Analysis of Growth of Okra (*Abelmoschus esculentus*) in Different Percentage of Organic Manures

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***Abstract*- The growth of okra plants was studied in 7 experimental treatments – soil alone and different percentages of cow dung, vermicompost and poultry litter mixtures with soil, under laboratory conditions. Growth performance of okra regarding the height of the plant and number of leaves was higher in a mixture of 70% vermicompost and 30% soil (T5). Present result indicates that vermicompost amended soil enhanced the growth rate of okra plant compared to the plants treated with other organic fertilisers.**

***Keywords*: Vermicompost, Cowdung, Poultry Litter, Soil, Percentage.**

INTRODUCTION:

Composting is a type of waste processing that has gained increasing acceptance over the years. As a rule, the process consists of the natural decomposition of organic waste and diverse species of microorganisms. During this process, a succession of aerobic microorganisms' breakdown and transform organic material into a range of increasingly complex organic substances, (4). In composting, additionally the microorganisms generate heat and a solid substrate, with less carbon and nitrogen, but more, which is called compost, (9).

The composting process is similar to the natural process of mineralization and humidification occurring after incorporating organic residues into cultivated soils. Compost application can improve soil quality and productivity as well sustainability of agricultural production by replenishing soil organic matter and supplying nutrients. Organic matter is a vital component of a healthy soil as it plays an important role in soil physical, chemical and biological fertility.

One of the present-day challenges in agriculture is organic or eco-friendly practices which include uses of bio fertilisers in farming. Some examples of biofertilizers are raw or composted animal manures, compost without synthetic additives, green manures etc. In this paper, we have investigated the growth performance of okra plants in different types of animal manure such as cow dung, vermicompost and poultry manure or litter.

METHODOLOGY:

7 earthen containers were used in this experiment. Different animal manure such as cow dung, vermicompost and litter were kept in sun for 5 days to become air dried. The experiment consists of 7 treatment combinations viz. T_0 (control, only soil); T_1(70% soil and 30% cow dung); T_2 (70% soil and 30% vermicompost); T_3 (70% soil and 30% litter); T_4 (70% cow dung and 30% soil); T_5 (70% vermicompost and 30% soil); T_6 (70% litter and 30% soil).

Then, these experimental containers were kept for one day for proper balancing of soil and organic manure. On the next day, in each container four healthy and good quality okra seeds were sown within a certain distance from one another. Everyday water was sprinkled on the treatment containers.

After a few days, the seeds were germinated and data of germination was recorded.

After a few days of germination, sapling started. The first day of sapling to any treatment, is considered as **initiation day or Day 0**. The height of sapling at day 0 is recorded. On day 4 of first sapling the height of small plants was measured and the number of leaves is counted, and this experiment was conducted for 40 days.

RESULT AND DISCUSSION:

Organic fertilisers enhance soil quality and add nutrients for plant growth. These experiment results revealed that T_1 and T_4 took a minimum number of days (3 days) to germinate. This is because cow dung is rich in minerals including potassium, phosphorus and calcium. Addition of cow dung increases the organic carbon content of degraded soil which may lead to the increasing activity of beneficial soil microorganisms as well as the fertility status of soil by increasing the availability of nutrients for the plant, (10). This is, (2, 7), reported that phosphorus plays a significant role in seed germination and viability. Soils having phosphorous deficiency oppresses the initial plant growth. So, the seeds in poultry litter manures take maximum days to germinate (11 days in T_3 and 14 days in T_6), as litter contains a minimum phosphorus percentage other than two organic manures.

In T_6, before germination, the root tip portion which came out from the seed was brown in colour and then after the germination, the sapling was also brown in colour; because of the high nitrogen percentage present in the poultry litter manures. So, high percentage of poultry litter is not good for the health of okra.

