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# Effect of organic manures and Inorganic fertilizers on the growth and yield of Black gram (*Vigna mungo* L.)

**Bevara Anasuyamma, Shikha Singh, Bevara Asirinaidu and Karumuri Abhigna**

**Abstract**
A field experiment was conducted during *kharif* season of 2021 at experimental field of the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, and Uttar Pradesh, India. The soil of experimental field is Sandy loam in texture, nearly neutral in soil reaction (pH 7.4). To determine the "Effect of Organic manures and Inorganic fertilizers on the growth and yield of Black gram (*Vigna mungo* L.)". The treatments consisted of Vermicompost, Neem cake, FYM and NPK *viz*., Vermicompost 1t/ha, Neem cake 2t/ha, FYM 4t/ha and NPK whose effect is observed on Black gram. The Experiment was laid out in Randomized Block Design with Ten treatments Replicated thrice. The results obtained that the $T_4$ with the application of Vermicompost 1t/ha + RDF (100%) – 20:40:20 NPK kg/ha was recorded significantly maximum plant height (44.75 cm), number of root nodules per plant (18.89), number of branches per plant (8.33), plant dry weight (11.15 g/plant), pods per plant (36.33), seeds per pod (7.00), test weight (37.14 g), grain yield (1294 kg/ha).The results obtained with the treatment of $T_3$ with the Appilication of Vermicompost 1 t/ha + RDF (75%)- 15:30:15 NPK kg /ha was recorded significantly maximum crop growth rate (11.07 g/m2/day) and relative growth rate (0.04 g/g/day).The results obtained with the treatment of $T_4$ Vericompost1t/ha + RDF (100%) – 20:40:20 NPK kg/ha recorded significantly maximum gross return (81522 INR/ha), net return (54362 INR/ha) and B:C ratio (2.00) The results obtained with the treatment of $T_{10}$ (Neem cake 2t/ha + RDF (100%)- 20:40:20 recorded gross return (53160 INR/ha).

**Keywords:** Vermicompost, neemcake, FYM, Nitrogen, phophorous, potassium, yield, economics

## Introduction
Black gram (*Vigna mungo* L.) is one of the important pulse crops raised throughout India which belong to the family "Fabaceae". Black gram reported as originated in the North India. People in various regions of India use black gram with different names like *urd* or *urid* in Hindi, adad in Gujarati; *Masakalai* in Bengali; *Minappappu* in Telugu; *Ulunthu* in Tamil; *Udri bale* in Kannada and *Uzhummu* in Malayalam. Black gram is consumed in various forms as dal (whole or split, husked and un husked). After green revolution cereal grain production increased, which resulted in sharp decline of per capita production and availability of pulses with record of 4.0 million tones of imported pulses in 2012-13 (Singh *et al*., 2017) [16]. Black gram has anti nutritional factors Black gram is very nutritious as it contains high levels of protein (25g/100g), potassium (983 mg/100g), calcium (138 mg/100g), iron (7.57 mg/100g), niacin (1.447 mg/100g), Thiamine (0.273 mg/100g), and riboflavin (0.254 mg/100g). Black gram has been shown to be useful in mitigating elevated cholesterol levels (Divyavani *et al*. 2020) [5].

Farm yard manure contains 0.5% Nitrogen, 0.2% Phosphorus and 0.5% Potassium. It is remedies for maintain of soil health as well as productivity of crop plants along with the application of chemical fertilizers. Vermicompost is the product of decomposition process using various species of worms, usually red wigglers, white and other earthworms, to create a mixture of decomposing vegetables or food waste, bedding materials, and vermicast. This process is called vermicomposting. Vermicompost contain 0.6% nitrogen, 1.34% phosphorous, 0.4% potassium. Neem cake powder provides the plant all the necessary nutrients and also helps control pest. Neem cake powder lasts longer and also retains water to keep the soil in good condition. Neem cake contain 0.45 Nitrogen, 0.40 Phosphorous and 5.20% Potassium.

