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# Influence of Vegetable and Fruit Wastes Vermicompost on the Growth and Yield of Black Gram (*Vigna mungo* L.)

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## ABSTRACT

**Background:** Composting is the process of breaking down of organic matter using living organisms which can be used as manure for soil conditioning. Vermicomposting is the rapid decomposition of biowastes using earthworm species which will enhance the growth and yield of plants.

**Methods:** The vermicomposting of vegetable and fruit wastes was carried out during summer season (May-July) and by using the vermicompost a pot culture experiment was conducted in black gram for three months from August to October, 2019. The treatments consist of combinations of vermicomposted wastes and cowdung along with bioinoculants, Soil served as control. The biometric parameters such as root length, shoot length, fresh weight and dry weight on 15, 35, 55 DAS and yield characters like number of pods/plants, number of seeds/pods, pod length, weight of seed/ pod, pod fresh weight and pod dry weight were recorded and statistically analysed. The present study has been attempted to convert the vegetables and fruit waste into compost as manure and analyse its effect on vegetative growth and yield parameters of black gram (*Vigna mungo* L.).

**Result:** The highest value of shoot length, root length, fresh weigh and dry weight were noted in fruit waste + cowdung + *Pleurotus eous* (APK1) + *Trichoderma asperelloides* + *Eudrilus eugeniae* on 15, 35 and 55 day after sowing (DAS) and the least was reported in control (only soil). The application of $T_8$ treatment reported the highest yield characters which were followed by other treatments and control on 15, 35 and 55 DAS. The study concluded that $T_8$ (F.W + cow dung + *P. eous* + *T. asperelloides* + *Eudrilus eugeniae*) is an effective biocompost for the growth and yield of black gram (*Vigna mungo* L.) which is eco-friendly.


**Key words:** Black gram, Fruit waste, *Eudrilus eugeniae*, Vegetable waste, Vermicomposting.

## INTRODUCTION

Agriculture plays a vital role in Indian economy as most of the population, from rural areas depend on it for their livelihood. Organic farming can address many of these problems, as this system helps to maintain soil productivity and effectively control pest by enhancing natural processes and cycles in harmony with environment (Barik, 2017). Organic waste and the biofertilizers are the alternate sources that meet the nutrient requirement on crops (Faheed and Fattah, 2008). India produces about 3000 million tons of organic waste annually, which can be degraded and can produce eco-friendly manure for sustainable environment (Achsah and Lakshmi, 2013). As disposal of organic waste are important for healthy environment, environment friendly management and disposal of wastes has become global priority (Sakthivigneswari and Vijayalakshmi, 2017). Vermicomposting is a cheap and low-cost technological process of composting where species of earthworm is introduced to produce a better end product. Vermicompost application promoted the plant growth and also protects the crops from the pest and diseases (Sinha *et al*. 2010). Black gram is a bean that grows mainly in south Asia and it is an annual herb. The plant is erect and hairy. It is healthy pulse which is rich in vitamins, minerals. It is also the store-house to many nutrients especially calcium, potassium, iron, magnesium, copper, manganese. The seed of black gram is used for cooling and astringent properties. The aim of the experiment was biocomposting of vegetable and fruit wastes into biomanure and to study the effect on growth and yield of black gram (*Vigna mungo* L.).

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## MATERIALS AND METHODS

The composting and vermicomposting were carried out during summer season (May-July) and the pot culture experiment was conducted for three months from August to October during 2019 at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu (11.0196°N, 76.9504°E).

### Collection of waste

The vegetable wastes were collected from local vegetables market situated near the Institute. The fruit wastes were

collected from nearby fruit sellers. Thus, collected wastes were cut into small pieces, sun dried and stored in polythene bags.

### Assembling of seed

The seeds of black gram (*Vigna mungo* L.) were obtained from Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu and were subjected to pot culture studies with three replications.

### Preparation of compost pit

Eight compost pits were dug with a dimension of 1.5 feet length and 4 square feet width. The compost pit were designated as $C_1$-$C_8$ (C denotes as compost).

### Collection of earthworm

The earthworm species African earthworm (*Eudrilus eugeniae*) was collected from ICAR KVK (Krishi Vigyan Kendra) Coimbatore, Tamil Nadu.