The differential growth (regarding plant height) of okra plant on various treatments over a period of 40 days is represented in Fig.1. It is observed that the plant of T_4 has shown greater plant height (61 cm). This may be due to the fact that cow dung is a source of many important nutrients that plants need for healthy growth and also nourishment of the soil. This experiment (5), focuses on the fact that manure contains the three major plant nutrients, nitrogen, phosphorus and potassium (NPK), as well as many essential nutrients such as Ca, Mg, S, Zn, Cu, Mn etc. Cow dung increases pH, cation exchange capacity, total N, organic C, loss on ignition and exchangeable Mg and Ca. It decreases sulphate absorption. Moreover, cow dung manure plays a significant role in maintaining the nutrients status of the plant (8). Similarly, T_2 has also shown significant plant height (58cm) because of the high calcium percentage present in cow dung.

However, the plant on vermicompost treatment (specially T_5) showed rapid increase in height because of high quality release of nutrients in soil with passage of time. In vermicompost treatment, the stem part of the plants are very

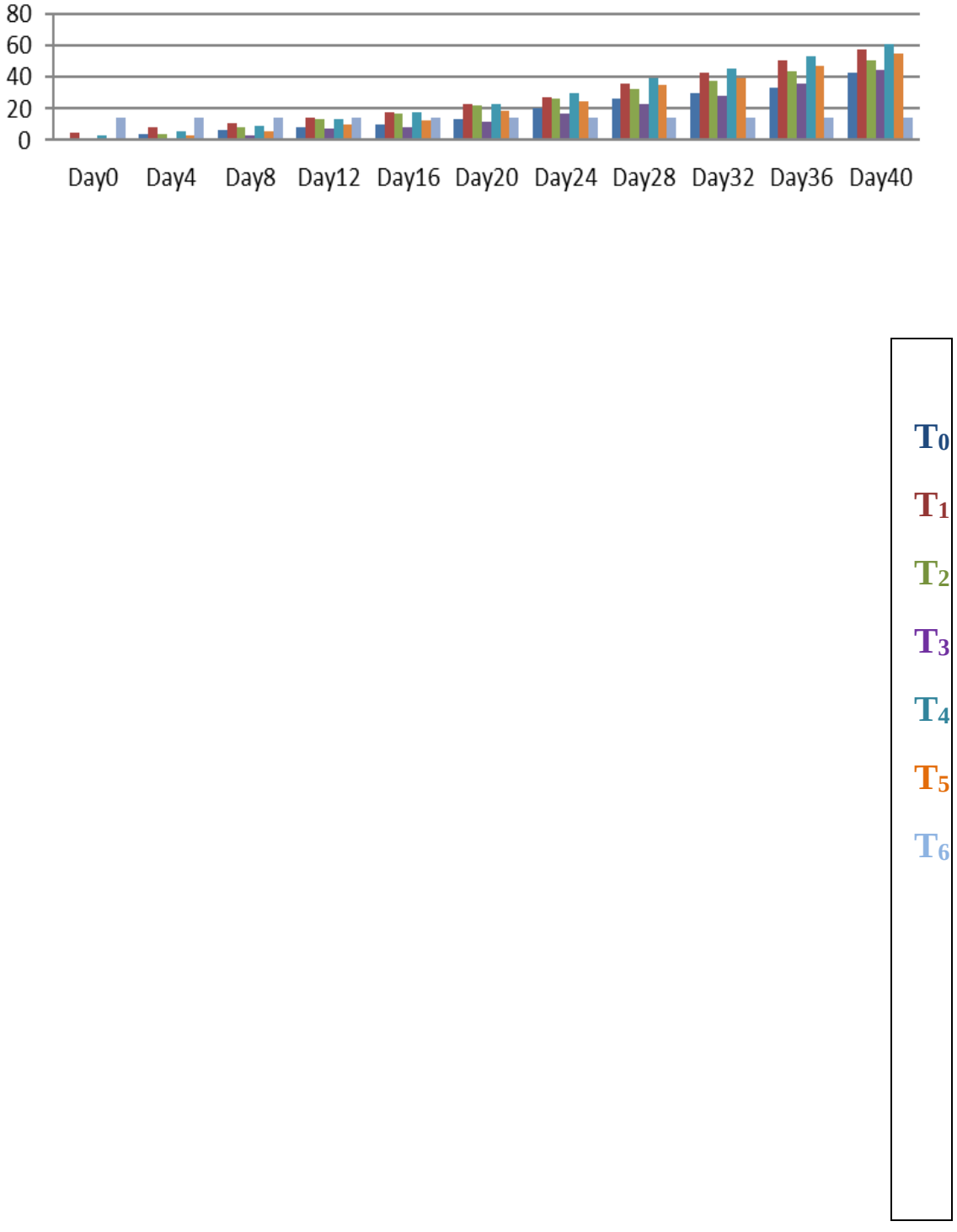

Fig.1. The Differential Growth (Regarding Plant Height) of Okra Plant on various treatments over a period of 40 days;

Abbreviations: T_0-Control, Only Soil, T_1- 70% Soil &30% Cow dung, T_2- 70% Soil & 30% Vermicompost, T_3- 70% Soil & 30% Litter, T_4- 70% Cow dung & 30% Soil, T_5- 70% vermicompost & 30% Soil, T_6- 70% Litter & 30% Soil.

