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# STANDARDIZATION OF ORGANIC CULTIVATION PRACTICES ON YIELD IN BITTER GOURD (*MOMORDICA CHARANTIA* L.) VAR. PUSA AUSHADHI

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**ABSTRACT**

The present investigation entitled "Standardization of organic cultivation practices on yield in bitter gourd (*Momordica charantia* L.) var. Pusa Aushadhi" was carried out during *rabi* season in the year 2021-2022 at P.G research farm, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad. The experiment was carried out with twenty (20) treatments in Randomized Block Design with three (3) replications *i.e.* **$T_1$:** Farmyard manure (25 t/ha) + AMC (12.5 kg/ha), **$T_2$:** Farmyard manure (25 t/ha) + VAM (10 kg/ha), **$T_3$:** Farmyard manure (30 t/ha) + AMC (12.5 kg/ha), **$T_4$:** Farmyard manure (30 t/ha) + VAM (10 kg/ha), **$T_5$:** Vermicompost (10 t/ha) + AMC (12.5 kg/ha), **$T_6$:** Vermicompost (10 t/ha) + VAM (10 kg/ha), **$T_7$:** Vermicompost (12 t/ha) +AMC (12.5 kg/ha), **$T_8$**: Vermicompost (12 t/ha) +VAM (10 kg/ha), **$T_9$:** Poultry manure (6 t/ha) + AMC (12.5 kg/ha), **$T_{10}$:** Poultry manure (6 t/ha) + VAM (10 kg/ha), **$T_{11}$:** Poultry manure (8 t/ha) + AMC (12.5 kg/ha), **$T_{12}$:** Poultry manure (8 t/ha) + VAM (10 kg/ha), **$T_{13}$**: Neem cake (1 t/ha) + AMC (12.5 kg/ha), **$T_{14}$:** Neem cake (1 t/ha) + VAM (10 kg/ha), **$T_{15}$:** Neem cake (2 t/ha) + AMC (12.5 kg/ha), **$T_{16}$:** Neem cake (2 t/ha) + VAM (10 kg/ha), **$T_{17}$:** RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha), **$T_{18}$:** RDF(40: 80: 50 NPK kg/ha) + VAM (10 kg/ha), **$T_{19}$:** RDF (40: 80: 50 NPK kg/ha), **$T_{20}$:** Absolute control. Different treatment combinations of RDF and organic manures along with bio fertilizers have a significant influence on yield in bitter gourd. The results on yield showed that among the treatments, $T_{17}$ RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) recorded significantly minimum number of days taken to first fruit harvest (43.33 days), maximum number of days for last fruit harvest (112.72 days), maximum fruit length (19.89 cm), maximum fruit weight (85.2 g), maximum fruit yield per plant (2.21 kg), maximum fruit yield per plot (2.3.01 kg), maximum fruit yield per hectare (20.01 t) were recorded in the treatment $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) compared to the other treatments.
***Keywords*** **:** Bitter gourd, Farmyard manure, Vermicompost, Poultry manure, Neem cake, AMC, VAM, Pusa Ausadhi.

## Introduction

Bitter gourd (*Momordica charantia* L.) is diploid in nature (2n=22) and belongs to family Cucurbitaceae. It grows best in well-drained loamy soil with a pH of 6.5-7.0. Although the plant is adaptable to a wide range of climates, it produces best in hot climates (Binder *et al.,* 1989).

Annual production of bitter Gourd in India, cultivated over 114,771 ha and yields about 12,448 kgs / ha. In Telangana, bitter gourd crop occupies 960 ha and 22,660 MT in production (Ministry of Agriculture and Farmers Welfare).

Momordicin, Momordicinin, and Momordicilin are three pentacyclic triterpenes that build over time and induce bitterness in the fruit; the bitterness then diminishes as the fruit ripens [(Begum *et al.,* 1997);

(Cantwell *et al.,* 1996)]. Fruit contains a high concentration of vitamin C (88 mg/100g). It contains antioxidant, antimicrobial, antiviral, antihepatotoxic, antiulcerogenic, and blood sugar-lowering effects (Behera *et al*., 2011). It also has a variety of medical characteristics, including a germicidal impact, laxative action, and the ability to treat blood illnesses such as rheumatism, diabetes, asthma, and AIDS. Bitter gourd possesses hypoglycemic (blood sugar-lowering) properties and is therefore utilized as an anti-diabetic and hypoglycemic agent (Palaniswamy *et al*., 2011). It has anti-inflammatory, antiviral, anticancer, anti-leukemia, anti-tumour, analgesic, abortifacient, immune suppressive, blood-cleansing, blood sugar-lowering, and hormone-balancing properties that combat free radicals, kill cancer cells, and prevent tumours (Taylor, 2005).