Nitrogen fertilizer is helps to increase the vegetative growth, nitrogen is essential constituent of protein and protoplasm of chlorophyll. N play important role in synthesis of Auxin. Nitrogen is being fixed by symbiosis with Rhizobium bacteria.

It is known to increase nitrogen percentage in the soil by fixing atmospheric nitrogen. Phosphorus is an important plant nutrient which is referred to as the "Master key" element in crop production. It is associated with several vital functions like seed germination, flowering cell division, synthesis of fat, starch and in almost every biochemical activities. It also induces root proliferation and nodulation. It improves the quality of grain and serves the dual purpose of increasing yield of main crop as well as succeeding crop (Chaudhary *et al*. 2018) [3]. Potassium is the third macro nutrient required for plant growth, after nitrogen and phosphorus. In drought, Potassium plays an active role in the maintenance of turgidity in plant cell and regulate stomata function.

## Materials and Methods

The materials and methodology and techniques adopted in the present experiment entitled, Effect of Organic manures and Inorganic manures on growth and yield of Black gram (*Vigna mungo* L.) with a brief description regarding site of experiment, soil properties, sampling techniques, climatic conditions during crop growing period, cropping history, calendar operations and statistical analysis are presented in this chapter with following headings.

In order to study the organic manures (Vermicompost 1t/ha, FYM 4t/ha, Neemcake 2t/ha) and three inorganic fertilizers (100% RDF, 75% RDF, 50% RDF) on the growth and yield characters of Blackgram. The experiment was conducted at during *Kharif* 2021 Crop Research Farm, Naini Agricultural Institute, SHUATS, Prayagraj. The experimental site of the study is geographically located at 25.28ºN latitude, 81.54ºE longitude and 98 m altitude above the mean sea level (MSL). The soil of the experimental field constituting a part of central Gangetic alluvium is neutral and deep. Pre- sowing soil samples were taken from a depth of 15 cm with the help of an auger. The composite samples were used for the chemical and mechanical analysis. The soil was sandy loam in texture, low in organic carbon (0.36%) and medium in available nitrogen (171.48 kg/ha), phosphorous (15.2 kg/ha) and low in potassium (232.5 kg/ha). The treatments consist of organic manures and inorganic fertilizers respectively. The experiment was laid out in randomized block design with nine treatments each replicated thrice and control *i.e.*, recommended N, P and K (20:40:20 kg/ha) alone. The plots were prepared with dimension of 5 m × 3 m and seeds of variety T-9 were sown with a spacing of 30cm × 10 cm. At 4-5 leaf stage plants were thinned to appropriate density. Weeds were controlled manually at 5-leaf stage, stem elongation and flowering stage to maintain a uniform plant population. Growth characteristics plant height (cm), number of branches per plant, dry weight per plant (g), crop growth rate (g/m$^2$/day) and relative growth rate (g/g/day) were recorded, with following formulas (A & B). Irrigation were given uniformly and regularly to all plots as per requirement so as to prevent the crop from water stress at any stage. The crop was completely harvested at physiological maturity stage and their biometric observations such as number of Pods per plant, number of seeds per pod, 1000 seed weight (g), seed yield (kg/ha), stalk yield (kg/ha) and were recorded. The data recorded for different characteristics were subjected to statistical analysis by adopting the method of analysis of variance (ANOVA) as described by Gomez (1984).

## Result

### Growth parameters

Table.1pertaining that details of influence of Organic manures and Inorganic manures on Black gram growth attributes.

**Plant height (cm)**

At harvest, maximum plant height (44.75 cm) was recorded with application of$T_4$ – Vermicompost 1t/ha + RDF (100%) – 20:40:20 NPK Kg/ha which was significantly superior over all other treatments and statistically at par with treatment ofVermicompost1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha(43.88cm) and Neem cake 2 t/ha + RDF (75%) – 15:30:15 NPK kg/ha(42.51cm)

**Number of Branches /Plant**

At harvest, maximum number of branches/plant (8.33) was recorded with application of Vermicompost 1t/ha + RDF (100%) – 20:40:20 NPK Kg/ha which was significantly superior over all other treatments and statistically at par with treatment of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha (7.89) and FYM4 t/ha + RDF (50%) – 10:20:10 NPK kg/ha(7.77), FYM 4t/ha + RDF (100%) -20:40:20 NPK kg/ha (7.89).

