotary plough twice followed by laddering to achieve a medium tilth required for the crop under consideration. All weeds and other plant residues of previous crop were removed from the field. Immediately after final land preparation, the field layout was made on March 25, 2017 according to experimental specification. Individual plots were cleaned and finally prepared the plot .The specific plots area was fertilized @ 45 kg ha^{-1}, 80-90 kg ha^{-1}, 58 kg ha^{-1}, 2.6 ton ha^{-1}, 2.5 ton ha^{-1} and 375 kg ha^{-1} of Urea, TSP, MOP, vermicompost, poultry litter and mixed fertilizer respectively. The entire amounts of Urea, TSP, and MOP, vermicompost, poultry litter and mixed fertilizer were applied in different combinations according to treatment as basal dose at final land preparation. Some intercultural operations such as irrigation, drainage, thinning,gap filling ,weeding top dressing ,spraying of insecticides and fungicides, protection of crops from other pests. Maturity of crop was determined when 80-90% of the pods become blackish in color. The harvesting of black gram was done from 20 June to 04 July, 2017. Three pickings were done. Five pre-selected plants per plot was collected from which different yield attributing data were recorded and $1m^2$ area from middle portion of each plot was separately harvested and bundled, properly tagged and then brought to the threshing floor for recording grain and straw yield. The grains were cleaned and sun dried to a moisture content of 12%. Straw was also sun dried properly. Finally grain and straw yields $plot^{-1}$ were determined and converted to kg ha^{-1}.

Data collection

Experimental data were determined from 15 days of growth duration and continued until harvest. Dry weights of plant were collected by harvesting respective number of plants at different specific dates from the inner rows leaving border rows and harvest area for grain. The following data were recorded during the experimentation ,Seed weight $plant^{-1}$, Weight of 1000 seeds (g), Seed yield (t ha^{-1}), Stover yield (t ha^{-1}) at harvest , Biological yield (t ha^{-1}) and

Harvest index (%).

Statistical analysis

All the collected data were analyzed following the analysis of variance (ANOVA) technique using a statistical computer software IBM-SPSS (Version 20.0) and the means were adjusted by Tukey's Test at 5% level of significance.

Results and discussion

Seed weight plant^{-1}

Seed weight plant^{-1}had a significant impact among two blackgram varieties. BARI Mash-3(V_2) shown higher seed weight plant^{-1}(5.03 g) where BARI Mash-2(V_1) was lower (4.54 g) than V_2as shown in Fig. 1.Seed weight plant^{-1} of blackgram exerted significant effect due to different combination of organic and inorganic fertilizers as shown in Fig. 1. It can be inferred from the figure that seed weight plant^{-1} increased sharply with the increased fertilizer level and the highest increased was found with F_2 treatment. Further increases of fertilizer dose reduce the seed weight plant^{-1} gradually and the reduction continued up highest dose (F_7). However, F_2 showed the highest seed weight plant^{-1}(6.09 g). F_0 showed the lowest seed weight plant^{-1}(3.32 g).

Table 1. Interaction effect of variety and different combinations of organic and inorganic fertilizer on seed weight and thousand seed weight of blackgram.

Treatments(variety and fertilizer combinations)	Seed weight plant^{-1} (g)	Thousand seed wt. (g)
V_1F_0	3.07 g	35.44 g
V_1F_1	5.49 a-d	41.91 a-c
V_1F_2	5.84 a-c	40.47 b-f
V_1F_3	5.16 a-f	38.92 c-f
V_1F_4	4.92 a-f	38.59 c-g
V_1F_5	4.29 b-g	37.82 d-g
V_1F_6	3.72 e-g	37.21 fg
V_1F_7	3.83 d-g	37.38 e-g
V_2F_0	3.57 fg	37.44 e-g
V_2F_1	5.98 ab	43.91 a
V_2F_2	6.34 a	42.47 ab
V_2F_3	5.66 a-c	40.92 a-d
V_2F_4	5.40 a-e	40.59 a-e
V_2F_5	4.78 a-f	39.82 b-f
V_2F_6	4.22 c-g	39.21 b-f
V_2F_7	4.32 b-g	39.38 b-f
LSD (.05)	1.70	3.35
CV (%)	10.52	2.51

V_1 = BARI Mash-2, V_2 = BARI Mash-3, F_0= 0 (Control); F_1= Recommended dose of fertilizer (RDF), F_2= 25% less than RDF + vermicompost; F_3= 50% less than RDF + vermicompost, F_4= 25% less than RDF + poultry litter, F_5= 50% less than RDF + poultry litter, F_6= 25% less than RDF + mixed fertilizer, F_7= 50% less than RDF + mixed fertilizer.

