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Effect of biocomposted groundnut shell on growth and yield of bhendi (*Abelmoschus esculentus* (L.) Moench.

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Abstract

Groundnut shell wastes accumulation may cause a major environmental threat which compose of tremendous lignin and cellulose. Hence, the present study deals with the degradation of groundnut shell waste through vermicomposting technology. The experiment on bhendi [*Abelmoschus esculentus* (L.) Moench] was conducted during the period of June - August with three replications using randomized block design (RBD) method. Bioconversion of groundnut shell was recycled by following treatments such as T_1- Groundnut shell + *Trichoderma asperelloides* + *Eisenia fetida* (5 t ha^{-1}) T_2 - Groundnut shell + Microbial consortium (5 t ha^{-1}) T_3 - Groundnut shell + Microbial consortium + *Eisenia fetida* (5 t ha^{-1}). On 25, 50 and 75 DAS the growth parameters and on 90 DAS yield parameters were observed. An application of biocompost T_3 significantly increased the growth parameters like root length (cm), shoot length (cm), no. of leaves, diameter of leaf (cm), fresh weight (g), dry weight (g) and yield attributes like length of fruit (cm), diameter of fruit (cm), no. of seeds/fruit, fruit yield/plant (g), fruit yield/ bed (kg), fruit yield/three beds (kg), fresh weight (g) and dry weight (g) of bhendi followed by T_2 when compared to the control. Based on the results T_3 (groundnut shell partially biodegraded by microbial consortium and vermicomposted by earthworm) enhanced the fruit yield/plant (298.92g), fruit yield/bed (1.291kg) and fruit yield/three beds (5.423kg). Therefore, the bio-manure prepared from groundnut shell promotes plant growth and yield attributes of bhendi.

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Disposal of groundnut shell wastes are major environmental issues, which gets composted very slowly due to the presence of high amount of lignin and cellulose. Nowadays, consumption of groundnut is tremendous in the world particularly India, China, USA, Indonesia and Myanmar. In India groundnuts are prominent oilseed crop.Huge amount of groundnut shell is used for packing materials. In the developing countries groundnut shells are either burned or dumped or left to degrade naturally creates environmental pollution.

Groundnut shell contains macro and micro nutrients like calcium, potassium, phosphorus, magnesium, zinc and small amount of fat and proteins[15]. Hence, groundnut shell can be converted into natural fertilizers for sustainable plant growth. In the present study bhendi [*Abelmoschus esculentus* L. (Moench)] is used as test crop. The fruits are rich in vitamins, calcium, potassium and minerals, the mature seeds are good source of oil, protein and unsaturated fatty acids.[10] and the mature fruit & stem contain crude fiber about 2.4 mm long, it is used in paper making and fabric industries as a substitute for jute. The aim of the study was to evaluate the growth and yield of bhendi as influenced by groundnut shell compost.

Collection of materials :

Groundnut shell was collected from groundnut field Pollachi, Coimbatore, Tamil Nadu, India. The collected sample was chopped into small pieces and dried under sunlight it was stored for further process. The epigeic earthworm *Eisenia fetida* was obtained from earthworm breeding centre at Kisan Vigyan Kendra, Coimbatore, Tamil Nadu, India. Seeds of "bhendi [*Abelmoschus esculentus* L. (Moench)]" were collected from department of vegetables crops, TNAU, Coimbatore.

Preparation of consortium :

The selected microorganisms like Bacteria (*Bacillus licheniformis*), Cellulolytic fungi (*Paecilomyces variotti*), lignolytic fungi (*Pleurotus florida*) and Actinomycetes (*Streptomyces lavendulae*) were used to make a microbial consortium.

Compost pit preparation :

The groundnut shell was partially decomposed by pit composting method, each pit measuring 2 feet height and 1.5 feet width named as C_1, C_2 and C_3 (C standard for compost). The sun dried groundnut shell was transferred to the respective pits along with cowdung. *Trichoderma asperelloides* (20 g) was added to C_1 and 20 g of microbial consortium was added to C_2 and C_3 uniformly. The compost moisture content was maintained spraying water daily and it was mixed thoroughly once a week. After 30 days the compost was partially decomposed, 20 healthy epigeic earthworms (*Eisenia fetida)* were inoculated into the C_2 and C_3 samples.