### Preparation of vermicompost

About 60×30×15 cm size plastic tray was purchased from the market and small holes were made at the bottom of the trays to facilitate draining of excess water. Vermibeds were prepared by combination of pre-decomposed vegetable and fruit wastes and cow dung in 2:1 ratio. (2.0 kg of pre-decomposed waste and 1 kg of dried cow dung in the trays.

### The experimental treatments

A pot culture experiment was carried out with sandy loam clay soil and vermicompost prepared from vegetable and fruit waste. Initially, the pebbles present in the soil were removed and 7.0 kg of sandy loam clay soil was filled in each pot. Ten seeds were sown and among the germinated ones, five healthy plants were maintained in pot for the study. The different treatments for pot culture are given below:

| Treatments | |
|---|---|
| C | Control (Only soil) |
| $T_1$ | Vegetable wastes + Cow dung + *Eudrilus eugeniae* (5 t/ha). |
| $T_2$ | Vegetable wastes + Cow dung + *Pleurotus eous* (APK1) + *Eudrilus eugeniae* (5 t/ha). |
| $T_3$ | Vegetable wastes + Cow dung + *Trichoderma asperelloides* + *Eudrilus eugeniae* (5 t/ha). |
| $T_4$ | Vegetable wastes + Cow dung + *P. eous* (APK1) + *T. asperelloides* + *Eudrilus eugeniae* (5 t/ha). |
| $T_5$ | Fruit wastes + Cow dung + *Eudrilus eugeniae* (5 t/ha). |
| $T_6$ | Fruit wastes + Cow dung + *Pleurotus eous* (APK1) + *Eudrilus eugeniae* (5 t/ha). |
| $T_7$ | Fruit wastes + Cow dung + *Trichoderma asperelloides* + *Eudrilus eugeniae* (5 t/ha). |
| $T_8$ | Fruit wastes + Cow dung + *P. eous* (APK1) + *T. asperelloides* + *Eudrilus eugeniae* (5 t/ha). |

### Statistical analysis

The biometric data obtained on 15, 35, 55 DAS and 75 DAS were analyzed statistically using one way or two-way anova.

## RESULTS AND DISCUSSION

### Biometric character

The present study results showed a positive effect of compost treatments on the test crop and significantly maximum increase was observed in $T_8$ treated plants during 15, 35 and 55 DAS.

### Shoot length and root length (Table 1)

A significant increase in shoot length was observed $T_8$ (56.9, 62.1 and 71.5 cm) followed by $T_4$ (44.1, 56.2 and 62.5 cm) on 15, 35 and 55 DAS when compared to Control (21.8, 29.7 and 38.5 cm). The highest root length was reported in $T_8$ (14.5, 17.2 and 18.5 cm) treatment followed by $T_4$ (14.1, 16.3 and 16.8 cm) on 15, 35 and 55 DAS.

The results were in agreement with the finding of Badar and Qureshi, (2014), who reported that increased root length of 28.0 cm on 30$^{th}$ day and 29.66 cm on 60$^{th}$ day in sunflower plants in *Trichoderma hamatum* inoculated rice husk (5 kg) as compared to the control.

The finding is in conformity with Kamble *et al.* (2016) that, application of $T_3$- 100% NPK+ poultry manure @ 5 t ha$^{-1}$, recorded maximum plant height (37.30 cm), and yield attributing characters such as pod length (12.83 cm), pod diameter (0.93 cm), number of pods plant$^{-1}$ (42.18). The lowest value of growth characters was recorded in treatment $T_{16}$ - FYM @ 25 t ha$^{-1}$ in French bean.

According to Coulibaly *et al.* (2019) the tallest plant (70.19 cm) was measured with the compost from pig waste, followed by the chicken compost (51.4 cm) and the shortest was noted with the control (22.45 cm) on 45 days in maize.

The results in par with Sutar *et al.* (2019) who recorded that application of jeevamrutha @1000 l ha$^{-1}$ has higher plant height (65.60 cm), number of branches (8.89), number of leaves (26.50), leaf area (1039.56 cm$^2$) and yield attributing characters like number of pods per plant (20.57), pod length (19.8 cm), number of seeds per pod (15.58), seed weight per plant (9.53 g) and test weight (11.82 g) when compared to control in cowpea.