The use of expensive commercial fertilizers, which are prohibitively expensive for small and marginal farmers, allowed them to replace chemical fertilizers with a combination of organic manures and bio-fertilizers, increasing soil fertility, crop productivity, and fruit yield. Organic farming makes use of organic manures and naturally occurring compounds like biofertilizers, biopesticides, botanicals, and integrated pest control. To ensure environmental quality and safety. Organically cultivated veggies are nutritious and profitable, with fewer post-harvest losses. Biofertilizers are associations that supplement plant nutrition. Some of the ways that carrier-based microorganisms found in biofertilizers boost productivity include biological nitrogen fixation, solubilization of insoluble phosphate, and manufacture of hormones, vitamins, and other plant growth factors (Bhattacharyya *et al*., 2000).

Farmyard manure increases soil permeability to air and water while also increasing nutrient uptake, improving soil moisture holding capacity, cation exchange capacity (CEC), and soil pH. They also increase soil bulk density and stimulate microbial activity (Subedi, 1998).

Vermicompost has been shown to have a great potential as a soil amendment. It has been determined to be an ideal organic nutrition source due to its high macro and micronutrient content, which aids in yield enhancement (Hidalgo *et al.,*1999).

Poultry manure is the best and richest because liquid and solid excreta are released simultaneously, reducing urine loss. It includes growth-promoting chemicals that improve plant development and agricultural yield (Samman *et al.,* 2008). It enhances soil structure, nutrient retention, aeration, soil moisture holding capacity, water infiltration, and plant P availability (Garg and Bahl, 2008).

Neem cake boosts soil aeration, water holding capacity, soil texture, and organic matter content for better crop development and increase in dry matter.

Arka Microbial Consortium is a carrier-based product that includes N-fixing, P- and Zn-solubilizing, and Plant Growth Promoting Microbes in a single formulation. The peculiarity of this technology is that farmers have no requirement to use nitrogen-fixing, phosphorus-solubilizing, and growth-promoting bacterial inoculants individually. It can be simply applied using seed, soil, water, and nursery medium like coco-peat (Aswathi *et al.,* 2020).

Mycorrhiza forms symbiotic relationships with plant roots and fungal mycelia, facilitating nutrient uptake, particularly phosphorus, zinc, and sulphur, as well as the production of growth hormones such as gibberellic acid, indole acetic acid, and dihydrozeatin, which accelerates plant growth (Ikiz *et al.,* 2009) and crop yield (Dasgan *et al.,* 2008).

## Material and Methods

The present investigation was carried out during *rabi* season in the year 2021-2022 at P.G research farm, College of Horticulture, Rajendranagar, Hyderabad. Sri Konda Laxman Telangana State Horticultural University. The experimental site is situated at a latitude of $17^{0}$.32' North, longitude of $78^{0}$.40' East and altitude of 542.3 m above mean sea level. The plots were demarcated into three (3) replications, each replication with twenty (20) treatments and experimental design followed is Randomized Block Design (RBD). The experimental field had sixty (60) plots. The protrays were selected, cleaned and filled with cocopeat: perlite: vermiculite in the ratio of 3:1:1 suitable for rooting media. The seeds were soaked for overnight and imbibed seeds were sown and were kept in shade net for germination purpose. The seedlings at two leaf stage planted into already prepared plots.