This might be due to the different combinations of organic and inorganic fertilizer on seed weight plant^{-1}. The result confirms with findings of Gawai and Pawar (2006) who reported that use of organic manures along with inorganic fertilizers leads to increase in productivity and also sustain the soil health for a longer period.Interaction of variety and fertilizer combination gave significant result on seed weight plant^{-1} of blackgram (Table 1). Where V_2F_2 showed the highest result (6.34 g) which was statistically similar with V_1F_1, V_1F_2, V_1F_3, V_1F_4, V_2F_1, V_2F_3, V_2F_4, and V_2F_5 combinations. Where V_1F_0 showed the lowest

result (3.07 g) which was statistically similar with V_1F_5, V_1F_6, V_1F_7, V_2F_0, V_2F_6 and V_2F_7 combinations. Rajkhowa *et al.* (2002) reported that the application of 100 per cent RDF along with vermicompost @ 2.5 t ha^{-1} in green gram recorded significantly higher seed weight over control and it was on par with the application of 75% or 50% RDF + vermicompost (2.5 t ha^{-1}) over control in green gram.

Table 2. Interaction effect of variety and different combinations of organic and inorganic fertilizer on seed yield, stover yield and biological Yield of blackgram.

Treatments(variety and fertilizer combinations)	Seed yield (t ha^{-1})	Stover yield (t ha^{-1}) at harvest	Biological yield (t ha^{-1})
V_1F_0	1.61 j	3.77 b	5.38 b
V_1F_1	1.77 d-f	4.98 ab	6.75 ab
V_1F_2	1.78 d-f	5.13 ab	6.91 ab
V_1F_3	1.74 f-h	4.65 ab	6.39 ab
V_1F_4	1.68 hi	4.50 ab	6.18 ab
V_1F_5	1.67 i	4.35 ab	6.02 ab
V_1F_6	1.70 g-i	3.84 b	5.54 b
V_1F_7	1.70 g-i	4.65 ab	6.35 ab
V_2F_0	1.76 e-g	4.42 ab	6.18 ab
V_2F_1	1.87 e-g	5.50 a	7.37 a
V_2F_2	1.90 a	5.64 a	7.54 a
V_2F_3	1.85 a-c	5.16 ab	7.01 ab
V_2F_4	1.81 b-e	5.10 ab	6.91 ab
V_2F_5	1.79 c-f	4.84 ab	6.63 ab
V_2F_6	1.84 a-c	4.35 ab	6.19 ab
V_2F_7	1.83 b-d	5.17 ab	7.00 ab
LSD (.05)	0.0617	1.14	1.06
CV (%)	4.14	7.43	5.74

V_1 = BARI Mash-2, V_2 = BARI Mash-3, F_0= 0 (Control); F_1= Recommended dose of fertilizer (RDF), F_2= 25% less than RDF + vermicompost; F_3= 50% less than RDF + vermicompost, F_4= 25% less than RDF + poultry litter, F_5= 50% less than RDF + poultry litter, F_6= 25% less than RDF + mixed fertilizer, F_7= 50% less than RDF + mixed fertilizer.

Weight of thousand seeds (g)

Weight of 1000 seeds (g) showed a significant variation on thousand seed weight between two black gram varieties. BARI Mash-3(V_2) had higher weight of 1000 seeds (40.47 g) than BARI Mash-2(V_1) (38.47 g) as shown in Fig. 2. Different response was observed in weight of 1000-seedson different combinations of fertilizer. All eight combinations of different organic and inorganic fertilizer combinations are significant where F_1 and F_2 showed highest weight of 1000 seeds (42.91 g and 41.47 g, respectively). F_3 and F_4 showed medium weight of 1000 seeds (39.92 g and 39.57 g, respectively) in comparison to F_1 and F_2. F_0 showed the lowest weight of 1000 seeds (36.44 g). This might be due to the different combinations of organic and inorganic fertilizer on weight of 1000 seeds as shown in Fig. 2. Significant result was found at the interaction of variety and fertilizer. Interaction of V_2F_1 showed the height 1000 sees weight which was statistically similar with V_2F_2, V_1F_1, V_2F_3, and V_2F_4 interactions. On the other hand, V_1F_0 treatment showed the lowest weight of 1000 sees weight which was statistically similar with V_1F_4, V_1F_5, V_1F_6, V_1F_7 and V_2F_0 interactions (Table 1). Pannu *et al.* (2007) reported that the application of FYM as well as PM (pressmud) at 2.50 t/ha along with one fourth of the recommended dose of NP fertilizer (12 kg N and 40 kg P ha^{-1}) 9 recorded the highest yield (6.90 and 6.60

q ha^{-1} respectively) of black gram and similar trend was observed for the various growth attributes, such as number of pods plant^{-1}, plant height and 1000-grain weight.

