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RESEARCH ARTICLE

VEGETABLE COMPOST PREPARATION AND GROWTH OF PLANTS

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ABSTRACT

Vegetable compost was prepared using vegetable wastes. Later, the prepared compost was used to grow plants such as tomato, french beans and lady's finger and the germination and growth studies were carried out. French beans showed a higher germination percentage of 80%. Tomato and lady's finger showed a germination percentage of 70% and 50% respectively. The growth parameters namely shoot length, root length and leaf diameter was studied after 15 days and 25 days of growth of the plants. The study showed a higher growth rate in vegetable compost treated plants than control plants.

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INTRODUCTION

Compost improves the soil in a number of ways and reduces the waste going to landfills. When added to soil, compost increases soil water and nutrient holding capacity. Compost makes all types of soil easier to work, from clay-rich to sandy soils. It also feeds soil organisms, including the bacteria, fungi, earthworms and insects living in healthy soil. It improves plant productivity and cover. Increased plant cover reduces water runoff and the potential for soil erosion and nutrient pollution. Manure and compost not only supply many nutrients for crop production, including micronutrients, but they are also valuable sources of organic matter (Rosen and Bierman, 2005). The recycling of compost to land is considered as a way of maintaining or restoring the quality of soils, mainly because of the fertilizing or improving properties of the organic matter contained in them. Furthermore, it may contribute to the carbon sequestration, and may partially replace peat and fertilizers (Smith *et al*., 2001). In the process of making compost, the high temperature destroys (1) seeds of weeds, (2) eggs of pests/insects, (3) pathogenic bacteria. Crops raised with compost are strong and resistant to disease, so it is not necessary to use much chemical fertilizer.

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Compost enhances the interaction of bacteria in the soil, thus nourishing it. The resulting compost-rich soil will be balanced and suitable for growing rice and vegetables. Composting helps to optimize nutrient management and the land application of compost may contribute to combat soil organic matter decline and soil erosion (Van-Camp *et al*., 2004).

MATERIALS AND METHODS

Soil & Seed collection

- Soil collected from Gandhi Maanagar in Coimbatore, Tamil Nadu.
- Seeds collected from Agricultural office in Malappuram, Kerala.

Materials Required (Plate 1)

- Peel of onion & garlic,
- Bitter gourd wastage without seeds,
- Cucumber,
- Pumpkin, ash gourd & all other vegetable wastes.

Method of Composting

The composting process was carried out according to Cogger and Sullivan (2009). Slow or cool composting, also called passive composting, is a simple, but, less-effective method of

producing compost. For slow composting, leaves, grass clippings and other garden wastes were placed in a bin or pile. This method requires little to no maintenance, but, it can take a year or more until the pile decomposes. Slow or cool composting is far less effective in killing weeds and pathogens than other methods, but requires much less effort. Hot or active composting is a much quicker way to produce compost. The decay process is controlled and manipulated to make it proceed quickly. The increased rate of decay produces heat. Hot compost piles heat quickly from 120˚ to 160˚C. At these temperatures, many pathogens and weeds are destroyed. As the process continues, the compost pile cools and low temperature organisms, such as earthworms and insects, add their efforts to the decay process.

Steps to create compost pile

Site: Pick a level, well-drained site. Build the pile on bare soil so that, soil bacteria and other organisms can move into it. In Northern Nevada's high desert climate, a bit of shade helps maintain moisture in the pile during summer. The site should be convenient, close to a water source, the garden or other major sources of raw materials.

Pile size: Cool compost piles can be of any size. Make hot compost piles at least one cubic yard or 3-feetwide by 3-feet long by 3-feet high, to hold- in the heat and maintains chemical processes. It is not necessary to use a bin or other structure, but it helps contain the composting materials. Bins or piles can be as large as a 5-foot cube in size. Piles or bins larger than this lack sufficient air in the middle of the pile and are more difficult to turn.