Similar results were observed by Pinky and Vijayalakshmi, (2020), who noted significant increase in shoot length and root length in $T_4$ treatment - F. W + cow dung + *P. eous* + *T. asperelloides* + *Eudrilus eugeniae* (5 t/ha) where C- Control (plain soil) on 15, 35 and 55 DAS in black gram.

The results coincide with Silpa and Vijayalakshmi, (2020) that, shoot length showed significant increase in $T_4$ (67.933 cm, 112.133 cm and 119.300 cm) on 25, 35 and 45 DAS when compared with the control (13.933 cm, 35.233 cm and 50.233 cm) and the root length is noted maximum in $T_4$ (18.133 cm, 26.867 cm and 30.100 cm) when compared to control (5.7 cm, 10.767 cm and 14.733 cm) on 25, 35 and 45 DAS in cowpea.

### Fresh weight and dry weight

A significant increase in fresh weight content (Table 2) was observed in $T_8$ (1.910, 1.967 and 2.063 gm) treatment

followed by other treatment and control (0.405, 0.700 and 0.821 gm) treatment on 15, 35 and 55 DAS. A maximum dry weight content was noted in $T_8$ (0.465, 0.492 and 0.665 gm) treatment which was followed by $T_4$ (0.390, 0.406 and 0.629 gm).

The present finding coincides with the result of Mehdizadeh *et al.* (2013) who reported that the application of municipal waste compost (20 t/ha) significantly enhanced the fresh weight (shoots-195.2 gm, roots-62.3 gm) and dry weight (shoots-51.2 gm, roots-13.5 gm) of tomato crop.

Furthermore, the present finding was in conformity with that of Sivakumar and Karthikeyan, (2016), who concluded that the increase in fresh weight (6.6 g) and dry weight (2.2 g) was due to the application of vermicomposted weed plants waste using *Eudrilus eugeniae* in brinjal plant.

The results are in par with Sharma *et al.* (2019) who observed the fresh and dry weight of plants were maximum in T7 (3.44 and 1.40 g) treatment followed by T6 (2.43 and 0.35 g) and T1 (1.76 and 0.15 g) in *Spinacia oleracea*.

Similar results were observed by Silpa and Vijayalakshmi, (2020) who noted a significant increase in fresh weight content in $T_4$ (7.195 g, 8.186 g and 12.555 g) when compared to control (1.053 g, 1.077 g and 1.856 g) and highest dry weight was registered in $T_4$ treatment (1.277 g,1.465 g and 2.254 g) over control (0.494 g, 0.604 g and 0.819 g) on 25, 35 and 45 DAS in cowpea.

The study reported by Al-Sabbagh *et al.* (2020) stated the maximum fresh weight of Chinese kale in Market compost (0.276 gm) grown plants followed by Ecodrum composter (0.271 gm), when compared to control (0.133 gm) respectively.

**Yield parameters (Fig 1)**

The maximum number of pods/plants was observed in $T_8$ (28.00) treatment followed by $T_4$ (24.00) when compared to control (8.00). The pod length and number of seeds/pods were significantly increased in $T_8$ (4.30 cm and 7.00) treatment followed by $T_4$ (4.00 cm and 6.00) treatment and control. The fresh and dry weight of the pods were increased significantly in $T_8$ (0.795 gm and 0.502 gm) followed by other treatment and control (0.410 gm and 0.215 gm). The weight of the seed showed maximum in $T_8$ (0.372 gm) and followed by $T_4$ (0.357 gm) treatment when compared to other treatment and control (0.139 gm).

A similar work was done by Hyder *et al.* (2015) who confirmed highest number of fruit (97) and diameter of the fruit (6.75 cm) in tomato plant due to the application of vermicompost (2 t/ha).