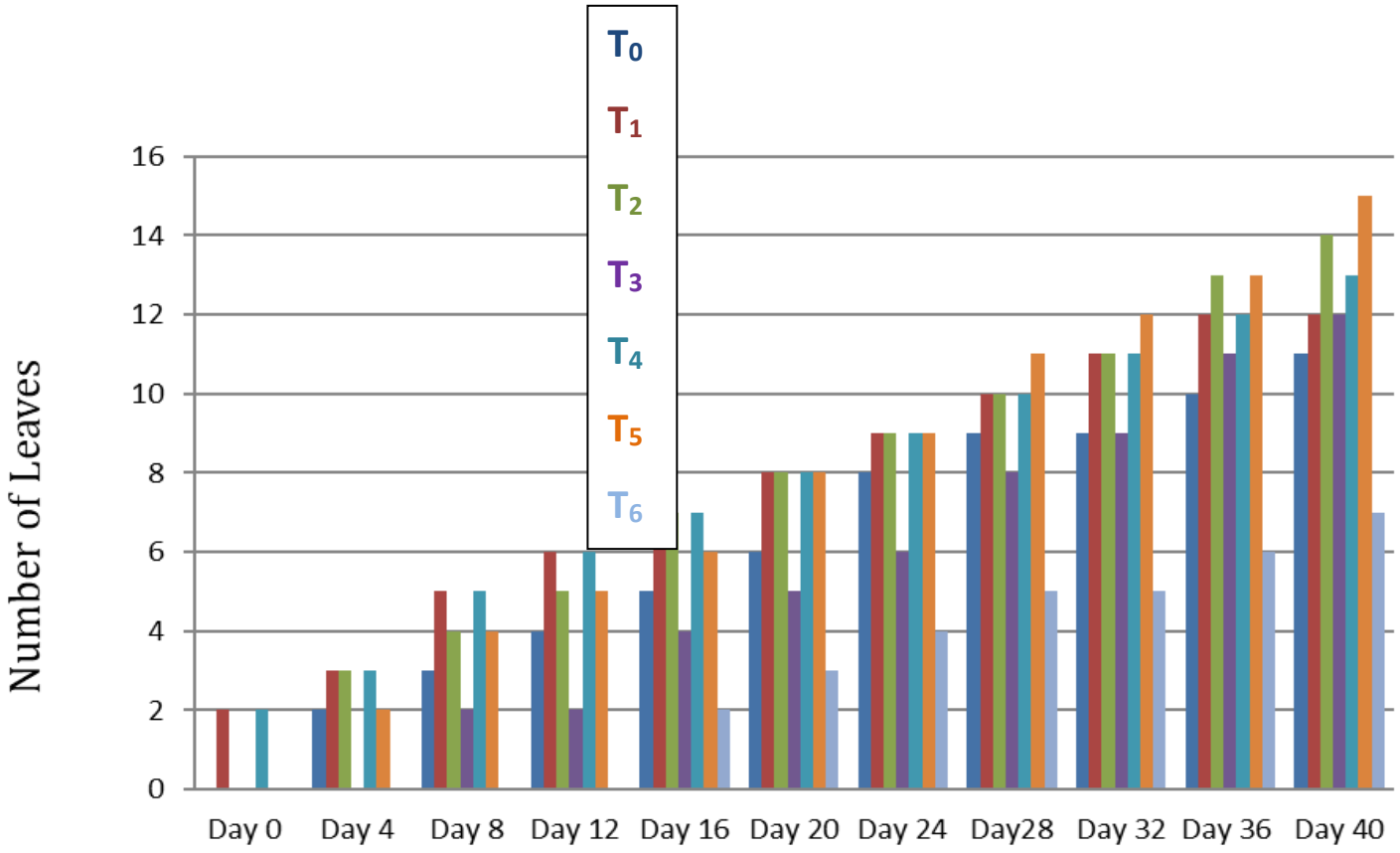

Fig.2. The Number of Leaves on various treatments over a period of 40 days;

Abbreviations: T_0-Control, Only Soil, T_1- 70% Soil &30% Cow dung, T_2- 70% Soil & 30% Vermicompost, T_3- 70% Soil & 30% Litter, T_4- 70% Cow dung & 30% Soil, T_5- 70% vermicompost & 30% Soil, T_6- 70% Litter & 30% Soil.

thick and well developed and appears to be healthy plants. Vermicompost stimulates the microbial activity of soil, increases the availability of O_2, maintains normal soil temperature, increases soil porosity, yield and quality of the plant, (3).
In case of litter treatment, T_6 has shown less plant height(14cm). In T_3 the plant shows a positive effect on the height(45cm), as 70% soil almost balances the pH of the mixture although 30% acidic litter is present.
The number of leaves per okra plant on various treatments over 40 days is represented in Fig 2. Nitrogen helps in leaf growth; phosphorus promotes rooting and potassium is essential for stem and root growth. In vermicompost treatments (T_2 and T_5) the okra plants have more leaves in comparison to the other treatments. In T_2 the plant has 14 leaves and in T_5 the plant has 15 leaves.

But in treatment T_6 the plant has a smaller number of leaves. After 30 days it is observed that the leaves of T_6 okra plant dies and exfoliate from the plant due to acidic conditions of the litter.

In cow dung treatments (T_1 and T_4) the plant has 12 leaves and 13 leaves respectively but the size of the leaves is small in comparison to the vermicompost treatments (T_2 and T_5), although the plants have shown greater plant height to that of T_2 and T_5.

In vermicompost treatments (T_2 and T_5), the size of the leaves is large. The incorporation of organic matter with soil, especially vermicompost, stimulates the activity of beneficial soil microorganisms and ensures continuous and sustainable supply of mineral nutrients, especially N, to plants. The nutrient availability to roots, soil physical features, and its vital processes are enhanced and roots are provided with an optimum substrate (1). Consequently, chlorophyll content is increased and the growth of vegetative parts is induced (6).
By statistical analysis, it is confirmed that there is a significant difference between height of the plant and number of leaves. Here $|t|=5.68 > t_{0.05},12 = 2.18$.

CONCLUSION:
The present study was conducted to assess the growth of okra plants in different compost treatments under laboratory conditions. It is concluded that vermicompost may be put to good use as a natural fertiliser for vegetable crops, especially Okra, for increased production and for sustainable agriculture system,

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