Ingredients: Maintain green materials to dry or woody materials in the ratio 1:2. A wide variety of substances can be used, including yard wastes, manure, etc. The finer the size of materials, the quicker they degrade. Continue adding materials in layers until the pile reaches the desired size.

Particle size: The size of the materials added to the compost pile plays a role in the speed of decomposition. Large particles allow air to circulate, but, bacteria and other organisms can only work on the outside of large particles. Very fine particles restrict airflow and are easily compacted. Aim for materials that are one-half inch to 1.5 inches in size. Chip, chop or shred woody materials before adding them to pile.

Water: Moisture content can often be insufficient for effective composting. The pile should be damp, not dripping wet and not dusty dry, but, about as wet as a sponge that has been wrung out. Water the pile as needed to keep it damp. The compost pile may be added to the drip irrigation circuit. However, be cautious about over-watering. Many nutrients may be lost, if water flows out of the compost pile. The excess water may also fill the air spaces. Composting is an aerobic activity that requires oxygen. Decomposition will continue without oxygen, but anaerobic decomposition produces foul odors and is a slower process. Additionally, anaerobic decomposition encourages the growth of human and plant pathogens that are difficult to avoid. Cover the pile during heavy rains, so that, it will not get too wet.

Mixing: Once the pile is built, it should begin Composting quickly. Turn the pile weekly, using a Pitch fork or shovel. Turning adds air to the pile. It also mixes the material from the outside of the pile to the inside of the pile, where, greater biological activity usually occurs. Check for moisture content while turning and water the pile if needed. Some hot composters do not add to the pile once it starts heating. To gauge the temperature of the pile, use a long-stemmed compost thermometer or your hand.

Curing: Depending on the speed of decomposition, the pile should stay hot for several weeks to two months. The pile will decrease in size to about half the original volume. Then, the pile needs to sit for another four to eight weeks to "cure." During the curing phase, pile temperatures will decrease to about 80 to 110˚ C. Turn the pile at least weekly during the curing phase. The compost is ready to use when the material in the pile no longer heats up when turned. The pile has a pleasant, earthy smell and the material in the pile is uniform, crumbly and dark brown in color.

Advantage of Compost

Composting provide greater yield for the farmers. In very dry areas, composting could be difficult due to scarcity of water and organic materials. Another advantage of compost is that diseases, pest & weeds are destroyed during the composting process. Compost gives better result than chemical fertilizer because its chemical composition is richer & more balanced. Compost also increases the water holding capacity of the soil.

Table 1. Growth of the vegetable crops after 15 days

S.No	Name of the plant	Shoot length* (cm)		Root length* (cm)		Number of Leaves/plant*	
		Control	Treated	Control	Treated	Control	Treated
1.	Tomato	8	10.5	8.5	10.2	3	5
2.	French bean	8.5	12.5	7.2	9.0	4	7
3.	Lady's finger	8.0	12.0	7.5	9.0	4	6

*Indicates the average of two values

Table 2. Growth of the vegetable crops after 25 days

S.No	Name of the plant	Shoot length* (cm)		Root length* (cm)		Number of Leaves/plant*	
		Control	Treated	Control	Treated	Control	Treated
1.	Tomato	12.0	15.0	10.2	13.0	5	7
2.	French bean	9.6	16.4	8.4	12.0	8	12
3.	Lady's finger	10.3	16.0	10.0	12.0	6	10

*Indicates the average of two values

Vegetable crops such as tomato, French beans and lady's finger were grown in control soil and soil treated with compost. The shoot length, root length and number of leaves per plant of the test crops were measured. Once the vegetable compost was ready, it was used for the cultivation of certain vegetables. The plant seeds (French beans, Tomato, Lady's finger) were taken for the study. Before the cultivation, lady's finger seeds were soaked in water for 2-3 hours. In Compost soil, the tomato and French bean plants grew on 5th day of sowing. The lady's finger plant grew on the 8th day. In normal soil, the tomato & French bean plant grew on 5th day of sowing. The lady's finger plant grew on 15th day.