The biofertilizers *viz*., Arka Microbial Consortium (AMC) and Vesicular Arbuscular Mycorrhiza (VAM) were added (12.5 kg/ha and 10 kg/ha) respectively to all organic manures for multiplication purpose. Biofertilizers enriched organic manures *viz*., well decomposed farm yard manure (25t/ha and 30t/ha), vermicompost (10t/ha and 12 t/ha), poultry manure (6 t/ha and 8 t/ha) and neem cake (1 t/ha and 2 t/ha) were applied to the respective pits 15 days before transplanting of seedlings and were thoroughly mixed with soil. The recommended doses of Nitrogen,

Phosphorous and Potassium @ 60:120:30 kg/ha were applied to the respective pits in the form of Urea, Single Super Phosphate and Muriate of Potash respectively. Half dose of urea and the entire dose of Single Super Phosphate and Muriate of Potash were applied at the time of transplanting as a basal application and the remaining half dose of Urea was divided into two split doses and were applied at 30 and 60 days after transplanting of seedlings. All other cultural and plant protection measures were done as per the recommended package of practices for the healthy crop.

The experiment was carried out with twenty (20) treatments in Randomized Block Design with three (3) replications *i.e.* **$T_1$:** Farmyard manure (25 t/ha) + AMC (12.5 kg/ha), **$T_2$:** Farmyard manure (25 t/ha) + VAM (10 kg/ha), **$T_3$:** Farmyard manure (30 t/ha) + AMC (12.5 kg/ha), **$T_4$:** Farmyard manure (30 t/ha) + VAM (10 kg/ha), **$T_5$:** Vermicompost (10 t/ha) + AMC (12.5 kg/ha), **$T_6$:** Vermicompost (10 t/ha) + VAM (10 kg/ha), **$T_7$:** Vermicompost (12 t/ha) +AMC (12.5 kg/ha), **$T_8$**: Vermicompost (12 t/ha) +VAM (10 kg/ha), **$T_9$:** Poultry manure (6 t/ha) + AMC (12.5 kg/ha), **$T_{10}$:** Poultry manure (6 t/ha) + VAM (10 kg/ha), **$T_{11}$:** Poultry manure (8 t/ha) + AMC (12.5 kg/ha), **$T_{12}$:** Poultry manure (8 t/ha) + VAM (10 kg/ha), **$T_{13}$**: Neem cake (1 t/ha) + AMC (12.5 kg/ha), **$T_{14}$:** Neem cake (1 t/ha) + VAM (10 kg/ha), **$T_{15}$:** Neem cake (2 t/ha) + AMC (12.5 kg/ha), **$T_{16}$:** Neem cake (2 t/ha) + VAM (10 kg/ha), **$T_{17}$:** RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha), **$T_{18}$:** RDF(40: 80: 50 NPK kg/ha) + VAM (10 kg/ha), **$T_{19}$:** RDF (40: 80: 50 NPK kg/ha), **$T_{20}$:** Absolute control.

The observations were recorded on yield parameters like number of days taken to first fruit harvest, number of days for last fruit harvest, fruit length, fruit weight, fruit yield per plant, fruit yield per plot and fruit yield per hectare. The data collected were analyzed statistically by following the analysis of variance (ANOVA) technique (Panse and Sukhatme 1985) [24]. Statistical significance was tested with 'F' value at 5 per cent level of significance and whenever the F value was found significant, critical difference was worked out at five per cent level of significance.

## Results and Discussion

### Yield Parameters

The data recorded on yield parameters *viz*., days taken to first fruit harvest, days taken to last fruit harvest, fruit length, average fruit weight, fruit yield per plant, fruit yield per plot and fruit yield per hectare are presented in the Table 1

### Number of days taken to first fruit harvest (days)

The data pertaining to number of days taken to first fruit harvest as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1

Significant differences were observed among the treatments on number of days taken to first fruit harvest. Significantly minimum number of days taken to first fruit harvest (43.33 days) was recorded in $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) which is on par with $T_{18}$: RDF (40: 80: 50 NPK kg/ha) + VAM (10 kg/ha) (44.56 days) and $T_{19}$: RDF (40: 80: 50 NPK kg/ha) (45.33 days). Apart from RDF, among organic manures $T_{11}$: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly minimum number of days taken to first fruit harvest (46.00 days). However, significantly maximum number of days taken to first fruit harvest was registered in $T_{20}$: Absolute control (58.00 days).