Seed yield (t ha^{-1})

Seed yield had a significant effect between two black gram varieties. BARI Mash-3(V_2) shown higher seed yield (1.83 t ha^{-1}) where BARI Mash-2(V_1) was lower (1.71 t ha^{-1}) than V_2 (Fig. 3). The efficacy of poultry litter applications to enhance crop growth (yield and nutrient uptake) depends upon its nutrient availability. Application of PL to cropland can also increase soil organic matter (Watts *et al.*, 2010).Seed yield showed different response on different combinations of fertilizer.

Table 3. Interaction effect of variety and different combinations of organic and inorganic fertilizer on harvest index of blackgram.

Treatments (variety and fertilizer combinations)	Harvest index (%)
V_1F_0	30.51 ab
V_1F_1	26.28 ab
V_1F_2	25.76 b
V_1F_3	26.28 ab
V_1F_4	25.76 ab
V_1F_5	27.24 ab
V_1F_6	27.24 ab
V_1F_7	27.94 ab
V_2F_0	29.81 ab
V_2F_1	31.06 a
V_2F_2	31.42 a
V_2F_3	30.83 ab
V_2F_4	30.40 ab
V_2F_5	30.19 ab
V_2F_6	30.82 ab
V_2F_7	30.60 ab
LSD (.05)	5.18
CV (%)	10.91

V_1 = BARI Mash-2, V_2 = BARI Mash-3, F_0= 0 (Control); F_1= Recommended dose of fertilizer (RDF), F_2= 25% less than RDF + vermicompost; F_3= 50% less than RDF + vermicompost, F_4= 25% less than RDF + poultry litter, F_5= 50% less than RDF + poultry litter, F_6= 25% less than RDF + mixed fertilizer, F_7= 50% less than RDF + mixed fertilizer.

All eight combinations of different organic and inorganic fertilizer combinations are significant where F_2 and F_1 showed highest seed yield (1.84 t ha^{-1} and 1.82 t ha^{-1}). F_3 and F_6 showed medium seed yield (1.79 t ha^{-1} and 1.77 t ha^{-1}) in comparison to F_2 and F_1. F_0 showed the lowest seed yield (1.68 t ha^{-1}). This might be due to the different combinations of organic and inorganic fertilizer on seed yield. Phosphorus is an important mineral element for grain legumes as it helps in root development, participates in synthesis of phosphate and phosphoproteins and takes part in energy fixing and releasing process in plants (Singh and Yadav, 2008).

Interaction of variety and fertilizer exerted significant response in respect of seed yield (Table 2). The value of seed yield was highest (1.9 t ha^{-1}) with V_2F_2interaction treatment which was statistically similar with V_2F_3 and V_2F_5 (1.85 t ha^{-1} and 1.84 t ha^{-1}, respectively). On the other hand, V_1F_0 interaction showed significantly lowest yield (1.61 t ha^{-1}). Das *et al.* (2007) reported that rabbit manure at 5 t/ha +

50% NPK (N:P:K kg 30:60:40 ha^{-1}) produced higher growth, yield attributes and seed yield (17.67 q ha^{-1}) of black gram compared to the control (7.69 q ha^{-1}).

Stover yield (t ha^{-1})

Significant result was found in stover yield at harvest among two black gram varieties. BARI Mash-3(V_2) shown higher stover yield at harvest (4.99 t ha^{-1}) where BARI Mash-2(V_1) was lower (4.48 t ha^{-1}) than V_2. (Fig. 4).