**Number of Nodules/plant**

At harvest, maximum Number of Nodules(18.89) was recorded with application of$T_4$ – Vermicompost 1t/ha + RDF (100%) – 20:40:20 NPK Kg/ha which was significantly superior over all other treatments and statistically at par with treatment of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha(17.44), FYM 4t/ha + RDF (100%) -20:40:20 NPK kg/ha(17.22), Neem cake 2 t/ha + RDF (75%) – 15:30:15 NPK kg/ha(17.22), Neem cake 2 t/ha + RDF (100%) - 20:40;20 NPK kg/ha (17.44).

**Dry Weight (g)**

At harvest, maximum Dry weight (11.15g) was recorded with application of$T_4$ -Vermicompost 1t/ha + RDF (100%) – 20:40:20 NPK Kg/ha which was significantly superior over all other treatments and statistically at par with treatment of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha(10.82g) and Neem cake 2 t/ha + RDF (75%) – 15:30:15 NPK kg/ha(10.22g).

**Crop growth rate (g/m$^2$/day)**

At 60– Harvest, maximum Crop growth(4.42 g/m$^2$/day) was recorded with application of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha (11.07 g/m$^2$/day) which was significantly superior over all other treatments Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha (9.80 g/m$^2$/day), FYM 4t/ha + RDF (100%) -20:40:20 NPK kg/ha(9.8), Neem cake 2 t/ha + RDF (75%) – 15:30:15 NPK kg/ha(10.19 g/m$^2$/day).

**Relative growth rate (g/m$^2$/day)**

At 60– Harvest, maximum Relative growth rate (0.04 g/m$^2$/day) was recorded with application of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha. There is no significant Difference among the treatments.

**Yield attributes**

Table. 2 pertaining that details of influence of Organic manures and Inorganic manures on Black gram yield attributes.

**Number of pods/plants**

Treatment with application of Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha was recorded maximum

number of pods/plant (36.33) which was significantly superior over all other treatments and statistically at par with treatment Of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha(35.33) and FYM 4t/ha + RDF (100%) -20:40:20 NPK kg/ha(32.66).

**Number of seeds/pods**

Treatment with application of $T_4$:Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha was recorded maximum number of seeds/pods (7.00) which was significantly superior over all other treatments and statistically at par with treatment of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha(6.66).

**Test weight**

Treatment with application of $T_4$:Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha was recorded maximum number of test weight (37.14) which was significantly superior over all other treatments and statistically at par with treatment of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha(36.93g).

**Seed yield (kg/ha)**

Treatment with application of $T_4$: Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha was recorded maximum seed yield (1294 kg/ha) which was significantly superior over all other treatments and statistically at par with treatment of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha(1276 kg/ha).

**Straw yield (kg/ha)**

Treatment with application of Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha was recorded maximum straw yield (2152 kg/ha) which was significantly superior over all other treatments and statistically at par with treatment of Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha (2050.00 kg/ha).

**Harvest index (%)**

Treatment with application of FYM 4 t/ha + RDF (75%) – 15:30:15 NPK kg/ha (50.03) was recorded maximum harvest index (50.03%) which was significantly superior over all other treatments. There is no significant difference among treatments.

**Discussion**

That all the growth parameters *viz*., plant height, dry weight, number of root nodules, number of branches plant-1 and number of flowers plant-1 recorded significant difference when subjected to different treatments levels of organic and inorganic nutrient sources including control. Kumar *et al*., (2020) [10].

Seed weight plant-1 of black gram 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 F2 treatment. Further increases of fertilizer dose reduce the seed weight plant-1 gradually and the reduction continued up highest dose. Noor-E-Zannat *et al*., (2020) [21].