The results obtained from studies revealed that among different treatment combinations of RDF and organic manures along with biofertilizers had shown significant results on number of days taken to first fruit harvest in bitter gourd. It revealed that number of days taken to first fruit harvest was early in $T_{17}$ and the same treatment recorded the minimum number of days taken to first female flower appearance with maximum number of female flowers in comparison over other treatments.

The results are in support with earlier findings of Kameswari *et al.* (2011) and Pranali *et al.* (2018) in ridge gourd; Vamsi *et al.* (2021) in cucumber;

### Number of days taken to last fruit harvest (days)

The data pertaining to number of days taken to last fruit harvest as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1

Significant differences were observed among the treatments on number of days taken to last fruit harvest. Significantly maximum number of days taken to last fruit harvest (112.72 days) was recorded significantly in the $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) which is on par with $T_{18}$: RDF (40: 80: 50 NPK kg/ha) + VAM (10 kg/ha) (110.30 days) and $T_{19}$: RDF (40: 80: 50 NPK kg/ha) (108.79 days). Apart from RDF, among organic manures $T_{11}$: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly maximum number of days taken to last fruit harvest (107.77 days). However, significantly minimum number of days taken to last fruit harvest was registered in $T_{20}$: Absolute control (91.55 days)

The results obtained from studies revealed that among different treatment combinations of RDF and organic manures along with biofertilizers had shown significant results on number of days taken to last fruit harvest in bitter gourd. The highest number of days taken to last fruit harvest was registered in $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) giving more of harvesting duration for last harvest which could be as a result of the same treatment that recorded the maximum in growth parameters resulting in better chlorophyll development and higher stomatal conductance leading to more synthesis of photosynthates with relation of source to sink which ultimately increased the duration of fruit production.

The results are in support with earlier findings of Sahu *et al.* (2020) in cucumber.

**Fruit length (cm)**

The data pertaining to fruit length as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1

Significant differences were observed among the treatments on fruit length. Significantly the maximum fruit length (19.89 cm) was recorded in the $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) which was on par with $T_{18}$: RDF (40: 80: 50 NPK kg/ha) + VAM (10 kg/ha) (19.54 cm) and it was followed by $T_{19}$: RDF (40: 80: 50 NPK kg/ha) (18.76 cm). Apart from RDF, among organic manures $T_{11}$: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly maximum fruit length (18.34 cm). However, significantly minimum fruit length was recorded in $T_{20}$: Absolute control (12.22 cm).

The results obtained from studies revealed that among different treatment combinations of RDF and organic manures along with biofertilizers had shown significant results on fruit length in bitter gourd. The maximum fruit length was recorded in $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) might be due to better performance of the treatment in all growth and yield aspects including vine growth, leaf area and flowering parameters where inorganic fertilizers containing biofertilizers were absorbed early, diversion of photosynthates to reproductive organs, increased carbohydrate production and flow of assimilates from source to sink was high which led to maximum length of fruit.

The results are in support with earlier findings of Momin (2007), Mulani *et al.* (2007) and Nasreen *et al.* (2011) in bitter gourd

**Average fruit weight (gm)**

The data pertaining to average fruit weight as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1

Significant differences were observed among the treatments on average fruit weight. Significantly maximum fruit (85.21 gm) was recorded in $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) which was on par with $T_{18}$: RDF (40: 80: 50 NPK kg/ha) + VAM (10 kg/ha) (84.06 gm) and $T_{19}$: RDF (40: 80: 50 NPK kg/ha) (83.12 gm). Apart from RDF, among organic manures $T_{11}$: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly maximum fruit weight (80.22 gm). However, significantly minimum fruit weight was recorded in $T_{20}$: Absolute control (56.76 gm)

The results obtained from studies revealed that among different treatment combinations of RDF and organic manures along with biofertilizers had shown significant results on fruit weight in bitter gourd. It indicated that, $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) recorded significantly maximum value that could be due to the fact that the treatment registered the higher fruit length which might be resulting in maximum fruit weight in the treatment compared to the other treatments. This could be attributed to increased photosynthetic area and translocation of photosynthates from source to sink which accelerated the formation of large-sized fruits which led to increase in fruit weight.

The results are in accordance with earlier findings of Rekha and Gopalkrishna (2001) in bitter gourd; Rahul and Singh (2010) in cucumber; Geethu *et al.* (2018) in bitter gourd.