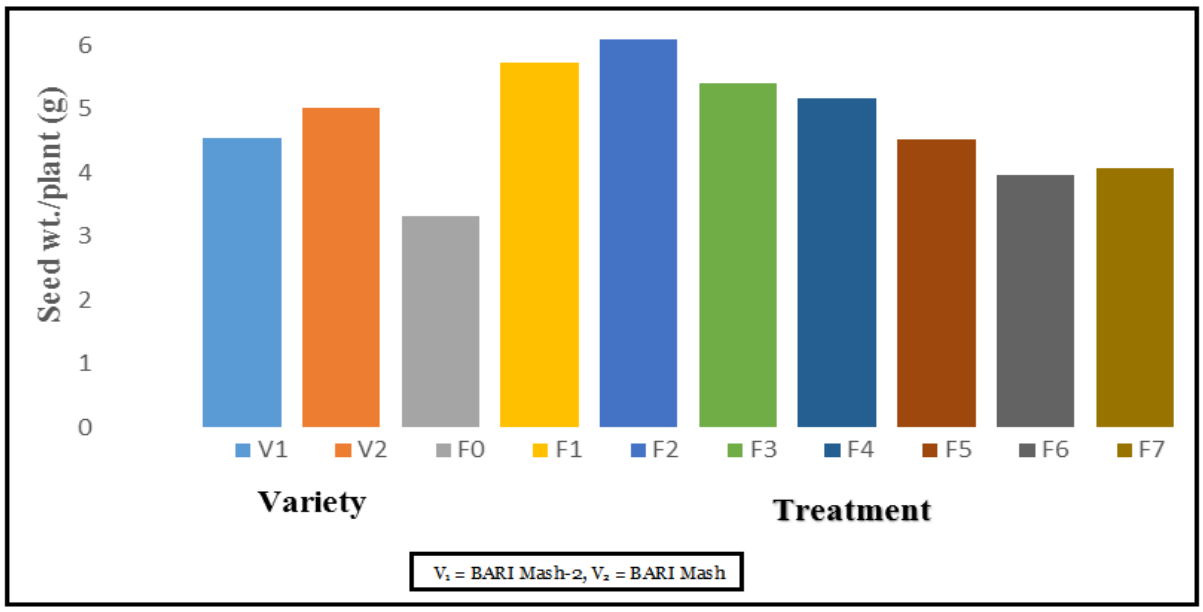

Fig. 1. Effect of variety on the seed weight plant^{-1} (g) of blackgram (LSD 0.05=0.32 and 1.05 for variety and fertilizer respectively).

All eight combinations of different organic and inorganic fertilizer combinations are significant where F_2 showed highest stover yield at harvest (5.39 t ha^{-1}).F_1 showed medium stover yield at harvest(5.24 t ha^{-1}) in comparison to F_2 and F_1. F_0 showed the lowest stover yield at harvest (4.03 t ha^{-1}). This might be due to the different combinations of organic and inorganic fertilizer on stover yield at harvest (Fig. 4).

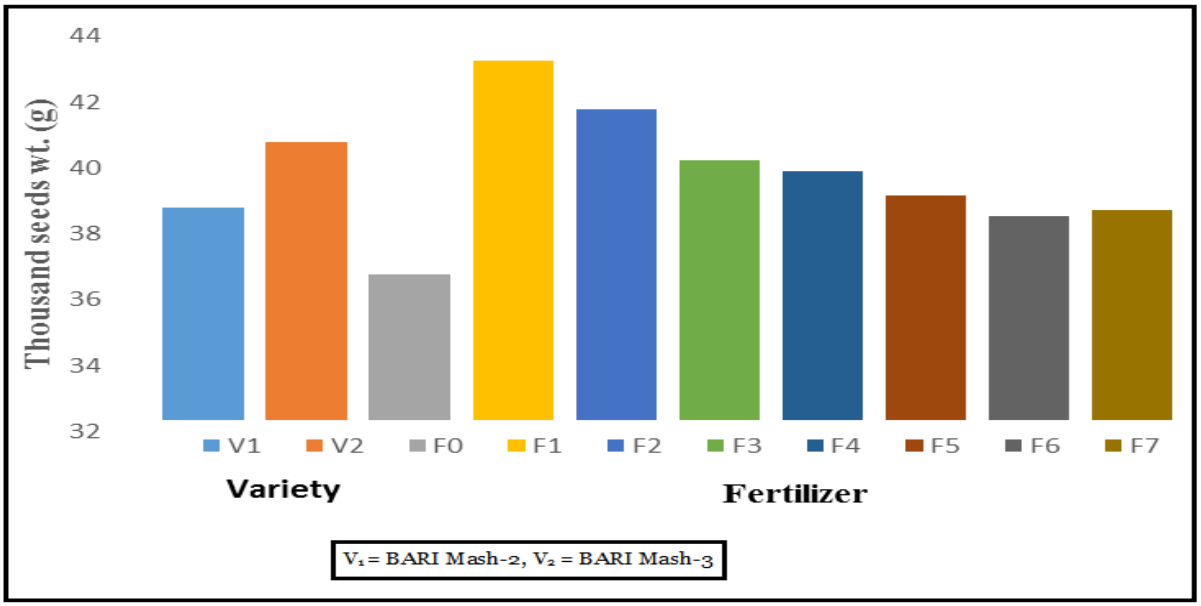

Fig. 2. Effect of variety on thousand seed weight (g) of blackgram (LSD0.05=0.64 and 2.06 for variety and fertilizer respectively).

