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Research Article

EFFECT OF FLOWER WASTE VERMICOMPOST ON THE GROWTH OF OKRA (*Abelmoschus esculentus*)

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Abstract: Okra is one of the most popular vegetables which is produced by heavy use of inorganic fertilizers. Vermicompost can be an alternative to inorganic fertilizers. A pot experiment was conducted with 3 treatments with three replications in grow bags (15 x 15 inch) to study the effect of vermicompost, chemical fertilizer and control on growth parameters and yield of okra (Abelmoschus esculentus). Vermicompost was prepared from used flower waste. Due to high availabilities of nutrients, vermicompost is better than, other fertilizers. Plant height of okra varied from 0.71 m to 1.72 m. The tallest plants for okra were obtained when inorganic fertilizer was spread. The number of leaves per plant was equal statistically when using vermicompost (32.5 leaves/plant) and inorganic fertilizer (32.30 leaves/plant) as soil amendments. Flowers took more time to appear on control treatment (*i.e.*, 58.7 days) as compared to the time taken with the vermicompost and the inorganic fertilizer of okra.

Keywords: *Vermicompost, Chemical fertilizer, Inorganic fertilizer, Yield and growth parameters, Environment, Okra, Floral Waste*

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Introduction

Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product [1]. It is a mesophilic process, utilizing microorganisms and earthworms that are active at 10–32°C (not ambient temperature but temperature within the pile of moist organic material). The process is faster than composting; as the resulting earthworm castings (worm manure) are rich in microbial activity and plant growth regulators, fortified with pest repellence attributes and are capable of transforming garbage into vermicompost [2,3]. It's wrong assumption that flower waste is biodegradable in nature so it can be discarding anywhere for decomposition and this leads to makeshift dumping areas for waste, which is a breeding ground for diseases [4]. If proper techniques use to resolve such types of environmental problem which is generated due to flower waste, not only resolve environmental problem but also generate additional revenue [5].

Material and Methods

The experiments were conducted in grow bags (15 x 15 inch) with 7kg waste holding capacity, with a hole at the side of bags. This experiment was conducted with 3 Treatments (T1 Vermicompost, T2: inorganic fertilizer and T3 Control with three replications. Flowers were collected from the nearby major temples of the city, after collection of flower waste, non-biodegradable part like plastic, coconut shell was removed by hand sorting. The segregated flower waste was air dried for 48 hours before use for composting. The earthworms (*Eisenia fetida*) were obtained from panagar village near district of Jabalpur. The use of *Eisenia fetida* for vermicompost preparation of industrial and sewage sludge, weed biomass, etc. has been well documented [6, 7], hence this species is used for the present study on vermicomposting of floral waste. It converts waste material into nutrient rich humus which is a good source of manure for plants [8]. For flower waste vermicomposting, flower waste and cow dung were mixed in 1:1 proportion (50%) each [9]. Around 40 earthworms were added to the container having flower waste and 20-25 days old cow dung for compost preparation.

Cow dung increases the rate of decomposition during vermicomposting of flower waste as it contains high minerals and nutrient content [10]. About 60% moisture content was maintained throughout the period of vermicomposting by sprinkling of water in every second day until brown to black colored granular structure was appear.

Experimental Design

The experiment was laid out in a complete block design with three replicates during one crop season. This experiment included three different treatments T1: vermicompost, T2 : inorganic fertilizer and T3: control. Sowing of local variety of okra was done in the month of march on the same day. In each grow bags 3 hole were made for seed sowing, 3 seeds of okra per hole at a depth of 2 to 3 cm were sown in all treatments. The germination (%) was observed after 10 days of sowing. Growth parameters such as plant height, number of pods per plant, fresh weight of pod, number of leaves per plant, pod length and yield were also measured

Statistical Tests

Data were analyzed by CRD (ANOVA). The means were compared using the least significant difference (LSD) test at $p \leq 0.05$ for rate of germination, plant height, number of leaves per plant, number of pods per plant, days to flower, pod length, and pod yield.

Result and Discussion

Influence of vermicompost and Fertilizers on okra seeds germination

Germination is the emergence and development from the seed embryo of those essential structures which indicate its ability to produce a normal plant under favorable conditions [11]. In this study germination (%) in all three treatments were evaluated and shown in [Fig-1]. It appeared that the germination rate differed significantly ($p < 0.05$) in function of the type of fertilizer. The higher rate of seed germination was obtained with treatment T1 (Vermicompost) was used as fertilizer.

Table-1 Effect of fertilizers on Growth parameters of okra (Abelmoschus esculentus)

Treatment	Growth parameters					
	Plant height (m)	Number of leaves/plants	Number of days to flower	Number of pods/plants	Green pod length (cm)	Pod yield/plant (g)
T1 : Vermicompost	1.53 ± 0.61[b]	32.5 ± 3.17[a]	48.3 ± 4.22[b]	30.24 ± 3.02[b]	11.3 ± 1.5[a]	416.19 ± 86.94[b]
T2 : Inorganic fertilizer	1.72 ± 0.53[a]	32.30 ± 6.44[a]	46.1 ± 7.18[c]	31.2 ± 8.65[a]	10.9 ± 5.62[a]	410.28 ± 94.64[a]
T3: Control	0.71 ± 0.18[c]	13.46 ± 3.21[b]	58.7 ± 6.55[a]	23.18 ± 4.32[c]	8.0 ± 2.03[b]	212.60 ± 20.38[c]