**Table 1:** Vegetative parameters of black gram influence by vegetable and fruit wastes vermicompost.

| Treatment | Shoot length (cm) | | | Root length (cm) | | |
|---|---|---|---|---|---|---|
| | 15 | 35 | 55 | 15 | 35 | 55 |
| C | 21.8 | 29.7 | 38.5 | 4.6 | 6.2 | 6.9 |
| $T_1$ | 28.9 | 30.0 | 43.2 | 6.5 | 6.7 | 7.3 |
| $T_2$ | 30.2 | 32.1 | 50.3 | 7.5 | 10.3 | 12.3 |
| $T_3$ | 36.9 | 44.5 | 48.0 | 9.3 | 14.5 | 14.9 |
| $T_4$ | 44.1 | 56.2 | 62.5 | 14.1 | 16.3 | 16.8 |
| $T_5$ | 31.5 | 34.2 | 46.2 | 8.0 | 9.2 | 9.8 |
| $T_6$ | 31.8 | 46.4 | 55.4 | 8.2 | 10.5 | 14.2 |
| $T_7$ | 40.2 | 48.0 | 64.2 | 11.2 | 15.2 | 16.3 |
| $T_8$ | 56.9 | 62.1 | 71.5 | 14.5 | 17.2 | 18.5 |
| SEd | | 2.96265 | | | 0.32923 | |
| Cd ($p<0.05$) | | 5.93977 | | | 0.66008 | |

**Table 2:** Effect of vegetable and fruit wastes biocompost on vegetative parameters of black gram.

| Treatment | Fresh weight (gm) | | | Dry weight (gm) | | |
|---|---|---|---|---|---|---|
| | 15 | 35 | 55 | 15 | 35 | 55 |
| C | 0.405 | 0.700 | 0.821 | 0.075 | 0.092 | 0.117 |
| $T_1$ | 0.496 | 0.736 | 0.974 | 0.106 | 0.146 | 0.286 |
| $T_2$ | 0.643 | 1.144 | 1.341 | 0.139 | 0.270 | 0.390 |
| $T_3$ | 0.955 | 1.224 | 1.580 | 0.287 | 0.314 | 0.456 |
| $T_4$ | 1.241 | 1.694 | 1.885 | 0.390 | 0.406 | 0.629 |
| $T_5$ | 0.736 | 1.049 | 1.168 | 0.164 | 0.230 | 0.295 |
| $T_6$ | 0.964 | 1.332 | 1.653 | 0.235 | 0.315 | 0.436 |
| $T_7$ | 0.972 | 1.569 | 1.792 | 0.287 | 0.394 | 0.467 |
| $T_8$ | 1.910 | 1.967 | 2.063 | 0.465 | 0.492 | 0.665 |
| SEd | | 0.03366 | | | 0.03285 | |
| Cd($p<0.05$) | | 0.06749 | | | 0.06585 | |

The results are in conformity with Joshi *et al.* (2016), that application of $T_2$- RDF (20-40-0 NPK kg $ha^{-1}$) recorded significantly higher number of pods $plant^{-1}$ (79.60) and number of seeds $pod^{-1}$ (13.45) in cowpea.

The results coincide with Sajjan *et al.* (2020) who reported significant increase in seed yield such as number of pods per plant (117.19), number of seeds per pod (4.25) and pod length (5.66 cm) was reported in *rabi* season crop in dolichos bean [*Lablab purpureus* (L.) Sweet].

The results are in accordance with Ropo *et al.* (2020) who noted that poultry manure have the highest number of fruits per plant (8.75), heaviest fruit per plant (25.30 g), highest fruit length (6.60 cm) and fruit diameter (1.93 cm), which were significantly different from all other treatments.

The results coincide with Silpa and Vijayalakshmi, (2021) who observed that number of pods/plant (21), length of pod (16.50 cm), number of seeds/pod (20), weight of the seed/pod (1.68 g), pod fresh weight (5.711 g) and pod dry weight (2.398 g) in $T_8$- Raw Jack fruit peel + 10 g *Pleurotus eous* + 10 g *Pleurotus florida* + *Eudrilus eugeniae* 5 $t/ha^{-1}$ treatment when compared to control in *Vigna unguiculata* (L.) Walp.