**Fruit yield per plant (kg)**

The data pertaining to fruit yield per plant as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1.

Significant differences were observed among the treatments on fruit yield per plant. Significantly maximum fruit yield per plant (2.21 kg) was recorded in $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) which was on par with $T_{18}$: RDF (40: 80: 50 NPK kg/ha) + VAM (2.15 kg) and it was followed by $T_{19}$: RDF (40: 80: 50 NPK kg/ha) (2.07 kg). Apart from RDF, among organic manures $T_{11}$: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly maximum fruit yield per plant (2.03 kg).

However, significantly minimum fruit yield per plant was recorded in $T_{20}$: Absolute control (0.90 kg).

The results revealed that among different treatment combinations of RDF and organic manures along with biofertilizers had shown significant results on fruit yield per plant in bitter gourd. The maximum fruit yield per plant was recorded in $T_{17}$ might be due to application of NPK fertilizers indicated that the nutrients taken up by the plant were well absorbed in cell multiplication, amino acid synthesis, and energy formation which led to increase in photosynthesis. Photosynthetic activity products were then translocated from the source to the sink (fruits and growing buds) resulting in higher yield per plant.

The results are in support with earlier findings of Anjanappa *et al.* (2012) in cucumber; Ghosh *et al.* (2016) in watermelon; Sureshkumar *et al.* (2019) in bitter gourd.

**Fruit yield per plot (kg)**

The data pertaining to fruit yield per plot as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1.

Significant differences were observed among the treatments on fruit yield per plot. Significantly maximum fruit yield per plot (23.01 kg) was recorded in $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) which was on par with $T_{18}$: RDF (40: 80: 50 NPK kg/ha) + VAM (22.67 kg) and it was followed by $T_{19}$: RDF (40: 80: 50 NPK kg/ha) (21.52 kg). Apart from RDF, among organic manures $T_{11}$: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly maximum fruit yield per plot (18.66 kg). However, significantly minimum fruit yield per plot was recorded in $T_{20}$: Absolute control (7.50 kg).

The results revealed that among different treatment combinations of RDF and organic manures along with biofertilizers had shown significant results on fruit yield per plot in bitter gourd. The maximum fruit yield per plot was recorded in $T_{17}$ where all growth parameters were maximum leading to rapid vegetative growth might have accelerated the high photosynthetic rate and increasing the supply of carbohydrates. Better carbohydrate assimilation may have created favourable conditions for auxin synthesis resulting in maximum number of female flowers per vine and highest number of fruits per vine could have increased yields.

The results are in support with earlier findings of Das *et al.* (2015) in bottle gourd; Ghayal (2016) in cucumber

**Fruit yield per hectare (t)**

The data pertaining to fruit yield per hectare as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1

Significant differences were observed among the treatments on fruit yield per hectare. Significantly maximum fruit yield per hectare (20.01 t) was recorded in $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) which was on par with $T_{18}$: RDF (40: 80: 50 NPK kg/ha) + VAM (19.71 t) and it was followed by $T_{19}$: RDF (40: 80: 50 NPK kg/ha) (18.71 t). Apart from RDF, among organic manures $T_{11}$: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly maximum fruit yield per hectare (16.23 t). However, significantly minimum fruit yield per hectare was recorded in $T_{20}$: Absolute control (6.52 t).

The results revealed that among different treatment combinations of RDF and organic manures along with biofertilizers had shown significant results on fruit yield per hectare in bitter gourd. The maximum fruit yield per hectare was recorded in treatment $T_{17.}$ Fruit yield is primarily determined by fruit length (cm), fruit yield per plant (kg), fruit yield per plot (kg), and average weight of fruit (gm). The combined effects of inorganic and biofertilizers which favourably influenced nutrient translocation to the fruiting nodes and boosted fruiting, might be responsible for the increased number of fruits and also due to the influence of NPK, enhanced the synthesis of photosynthates leading to vigorous vegetative growth might have accelerated the photosynthetic rate, increasing the supply of carbohydrates, better assimilation, increased photosynthesis allocation to the economic part and hormonal balance in the plants. The addition of bio fertilizers might have played an important role in converting unavailable forms into available forms resulting in better nutrient uptake by increasing the synthesis of growth regulators such as IAA, GA, amino acids, and vitamins resulting in increase in bitter gourd yields.