Inoculation with the combination of the biofertilizers (Rhizobium sp. And Bacillus megaterium var. phosphaticum) resulted in higher yield, N and P content, N and P uptake by the grain and straw compared to no inoculation and individual inoculation (Tanwar *et al.*, 2003).

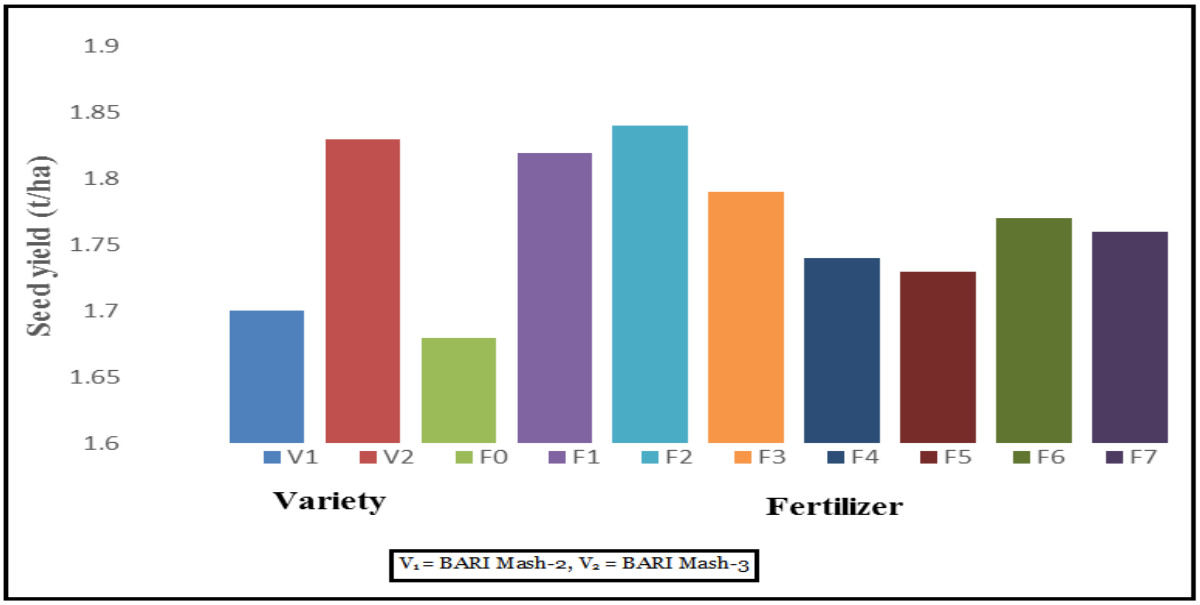

Fig. 3. Effect of variety on seed yield of blackgram (LSD 0.05=0.011 and 0.38 for variety and fertilizer respectively).

Interaction effect of variety and fertilizer gave significant result on stover yield of blackgram. Where V_2F_2 showed highest result (5.64 t ha^{-1}). Where V_1F_0 showed lowest result (3.77 t ha^{-1}). Which was statistically similar with all the combinations except V_1F_0 and V_1F_6 (Table 2) The increase in the seed and stover yield of blackgram with increase in the levels of phosphorus may be attributed to better vegetative growth as observed by taller plant height, more number of branches and increased in yield attribute like number of pods per plant, seeds per pod and length of pod resulted in higher seed and stover yield.