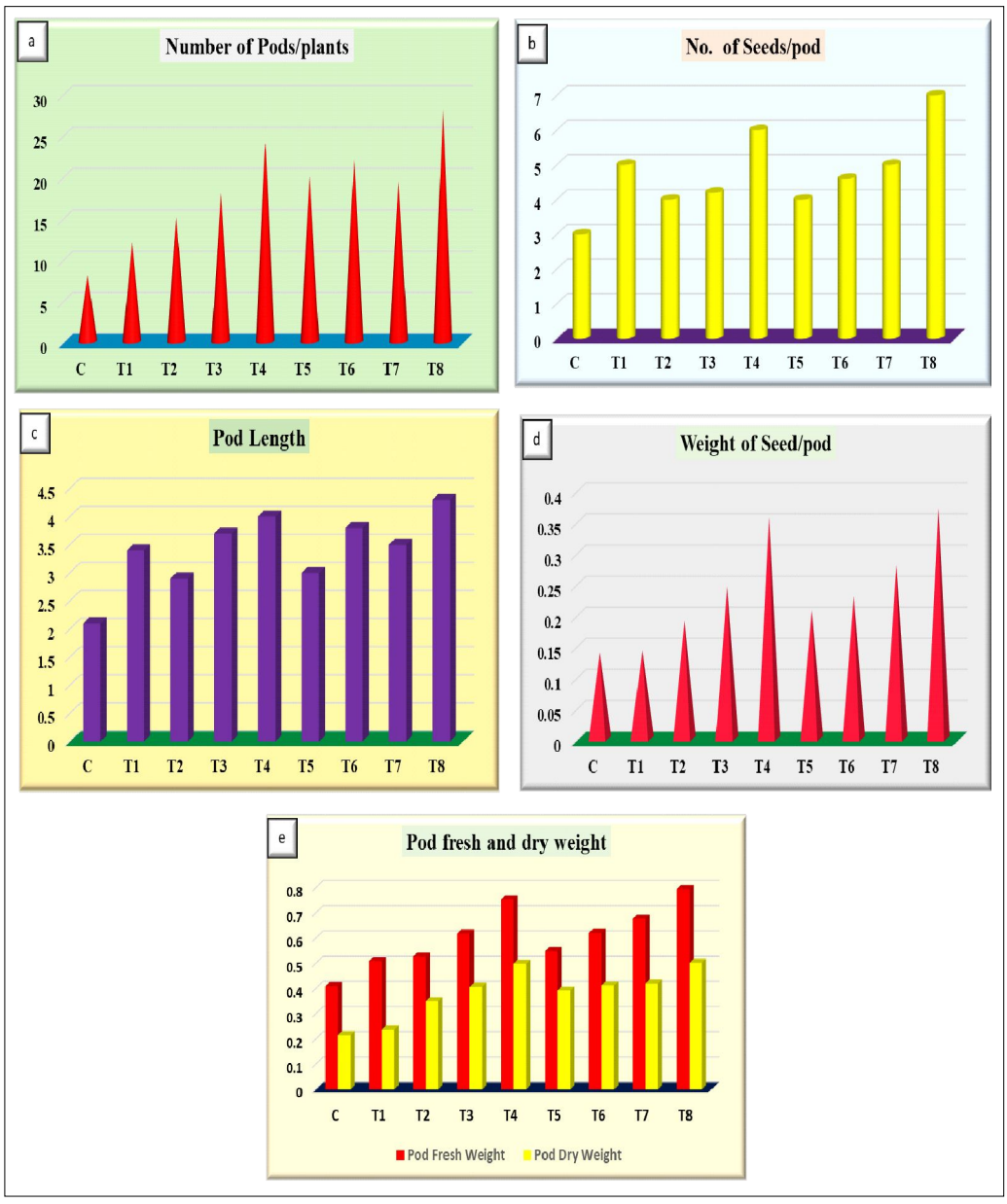


**Fig 1:** Yield attributing parameters of black gram (*Vigna mungo* L.).
a) Number of pods/plants b) No. of seeds/pod c) Pod length (cm) d) Weight of seed (g) e) Pod fresh weight (g) and Pod dry weight (g).

## CONCLUSION

Vermicompost contains macro and micro nutrients that help in growth and development of the plant. The present study indicated that application of the treatment ($T_8$ Vegetable waste + cow dung + *P. eous* (APK1) + *T. asperelloides* + *Eudrilus eugeniae*) showed highest growth and yield/plant in black gram. This composting can be done in large scale since it is cost effective and eco-friendly which is not harmful to the environment.

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