Plate 1. All vegetable wastes

Plate 2. Growth of plants after 15 days in vegetable compost treated soil

Plate 3. Growth of plants after 25 days in vegetable compost treated soil

RESULTS AND DISCUSSION

The vegetable compost obtained by the given method was used in cultivation of vegetable crops and initial growth parameters of the plants (Tomato, French beans and Lady's finger) were studied and tabulated. The germination percentage observed 15 days after sowing showed 70% (Tomato) in vegetable compost treated soil. French bean and lady's finger showed germination percentage of 80 % and 50 % respectively in vegetable compost treated soil. The growth parameters studied after 15 days and 25 days were shoot length, root length and number of leaves per plant. The results are tabulated in Table 1 & 2. Tomato plant grown in vegetable compost treated soil showed a shoot length of 10.5 cm, root length of 10.2 cm and number of leaves were found to be 5 after 15 days. Similarly, in French beans and lady's finger, the shoot length, root length and number of leaves in plants grown in vegetable compost treated soil were found to be 12.5 cm, 9 cm, 7 numbers and 12 cm, 9 cm and 6 numbers respectively (Table 1; Plate 2). After 25 days, the shoot length, root length and number of leaves

were measured in all the 3 test plants and tabulated (Table 2; Plate 3). Among the 3 plants studied, tomato showed a lower shoot length of 15 cm, but, the root length was higher (13 cm) in tomato. The number of leaves was found to be higher in French beans and it was 12. Lowest number of leaves was found in lady's finger (7). In all the crop plants taken for study, the vegetable compost treated plants showed better results in all the parameters rather than the control plants.

From the above studies, we could conclude that use of vegetable compost could bring about a change in the germination capacity and growth parameters of different vegetable crops (viz., tomato, French beans & lady's finger). The vegetable crops taken for the present study was due to their enormous benefit to humans. The work which has already been carried out using biowaste and vegetable waste compost in agriculture has shown the low nitrogen fertilizer value of composts (Amlinger *et al*., 2003; Hartl & Erhart, 2005; Gutser *et al*., 2005). The compost nitrogen added to the soil is present mostly in organic compounds, and it can be mineralized and thus be taken up by the plants, immobilized, denitrified, and/or leached. In different studies, crop nitrogen recovery was found to range between 2% and 15% of the total compost N applied, depending on various factors, including compost properties, climatic conditions, crop types, soil properties and management practices (Mamo *et al*., 1999; Nevens and Reheul, 2003; Wolkowski, 2003; Hartl and Erhart, 2005).

Benefits of tomato

Tomatoes play a key role in liver health and Russian doctors routinely prescribe tomatoes in the diets of factory workers exposed to toxic chemical. Tomatoes are useful detoxifiers because of the presence of chlorine and Sulphur, two very important detoxifying trace elements. Natural chlorine helps to stimulate the liver. It assists liver in its task as an important filter for body wastes. Tomato also assists the liver in removing the toxic waste products from the system. Sulphur helps to protect the liver from cirrhosis and other debilitating conditions. Drinking fresh tomato juice can help to regenerate the damaged, destroyed or surgically removed liver, promoting its health and well-being and counteracting the negative effects of an overly-rich diet by helping the liver break down fats and eliminate.

Benefits of French beans

French beans have significant amounts of soluble fiber. One cup of cooked beans provides about 9 - 13 grams of fiber. Soluble fiber can help lower blood Cholesterol. French beans are also high in protein, complex carbohydrates, folate and iron.

Benefits of lady's finger

The entire plant is edible. The leaves are eaten raw in salads. Okra seeds may be roasted and ground to form a caffeine-free substitute for coffee. Okra is a popular health food due to its high fibre, vitamin C and folate content. Okra is also known for being high in antioxidants. Okra is also a good source of calcium and potassium.

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