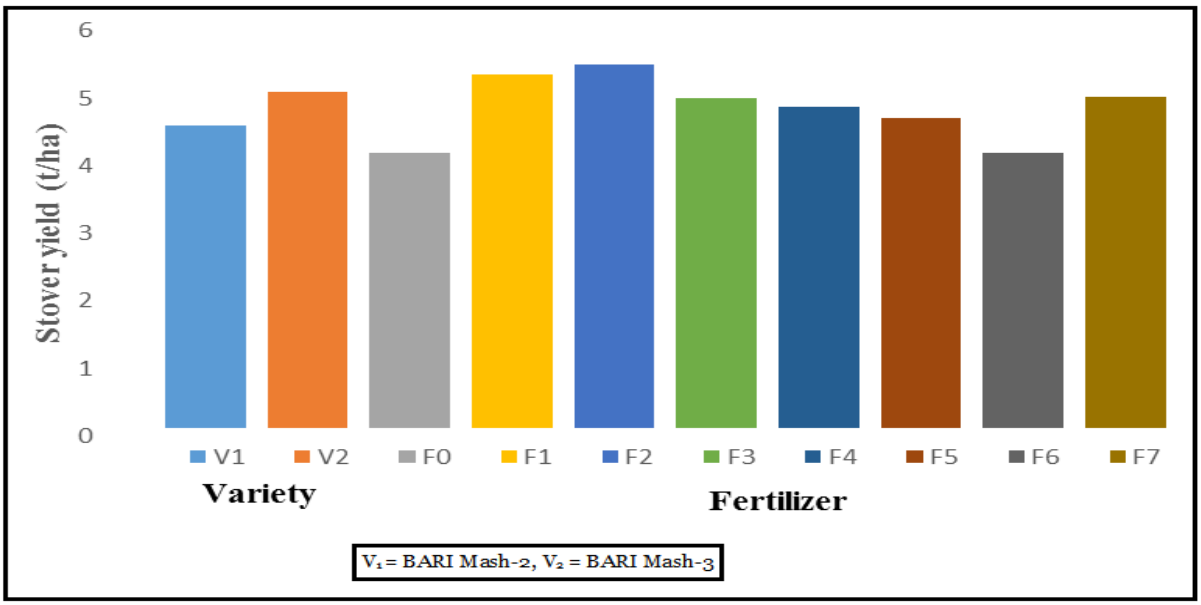

Fig. 4. Effect of variety on stover yield of blackgram (LSD 0.05=0.91 and 2.92 for v_1 and v_2 and fertilizer respectively).

The results were supported by the findings Vikrant *et al.* (2005).

Biological yield (t ha^{-1})

Tanwar *et al.* (2003) reported that the crop yield of blackgram, N and P contents, and N and P uptake increased with increasing P dose up to 80 kg ha^{-1}. Biological yield at harvest had a significant impact among two blackgram varieties. BARI Mash-3(V_2) shown higher biological yield (6.19 t ha^{-1}) where BARI Mash-2(V_1) was lower (5.98 t ha^{-1}) than V_2 (Fig. 5).

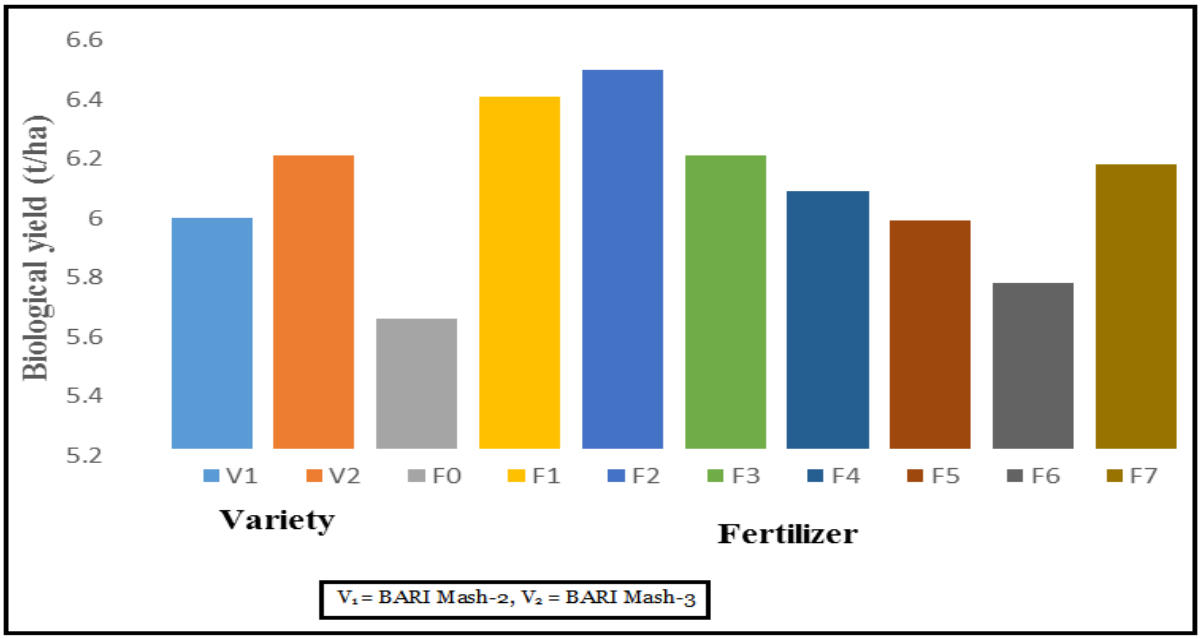

Fig. 5. Effect of variety on biological yield of blackgram (LSD 0.05=0.20 and 0.65 for variety and fertilizer respectively).

Biological yield showed different response on different combinations of fertilizer. All eight combinations of different organic and inorganic fertilizer combinations are significant where F_2 showed the highest biological yield (6.48 t ha^{-1}). F_1 showed medium biological yield (6.39 t ha^{-1}) in comparison to F_2. F_0 showed the lowest biological yield (5.64 t ha^{-1}). This might be due to the different combinations of organic and inorganic fertilizer on biological yield (Fig. 5).