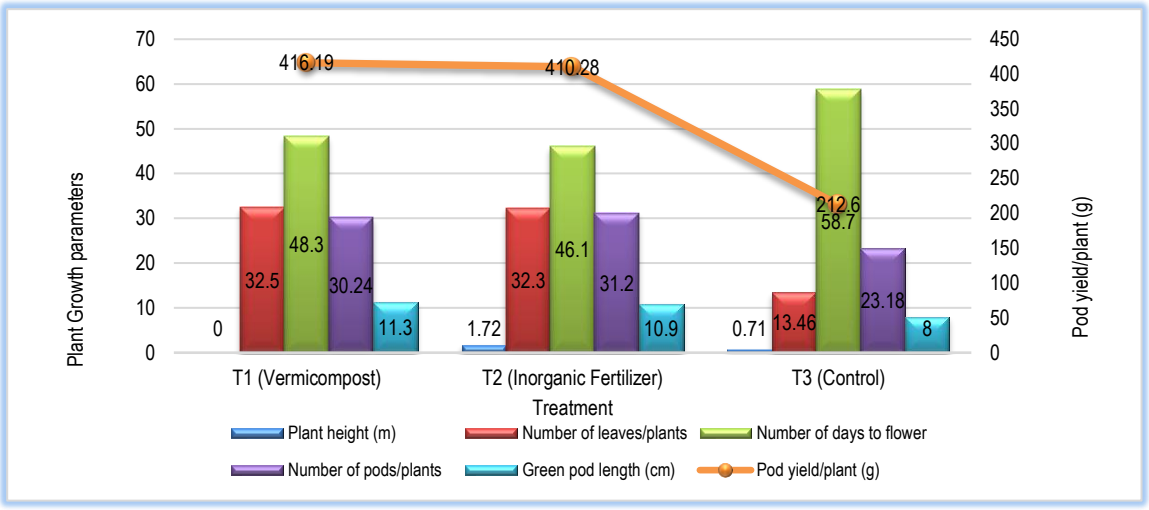

Fig-2 Growth parameters of okra

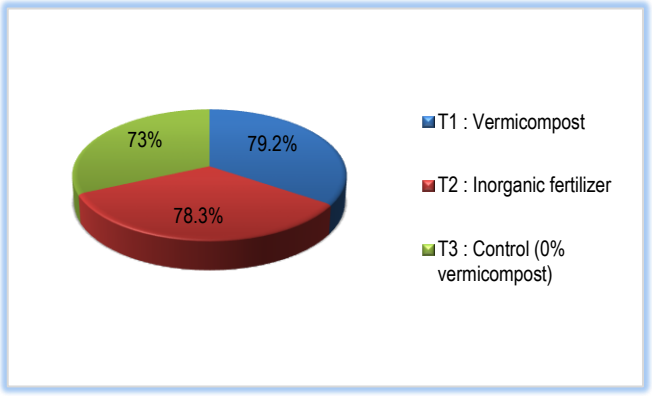

Fig-1 Okra seed germination (%)

Influence of vermicompost and Fertilizers on okra growth parameters

The growth parameters of the species Abelmoschus esculentus or okra varied significantly in function of the type of fertilizer (Table 1). Plant height varied from 0.71 m to 1.72 m. Maximum height of okra plants was obtained with inorganic fertilizer. The number of leaves per plant was statistically equal in both the treatments *i.e.*, vermicompost (32.5 leaves/plant) and inorganic fertilizer (32.30 leaves/plant). As compared to vermicompost and inorganic fertilizer, control treatment shows late flowering (*i.e.*, 58.7 days) of okra. Maximum number of pods/plant and pod yield (g) was observed in inorganic fertilizer treatment. In vermicompost and inorganic fertilizer, pod length (cm) and pod yield/plant (g) were statistically similar and was higher than those observed on control plots (Figure 2). The highest growth parameters were observed in treatments having inorganic fertilizer and the vermicompost as compared to the control.

The capacity of vermicompost to release nutrients for plant growth might be slow compared to inorganic fertilizer. However, the productivity of okra observed with the vermicompost and the inorganic fertilizer was statistically equal. Vermicompost has the ability to conserve soil properties for plant growth on long-term. The growth parameters observed in this study were higher than those reported by [12] when evaluating different doses of NPK on okra productivity. That difference could be linked to a variation in nutrients content of the medium the plants were cultivated on. Vermicompost has many applications in crop improvement such as pathogen destruction, water holding capacity of soil, improved crop growth and yield; also improve soil physical, chemical and biological properties [13]. The application of vermicompost enhances soil health and crop productivity due to improved nutrient uptake, the presence of humic substances, phytohormones, and enhanced microbial activities in vermicompost [14].

Vermicomposting technology can be used for the management and recycling of floral wastes. It reduces the level of pollution at the generation site. It could be the best organic fertilizer for producing organic vegetables, organic fruits, and ornamental plants [9]. Vermicompost added to the soil, increases germination, growth, flowering, fruit and production of a wide range of plant species [15]. Thus, vermicompost technology can be successfully applied for management and utilization of flower waste which is collected from various sources [16].

Conclusion

Vermicomposting is a method that uses earthworms and microorganisms to break down, accumulate, detoxify, and convert various waste materials into a product that can be used for agricultural purposes. This low-cost method of waste disposal is environmentally friendly and preferable to other disposal methods. It is clear that flower waste vermicompost is also better fertilizers than other fertilizers due to the availabilities of nutrients in vermicompost.

Application of research: Management of flower waste by conversion to value added product

Research Category: Vermicompost

Abbreviations: CRD-Completely randomized design, LSD-least significance difference

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Study area / Sample Collection: Jabalpur

Cultivar / Variety / Breed name: Okra (*Abelmoschus esculentus*)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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