Among the treatment, highest grain yield (8.93 q ha-1) recorded under application 100% N through 20 q ha-1 compost and it was at par with treatment 50% inorganic + 50% compost + Rhizobium, whereas control plots produced the lowest grain yield (4.88 q ha-1). Saket *et al*. (2014) recorded that amongst the organic sources of nutrients, 5 t ha-1 FYM recorded maximum yield and yield attributes over remaining treatments. This finding is also similar with Chandrakar *et al*. (2018), whom found that integrated use of organic manure, inorganic and biofertilizer had significant effect on yield and yield-attributes of blackgram over local check. Bagri *et al*., (2021) [2].

This increased plant growth characters might be due to the better availability of nutrients from organic and foliar sources of nutrients and effective conversion of nutrients from organics such as Fe, Mg and Zn available at the site of photosynthesis Yadav *et al*., (2017) [20].

It might be due to use of vermicompost and FYM improve the physical and chemical properties of soil. They help to augment the growth and development of the crop in two ways firstly, they supply plant nutrients and secondly, improved the availability of native nutrients in the soil through increased microbial activity and secretion of organic acids. The nutrient content in vermicompost is higher (1.60% N + 5.04% P2O5 + 0.80% K2O) than FYM (0.75% N + 0.17% P2O5 + 0.55% K2O) thus it gave better yield attributes, dry matter production and that resulted in higher grain yield. Jat *et al*., (2012) [8].

Neem cake is bio degradable and eco friendly, nourishes the soil and plants by providing all the macro and micro-nutrients. It promotes plant growth by suppressing pathogenic microorganisms [17, 18] Reddy *et al*., (2021) [15].

**Table 1:** Influence of Organic manures and Inorganic manures on growth of Black gram crop.

| Treatment | Plant height (cm) | Number of branches/ plant | Nodules/ plant | Dry weight (g) | Crop growth rate (g/m$^2$/day) | Relative growth rate (g/g/day) |
|---|---|---|---|---|---|---|
| 1. Control | 36.59 | 6.00 | 10.66 | 8.1 | 6.8 | 0.03 |
| 2. Vermicompost 1 t/ha + RDF (50%) – 10:20:10 NPKkg/ha | 40.81 | 7.55 | 16.88 | 9.55 | 9.00 | 0.03 |
| 3. Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha | 43.88 | 7.89 | 17.44 | 10.82 | 11.07 | 0.04 |
| 4. Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha | 44.75 | 8.33 | 18.89 | 11.15 | 9.80 | 0.03 |
| 5. FYM4 t/ha + RDF (50%) – 10:20:10 NPK kg/ha | 40.39 | 7.77 | 15.66 | 9.89 | 8.88 | 0.03 |
| 6. FYM 4 t/ha + RDF (75%) –15:30:15 NPKkg/ha | 38.80 | 7.22 | 16.22 | 10.01 | 8.96 | 0.03 |
| 7. FYM 4t/ha + RDF (100%) -20:40:20 NPKkg/ha | 41.93 | 7.89 | 17.22 | 10.06 | 9.8 | 0.03 |
| 8. Neem cake 2 t/ha + RDF (50%) – 10:20:10 NPK kg/ha | 40.57 | 7.22 | 15.88 | 9.13 | 8.34 | 0.03 |
| 9. Neem cake 2 t/ha + RDF (75%) – 15:30:15 NPK kg/ha | 42.51 | 7.55 | 17.22 | 10.22 | 10.19 | 0.03 |
| 10. Neem cake 2 t/ha + RDF (100%) - 20:40;20 NPKkg/ha | 39.14 | 7.22 | 17.44 | 9.23 | 7.60 | 0.03 |
| SEM (±) | 0.86 | 0.24 | 0.61 | 0.29 | 0.67 | 0.00 |
| CD (p=0.05) | 2.55 | 0.72 | 1.81 | 0.85 | 1.98 | - |