Field culture :

A field culture experiment on bhendi [*Abelmoschus esculentus* L. (Moench)] was conducted using red sandy loam soil having pH 6.2 during the month of June - August 2020 at Aalaandhurai, Coimbatore. The experiment was laid out in randomized block design (RBD)

with three replication and each bed measuring 1.5 feet wide and 3.5 feet long. Biodegraded groundnut shell was transferred to the respective beds T_1 - Groundnut shell + *Trichoderma asperelloides* + *Eisenia fetida*, T_2 - Groundnut shell + Microbial consortium and T_3 - Groundnut shell + Microbial consortium + *Eisenia fetida* (5 t ha^{-1}). Bhendi (Co4) seeds were sown in zic - zac position on each bed space between one feet distance. Irrigation was done once a week and weeds were removed by hand weeding at the regular interval of ten days. After germination the biometric data were recorded on 25, 50 and 75 DAS (root length, shoot length, diameter of leaf, fresh weight and dry weight of plant) Number of leaveswas counted manually. On 90th day length of fruit, diameter of fruit, no. of seeds / fruit, yield / plant, yield / bed, yield / three beds, fresh and dry weight of fruit were analyzed.

Statistical analysis :

The obtained data were statistically analyzed by two-way anova.

Bioconversion of groundnut shell was recycled by composting and vermicomposting method. The earthworms can consume all kinds of organic matter, excreta of worms contain tremendous nitrate in available form of macro and micro nutrients, which enhance the plant growth and vigorous production of yield[9]. Nalluri and Karri,[15] suggested that groundnut shell and chemical fertilizer increased the growth and yield parameters of brinjal and bitter gourd. The results also coincided with the result of Omidi *et al.,*[16] in *Viola* spp, Dzomeku and Illiasu,[2] in maize and Torkashvand *et al*.,[19] in ornamental plants.

Biometric parameters :

Data in figure 1 illustrated that the application of bio composted groundnut shell by using microbial consortium and *Trichoderma asperelloides* had significant effect on root length, shoot length, no. of leaves, diameter of leaf of bhendi during the period of June to August 2020. The highest root and shoot length was observed with the application of T_3 (Groundnut shell + Microbial consortium + *Eisenia fetida*) followed by T_2 (Groundnut shell + Microbial consortium) and T_1 (Groundnut shell + *Trichoderma asperelloides* + *Eisenia fetida*) than control on 25 DAS (18.3, 10.4, 9.4, 8.5), (15.6, 13.8, 12.5, 10.3) 50 DAS (24.8, 21.6, 20.3, 20.1), (28.4, 25.1, 24.5, 23.1) and 75 DAS (26.4, 22.9, 21.3, 20.4), (50.3, 46.6, 36.4, 35.7) respectively. The same treatment enhanced the plant biomass and number of leaves and diameter of leaf on 25 DAS (8.1, 7.2, 6.4, 5.7), (17.1, 12.2, 9.9, 8.7), 50 DAS (12.7, 11.3, 9.4, 8.0), (26.9, 23.1, 20.9, 19.1) and 75 DAS (18.1, 12.4, 11.7, 10.2), (33.2, 25.4, 24.9, 19.6) than control. Vermicompost and inorganic fertilizers increased the nutrients uptake from plants especially nitrogen content which enhanced the cell elongation, cell division and plant growth[17]. The significant increase in number of leaves and diameter of leaf might be due to better nutrients supply from T_3 bio-manure.

Among the three treatments T_3 (6.02, 36.81, 106.48), (1.40, 5.62, 19.01) had a high percentage of fresh and dry weight followed by T_2 (4.72, 31.01, 87.20), (0.82, 4.91, 13.18) and T_1 (3.94, 28.17, 74.51), (0.64, 4.24, 12.77) than control (3.02, 25.81, 67.82), (0.42, 3.75, 10.34) on 25, 50 and 75 DAS respectively

(figure 2). The maximum water content observed in the plant's uptake by roots from the soil and loss of water content promote dry weight decline than the fresh weight. The similar results were obtained by Ekundayo *et al.*,[3], the root length, stem length and fresh weight of okra leaf was higher in non-sterile soil than sterile soil and 25% urea plus 75% jeewamirta enhanced the growth and yield of Okra[4] and the application of 75% chemical fertilizer plus *Azospirillum brazilense* plus *Pseudomonas fluorescens* revealed increased growth and yield of bhendi[18]. On the other hand, green and white strips shade net house promote more suitable condition for maximum growth and yield of Okra than the white shade net house, green shade net house and open field by Kakade *et al.*,[8].

