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Research Article

EFFICIENCY OF PREPARED ORGANIC COMPOST BY THERMOPHILIC MICROBES ON VIGOUR GROWTHOF LEAFY VEGETABLES

Birajdar G.M., V.R.Kumbhar, R.S.Narayankar and *U.N Bhale

Research Laboratory, Dept. of Botany, Arts, Science and Commerce College, Naldurg, Tq. Tuljapur, Osmanabad 413602, Maharashtra, India

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ABSTRACT

Organic farming is a sustainable faming system that produces healthy crops and livestock without damaging the environment. It avoids the use of artificial chemical fertilizers and pesticides, relying instead on developing a healthy and fertile soil and growing a mixture of crops. In this investigation, the prepared (T1-Layered agrowaste;T2-Mixed agrowaste;T3-Mixed fungal culture with agrowaste;T4-Mixed bacterial culture with agrowaste;T5-Mixed Fungi+bacterial culture with agrowaste;T6-Fungal culture with layered agrowaste;T7-Bacterial culture with layered agrowaste;T8-Fungi +Bacterial culture with layered agrowaste) compost by pit method and available (FYM-Farm Yard Manuar; VC-Vermicompost; PM-Poultary Manuar) composts were analyzed on five important leafy vegetables crops and evaluated the % rate of seed germination and vigour growth. Generally, T3, T4, T5, T6 and T7 types of prepared organic compost was observed more significant in % germination and vigour growth and available VC and FYM as well. As compered to available compost, better result was recorded in case of length of stem and root in T4 and T7 treatments. The highest percent (100%) seed germination were found in *Rumex acetosa* (T5 treatment), *Spinacea oleracea* (T7 treatment) and *Trigonella foneum-graecum* (T4 treatment) and available VC found 100% seed germination in case of *Anethum graveolens* and *Coriandrum sativum*. In case of other growth parameters prepared type of composts was observed significant result as compared to control and available compost.

INTRODUCTION

In this way, the farm remains biologically balanced with variety of insects and wildlife that act as natural predators of crop pests, and soil full of microorganisms and earthworms to keep its vitality. Deficiencies in micronutrients such as vitamin A and iron in developing countries are widespread and have negative consequences for children's growth and development (Aphane *et al*., 2002). Therefore there is a need for people to grow green vegetables like amaranths to supply the body with such nutrients. The vegetable is accredited with possession of high nutritional values of essential nutrients like calcium, phosphorous, iron and other important components such as vitamins C, fiber, carbohydrate, fat and a high calorific value (Badra, 1991). Organic manure can serve as alternative practice to mineral fertilizers for improving soil structure (Dauda *et al*., 2008) and microbial biomass (Suresh *et al*., 2004).

Animal manure is known to be effective in maintenance of adequate supply of organic matter in soil, with improvement in soil physical and chemical condition and enhanced crop performance (Ikpe and Powel,2002), poultry, cattle, sheep and pig manure has been found to improve soil fertility and crop yield (Adeniyan and Oyeniyi, 2003; Ojeniyi and Adeyboyega. 2003). Ewulo (2005) reported that addition of poultry and cattle manure to soil lead to increase in soil PH, Organic Carbon, Nitrogen, Phosphorus, Calcium, Potassium, Magnesium, Sodium and CEC. Therefore the aim of this study is to assess the effect of cow dung, compost and inorganic fertilizer (NPK) on the growth and yield of amaranth and on chemical properties of the soil.

Many investigators emphasized the beneficial role of organic manures incorporated with biofertilizer to stimulate plant growth, yield of vegetables among them Abdalla, *et al*. (2001) on pepper; Abou-Hussein, *et al*. (2002) on potatoes; Adam, *et al*. (2002) on cantaloupe; Rizk, *et al*. (2003) on squash and Shams (2003) on sweet pepper.

Some workers reported the vermicomposts have been shown to improve the growth and yield of crossandra (*Crossandra*

Corresponding author:* **UN Bhale
Dept. of Botany, Arts, Science and Commerce College, Naldurg, Tq. Tuljapur, Osmanabad 413602, Maharashtra, India

undulaefolia Salisb.), tomatoes (*Solanum lycopersicum* L.), peppers (*Capsicum annuum* L.), strawberries (*Fragaria x ananassa* L.), lettuce (*Lactuca sativa* L.), marigold (*Tagetes patula* L.) and spinach (*Spinacea oleracea* L.) (Atiyeh *et.al*., 2000; Zaller, 2007). Therefore the objectives of this research was to compare the effects of composted wastes by thermophilic microbes with other regionally available compost on leafy vegetables