The results are in support with earlier findings of Arfan ul Haq *et al.* (2015), Dodake *et al.* (2015) and Soumyabrata and Kumar (2017) in bitter gourd.

**Table 2 :** Effect of different treatment combinations of RDF and organic manures along with biofertilizers on number of days taken to first fruit harvest (days), number of days taken to last fruit harvest (days), fruit length (cm), average fruit weight (gm), Fruit yield per plant (kg), fruit yield per plot (kg) and fruit yield per hectare (t) at different growth stages in bitter gourd.

| Treatments | Number of days taken to first fruit harvest (days) | Number of days taken to last fruit harvest (days) | Fruit length (cm) | Average fruit weight (gm) | Fruit yield per plant (kg) | Fruit yield per plot (kg) | Fruit yield per hectare (t) |
|---|---|---|---|---|---|---|---|
| $T_1$ | 52.66 | 97.19 | 14.19 | 66.64 | 1.33 | 12.26 | 10.66 |
| $T_2$ | 54.33 | 96.76 | 13.87 | 65.21 | 1.27 | 11.28 | 9.81 |
| $T_3$ | 52.00 | 99.19 | 14.88 | 69.37 | 1.49 | 14.17 | 12.32 |
| $T_4$ | 52.10 | 97.89 | 14.53 | 68.43 | 1.43 | 13.27 | 11.54 |
| $T_5$ | 51.00 | 101.01 | 15.46 | 70.14 | 1.59 | 15.47 | 13.45 |
| $T_6$ | 51.68 | 100.75 | 15.12 | 69.61 | 1.56 | 14.82 | 12.89 |
| $T_7$ | 49.14 | 103.27 | 16.31 | 74.46 | 1.71 | 16.34 | 14.21 |
| $T_8$ | 50.98 | 102.69 | 15.72 | 73.32 | 1.68 | 15.99 | 13.90 |
| $T_9$ | 47.33 | 105.45 | 17.37 | 77.16 | 1.90 | 17.64 | 15.34 |
| $T_{10}$ | 48.67 | 104.15 | 16.72 | 76.54 | 1.86 | 17.25 | 15.00 |
| $T_{11}$ | 46.00 | 107.77 | 18.34 | 80.22 | 2.03 | 18.66 | 16.23 |
| $T_{12}$ | 47.00 | 106.05 | 17.68 | 79.15 | 1.97 | 18.19 | 15.82 |
| $T_{13}$ | 57.01 | 93.06 | 12.94 | 60.15 | 1.08 | 9.90 | 8.61 |
| $T_{14}$ | 57.64 | 92.43 | 12.46 | 59.07 | 1.03 | 9.59 | 8.34 |
| $T_{15}$ | 55.66 | 95.70 | 13.53 | 63.17 | 1.20 | 10.72 | 9.32 |
| $T_{16}$ | 56.33 | 94.75 | 13.21 | 62.43 | 1.15 | 10.26 | 8.92 |
| $T_{17}$ | 43.33 | 112.72 | 19.89 | 85.21 | 2.21 | 23.01 | 20.01 |
| $T_{18}$ | 44.56 | 110.30 | 19.54 | 84.06 | 2.15 | 22.67 | 19.71 |
| $T_{19}$ | 45.33 | 108.79 | 18.76 | 83.12 | 2.07 | 21.52 | 18.71 |
| $T_{20}$ | 58.00 | 91.55 | 12.22 | 56.76 | 0.90 | 7.50 | 6.52 |
| **S.E (m) ±** | 0.73 | 1.39 | 0.29 | 1.04 | 0.03 | 0.25 | 0.21 |
| **CD at 5 %** | 2.09 | 3.98 | 0.83 | 2.99 | 0.07 | 0.70 | 0.60 |

## Conclusion

Based on the study, it was concluded that, different treatment combinations of RDF and organic manures along with bio fertilizers have a significant influence on growth and yield in bitter gourd. The experimental results revealed that application of $T_{17}$: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha) significantly increased yield was proved to be the best treatment in bitter gourd (*Momordica charantia*. L) var. Pusa Aushadhi.

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