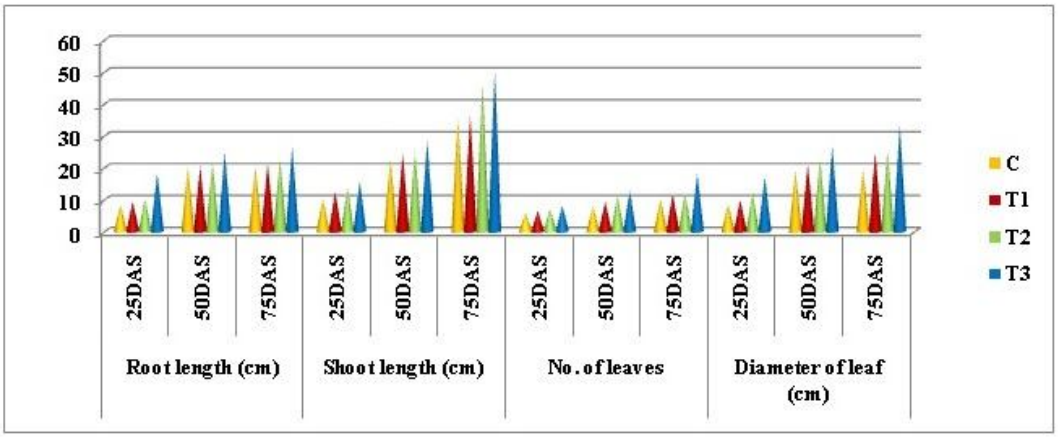

Figure 1 Vegetative parameters of Bhendi

Yield attributing characters like length of fruits (cm), diameter of fruit (cm), no. of seeds/fruit, yield/plant (g), yield/bed (kg), yield/three beds (kg), fresh and dry weight (g) maximum

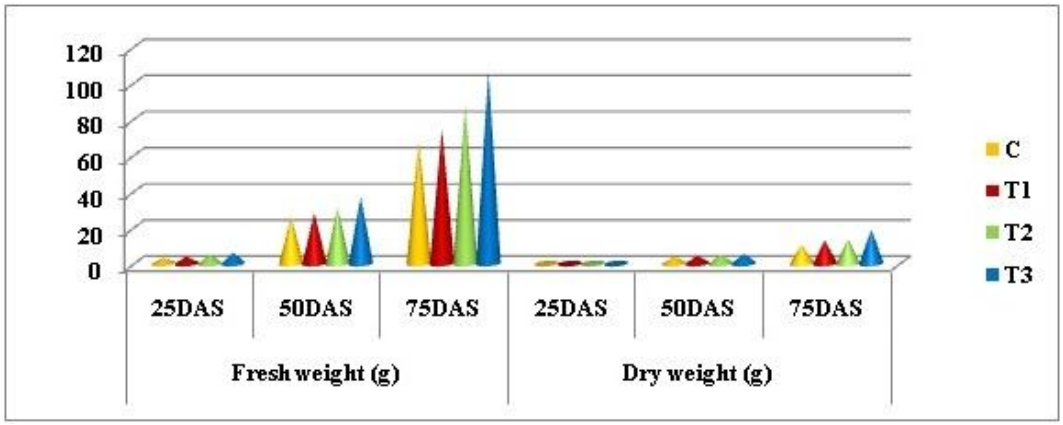

Figure 2 Vegetative parameters of Bhendi

increased the application of T_3 (18.1cm, 2.1cm, 72.2, 298.92 g, 1.291kg, 5.423kg, 25.92g and 2.006g) followed by T_2 (15.9cm, 1.8cm, 57.3, 270.24g, 0.702kg, 5.123kg, 23.56g and 1.695) and T_1 (14.7cm, 1.6cm, 54.7, 264.07g, 0.684kg, 4.975kg, 22.16g and 1.574g) when compared to the control (14.3cm, 1.3cm, 48.8, 253.32g, 0.528kg, 4.329kg, 18.76g and 1.007g) in figure 3 respectively.Gupta *et al*., (2019) reported that the application of farmyard manure 10 t/h enhanced the 15% and 75% fruit yield in Okra plant over than 100% NPK during the period of 2012-2013 and recommended dose of inorganic fertilizers increased the yield of Okra (6.58 t /h)