Interaction effect of variety and fertilizer showed non-significant result. Where V_2F_2 showed the highest result (6.91 t ha^{-1}). Where V_1F_0 showed the lowest result (5.38 t ha^{-1}) (Table 2). Vasanthi and Subramaniam (2004) evaluted the effect of organic manures with NPK fertilizer on the nutrient uptake and crude protein content in black gram. The combined application of vermicompost @ 2 t ha^{-1} with 100% NPK resulted the highest crude protein content, N, P, K contents and uptake.

Harvest index (%)

Harvest index had a significant impact between two black gram varieties. BARI Mash-3(V_2) shown higher harvest index (30.64 %) where BARI Mash-2(V_1) was lower (27.85 %) than V_2. (Fig. 6).

On different combinations of fertilizer, harvest index showed different response. All eight combinations of different organic and inorganic fertilizer combinations are non-significant where F_6 and F_0 showed highest harvest index (30.93% and 30.16%). F_5 and F_4 showed medium harvest index (29.06 % and 29.04 %) in comparison to F_2 and F_1. F_2 showed the lowest harvest index (28.59 %).

This might be due to the different combinations of organic and inorganic fertilizer on harvest index (Fig. 6). Patil (2002) noticed higher germination (94.50%),

root length (16.60 em), shoot length (14.00 em), viguor index (2889), seedling dry weight (59.84 mg), protein content (23.15%) and lowest electrical conductivity (0.731 dSm^{-1}) in seeds of greengram (Cv. chinamung cultivar) treated with RDF + FYM @ 2.5 t ha^{-1} compared to RDF and organic manures alone.

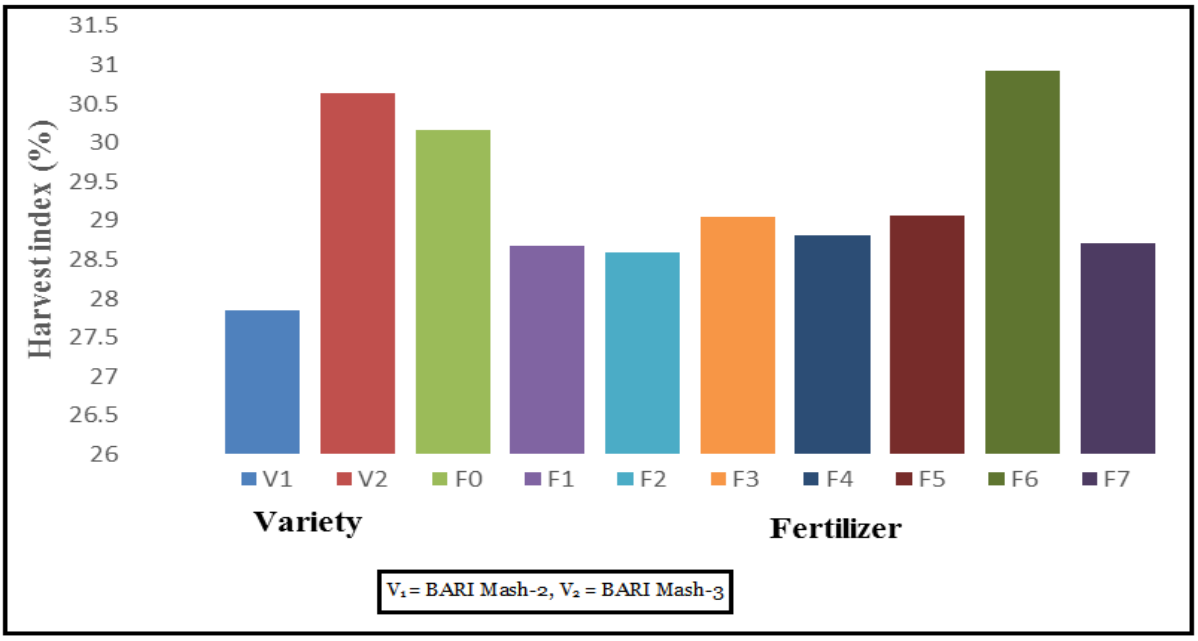

Fig. 6. Effect of variety on harvest index of blackgram (LSD 0.05=0.92 and 2.92 for variety and fertilizer respectively).

Interaction effect of variety and fertilizer showed significant result. Where V_2F_2 and V_2F_1 showed highest result (31.42% and 31.06%, respectively). Where V_1F_2 showed lowest result (25.76 %) (Table 3).