**Table 2:** Influence of Organic manures and Inorganic manures on yield and yield attributes of Black gram crop.

| Treatment | No. of Pods/plant | No. of seeds/pod | Test weight (g) | Seed yield (kg/ha) | Stalk yield (kg/ha) | Harvest Index (%) |
|---|---|---|---|---|---|---|
| 1. Control | 26.33 | 3.66 | 29.98 | 800 | 1390.67 | 36.52 |
| 2. Vermicompost 1 t/ha + RDF (50%) – 10:20:10 NPKkg/ha | 30.89 | 5.66 | 33.02 | 1035 | 1649.33 | 38.56 |
| 3. Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha | 35.33 | 6.66 | 36.93 | 1276 | 2050.00 | 38.36 |
| 4. Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha | 36.33 | 7.00 | 37.14 | 1294 | 2152.00 | 37.55 |
| 5. FYM4 t/ha + RDF (50%) – 10:20:10 NPK kg/ha | 30.44 | 5.66 | 32.63 | 989 | 1647.00 | 37.52 |
| 6. FYM 4 t/ha + RDF (75%) –15:30:15 NPKkg/ha | 32.00 | 6.00 | 35.34 | 1179 | 1717.67 | 50.03 |
| 7. FYM 4t/ha + RDF (100%) -20:40:20 NPKkg/ha | 32.66 | 6.22 | 35.96 | 1245 | 1840.33 | 40.35 |
| 8. Neem cake 2 t/ha + RDF (50%) – 10:20:10 NPK kg/ha | 30.22 | 4.44 | 32.08 | 900 | 1504.00 | 37.44 |
| 9. Neem cake 2 t/ha + RDF (75%) – 15:30:15 NPK kg/ha | 30.44 | 4.55 | 32.34 | 950 | 1623.67 | 36.91 |
| 10. Neem cake 2 t/ha + RDF (100%) - 20:40;20 NPKkg/ha | 30.89 | 5.66 | 34.50 | 1095 | 1690.33 | 39.31 |
| SEM (±) | 1.36 | 0.26 | 0.09 | 38.34 | 57.97 | 0.91 |
| CD (p=0.05) | 4.05 | 0.78 | 0.26 | 113.91 | 172.23 | 2.70 |

**Table 3:** Influence of Oraganic manures and Inorganic Fertilizers on economics of Blackgram.

| Treatment | Cost of Production((₹/ha) | Gross return (₹/ha) | Net return (₹/ha) | B:C ratio |
|---|---|---|---|---|
| 1. Control | 23160 | 50400 | 27240 | 1.17 |
| 2. Vermicompost 1 t/ha + RDF (50%) – 10:20:10 NPKkg/ha | 26710 | 65205 | 38495 | 1.44 |
| 3. Vermicompost 1 t/ha + RDF (75%) - 15:30:15 NPK kg/ha | 26935 | 80388 | 53453 | 1.98 |
| 4. Vermicompost 1 t/ha + RDF (100%) - 20:40:20 NPK kg/ha | 27160 | 81522 | 54362 | 2.00 |
| 5. FYM4 t/ha + RDF (50%) – 10:20:10 NPK kg/ha | 30710 | 62307 | 31597 | 1.02 |
| 6. FYM 4 t/ha + RDF (75%) –15:30:15 NPKkg/ha | 30935 | 74277 | 43342 | 1.40 |
| 7. FYM 4t/ha + RDF (100%) -20:40:20 NPKkg/ha | 31160 | 78435 | 47275 | 1.51 |
| 8. Neem cake 2 t/ha + RDF (50%) – 10:20:10 NPK kg/ha | 52710 | 56700 | 3990 | 0.07 |
| 9. Neem cake 2 t/ha + RDF (75%) – 15:30:15 NPK kg/ha | 52935 | 59850 | 6915 | 0.13 |
| 10. Neem cake 2 t/ha + RDF (100%) - 20:40;20 NPKkg/ha | 53160 | 68985 | 15825 | 0.29 |

## Conclusion

It is concluded that Treatment 4 Vermicompost 1t/ha + RDF(100%) – 20:40:20 NPK kg/ha recorded highest seed yield (1294 kg/ha), gross returns (81,522 Rs/ha), net returns (54,362 Rs/ha) and B:C ratio (2.00) which may be more preferable for farmers since it is economically more profitable and hence, can be recommended to the farmers.

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