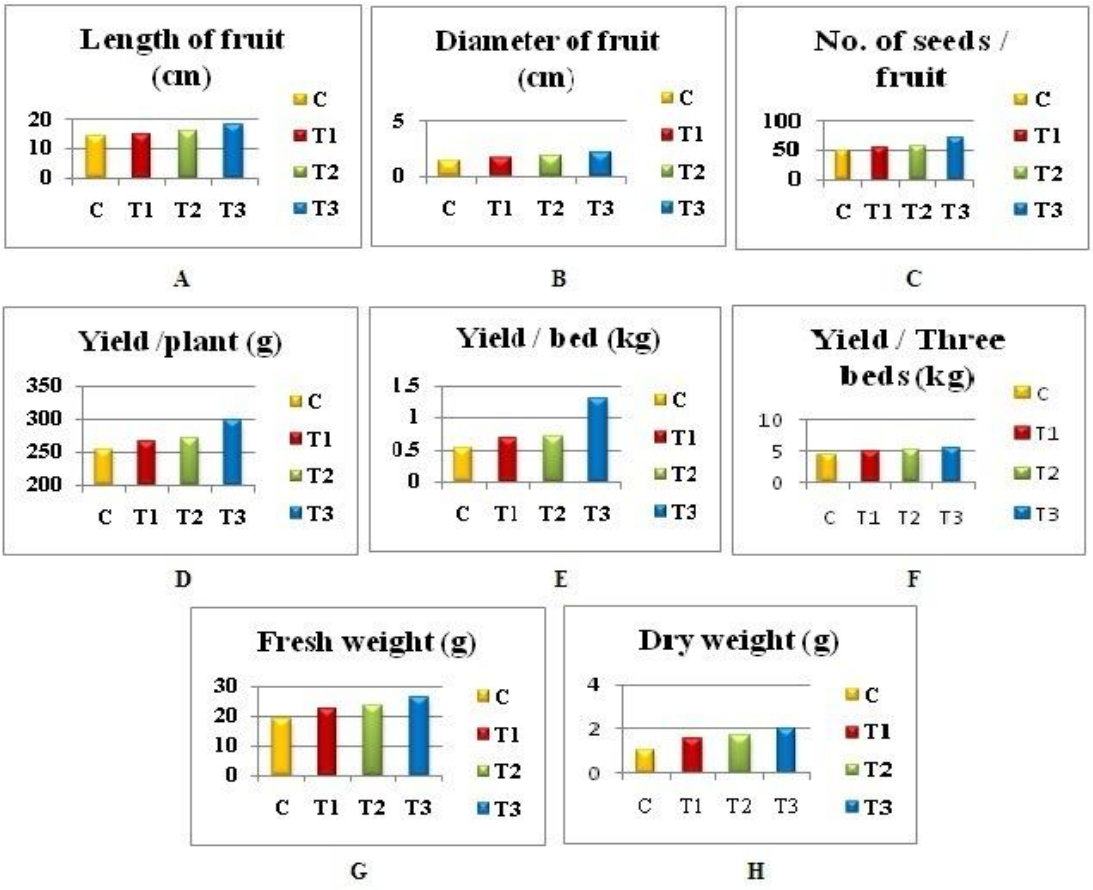

Figure - 3 (A - H) Yield parameters of bhendi

Muhmood *et al*.,[14] and Jat *et al*.,[7] revealed that maximum yield of Okra (37.65 q/ h) with the application of 75% recommended dose of farmyard manure + 6 t vermicompost / h + biofertilizer respectively.

This is the confirmation with the finding of Gill *et al*.,[5] in maize, Kumar *et al*.,[11] in garden pea, Dadiga and Jain,[1] in coriander, Lal *et al*.,[12] in fennel and Lal *et al*.,[13] in fenugreek.

Bio composting of groundnut shell waste is very easiest and cheapest method and it's containing macro and micro nutrients which increases the growth of plants and fertility of soil. Vermicomposting technology along with microbial consortium is the best results for growth and yield of bhendi.

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