Conclusion

From the above results it is clear that application of vermicompost and poultry litter with RDF in different combinations increased yield. Yield contributing characters like, 1000-seed weight, seed yield and biological yield and harvest index greatly influenced by vermicompost with RDF combinations (F_2 and F_3).

Therefore, it can be concluded that the application of organic and inorganic fertilizers had a better positive effect BARI Mash-3 than BARI Mash-2.

Acknowledgements

The authors gratefully acknowledging the financial support of National Science and Technology Fellowship (NST Fellowship), Ministry of Science and Technology, The Government of the People's Republic of Bangladesh.

References

Alabadan BA. 2009. Farmstead Infrastructures. First Edition. Jos University Press Limited, p 225.

Arancon NQ, Edwards CA, Bierman P. 2005. Influences of vermicomposts on field strawberries: Part 2. Effects on soil microbiological and chemical properties. Bioresource Technology, p **97,** 831-840.

BBS (Bangladesh Bureau of Statistics). 2010. Year book of agricultural statistics 2015. Bangladesh Bureau of Statistics Ministry of Planning, Bangladesh, Dhaka.

Das A, Tomar JMS, Patel DP, Munda GC. 2007. Effect of organic manures on the productivity of black gram (Phaseolus mungo) with and without fertilizer. Environment and Ecology **25(1),** 15-18.

Gawai PP, Pawar VS. 2006. Integrated nutrient management in sorghum (Sorghum bicolor) - chickpea (Cicer arietinum) cropping sequence under

irrigated conditions. Indian Journal of Agronomy **51 (1)**, 17-20.

Kaul AK. 1982. Pulses in Bangladesh. Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka, p 27.

Kingery WL, Wood CW, Delaney DP, Williams JC, Mullins GL. 1994. Impact of long-term land application of broiler litter on environmentally related soil properties. Journal of Enviornmental Quality **23,** 139-147. https://doi.org/10.2134/jeq1994.00472425002300010022x

Mahala CPS, Dadheech RC, Kulhari RK. 2001. Effect of plant growth regulators on growth and yield of blackgram (Vigna mungo) at varying levels of phosphorus.Legume Research **18(1),** 163-165.

Maskey SL, Bhattarai S. 1994. Effect of long term application on different sources of organic manure on maize/wheat rotation. In: Proceeding of IInd National conference on science and technology, 8-11 June 1994, RONAST, Kathmandu, p 215-217.

Mitchell CC, Donald JO. 1995. The value and use of poultry manure as fertilizer. Alabama Cooperative Extension Service, Circular No. ANR-244.

Pannu RPS, Chopra S, Kaur N. 2007. Effect of combined application of FYM, pressmud and fertilizers on the yield and growth characteristics of summer mash (Vigna mungo). Agricultural Science Digest **27(3),** 216-218.

Patil T. 2002. Influence of organics on seed yield, quality and storability studies on greengran Cv. Chinamung. M. Sc. (Agri.) Thesis, University of Agricultural sciences. Dharwad, Karnataka (India).

Rajkhowa DJ, Saikia M, Rajkhowa KM. 2003. Effect of vermicompost and levels of fertilizer on greengram. Legume Research **26(1),** 63-65.

Reddy BP, Swamy SN. 2002. Effect of farmyard manure, phosphate solubilising bacteria and phosphorus on yield and economic of blackgram (Phaseolus mungo). Indian Journal of Agricultural Sciences **70(10),** 694-696.

Singh RP, Singh, Bisen PK, Singh SN, Singh RK, Singh J. 2008. Integrated use of sulphur and molybdenum on growth, yield and quality of black gram (Vigna mungo L.) Legume Research **31,** 214-217.

Tanwar SPS, Sharma GL, Chahar MS. 2003. Effect of phosphorus and biofertilizers on yield, nutrient content and uptake by black gram (Vigna mungo L.) Hepper]. Legume Research **26(1),** 39-41.

Tisdale SL, Nelson WS, Beaton. 1985. Soil fertility and fertilizers. McMillan Publishers Company, New York.

Watts DB, Torbert HA, Prior SA, Huluka G. 2010. Long-term tillage and poultry litter impacts soil carbon and nitrogen mineralization and fertility. Soil Science Society of America Journal **74,** 1239- 1247.

Vasanthi D, Subramaniam S. 2004. Effect of vermicompost on nutroent uptake and protein content in blackgram. Legume research **27(4),** 293-295.

Vikrant Singh H, Malik CVS, Singh BP. 2005. Grain yield and protein content of cowpea as influenced by farm yard manureand phosphorus application. Indian Journal of Pulses Research **18(2),** 250-251.