MATERIALS AND METHODS

Compost preparation by pit method

Composting pits having a width of one meter, length of two meters and a height of 1.5 meters (1Wx2Lx1.5H) above and below the earth were prepared and it was constructed by bricks and polythene sheet (1mm size). Eight pits were filled with different wastes (soybean husk, jawar straw, groundnut leaves, dry leaves, maize stem, papers, sugarcane bagasse, cattle manure, fertile soil, food wastes etc.) and isolated dominant fungi and bacteria. Two different types of compost preparation methods were preferred i.e. mixed and layered. In layered method, first layer at the bottom with waste materials, second layer with cattle manure, third layer with fertile soil. Each layer was treated by thermophilic dominant fungi and bacteria. In case of mixed compost preparation method, agrowaste materials, cattle manure, fertile soil, papers, thermophilic microbes etc were mixed and prepared the pits and in each pits provided the sufficient amount of water with constant intervals. Each layer (thickness of 8-10 cm) was maintained. The upper layer of compost was covered with dry leaves to protect the composted heap from wind and sunshine in each pits.The treatments of pits compost i.e. T1-(Layered agrowaste), T2(Mixed agrowaste), T3(Mixed fungal culture with agrowaste),T4(Mixed bacterial culture with agrowaste), T5 (Mixed Fungi+bacterial culture with agrowaste),T6(Fungal cult ure with layered agrowaste),T7(Bacterial culturewith layered a growaste),T8(Fungi+Bacterial culture with layered agro waste) were considered and analysed the impact on crop productivity (Hassen *et al*., 2001; Karmegam and Daniel, 2003; Dosoretz, *et al*., 1990).

Selection of Leafy vegetables

The variety of five leafy vegetable crops i.e. *Rumex acetosa* (Sorrel), *Spinacea oleracea* (Spinach- All green) *Anethum graveolens* (Dill), *Coriandrum sativum* (Coriander- PD-1) and *Trigonella foneum-graecum* (Fenugreek- Pusa early bunchi) seeds were used from local farmers & market.

Compost establishment and treatment

The different treatments of prepared compost i.e. T1-T8 and available FYM, VC and PM were applied on leafy vegetables. Two kilograms capacities of polythene bags were used and each of which 10g/bags of composts added with sterilized soil and as per size of vegetables seeds were sown in it. After 45 days of sowing the data were analyzed i.e. % germination, shoot & root length, fresh and dry weight.

Data analyses

Data presented on the average of three replicates as means ± standard error obtained from independent experiments. The output results obtained from the differences between the treatments are significant @$p<0.05$ or insignificant. All data were statistically analyzed and the significance of differences was determined by using book (Mungikar, 1997).

RESULTS AND DISCUSSION

In this study, compost was analyses on some important crops and evaluated the rate of seed germination and biomass production in polythene bags after 45 days of application (Figure 1).

***Rumex acetosa*:** Sorrel seed germination rate highest was 100% in T5 next to T3, T4& T7 90% and lowest in T1 (60%). Stem length was observed more in T4 (34cm.) and least in control and PM (8.0cm). The root length was less in control (03cm) and more in T4 (11cm). Maximum fresh weight of stem was observed in T4 (14g) while least in T6 (1.2g). Root fresh weight was found more in T7 (1.8g) and less in T2 (1.2g). Maximum dry weight of stem was found in T3 (2.5g) and minimum in PM (1.3g). Root dry weight was highest in T7 and T3 and lowest in control and PM (Table 1).

***Spinacea oleracea*:** Spinach seed germination rate highest was found 90% in T7 followed by T5, T6, T8 & FYM i.e. 80% and least in control (40%). Stem length was observed more in T7 (10cm.) and less in control (6.1cm). The root length was less in PM (1.3cm) and more in T7 (3.2cm). Stem fresh weight was observed maximum in T7 while minimum in T1&T6. Fresh weight of root was found maximum in T7 (1.8g) and minimum in T2 and more stem dry weight in T7 (Table 2).

Anethum graveolen: Dill seed germination rate was 100% in VC and lowest in T1 (60%). Stem length was observed longest in T3 and FYM (19cm.) and shortest in T6 (12cm). The root length was shortest in T7 (3.0cm) and longest in T3 (9.0cm). Root fresh weigh was found maximum in T3 and FYM (6.7g) while least in T7 (0.46g). Stem fresh weight was observed more in T3 and FYM and least in T7. Dry weight of stem found optimum in FYM and minimal in control (1.5g). Root dry weight was highest in T3 (0.75g) and lowest in T7 (0.23g) (Table 3).

Coriandrum sativum: Coriander seed germination rate was 100% in VC and lowest in T1 (60%). Stem length was observed longest in T7 (21cm.) and lowest in T6 (0.8cm). The root length was shortest in T6 (0.3cm) and longest in T7 (0.9cm) .Root fresh weigh which was highest in T7 (1.8) and lowest in T6 (0.50cm). Stem fresh weight was observed highest in T7 (6.7g) and lowest in T6 (1.2g). Highest stem dry weight in T1 and PM i.e (1.6g) and lowest in T6 (0.8g). Root dry weight was highest in T7 (0.90g) while least in T6 (0.25g) (Table 4).

Trigonella foenum-greacum: The fenugreek seeds had the germination rate was found 100% in T4 and lowest in control. Stem length was observed more in FYM (44cm.) while less in control and T7 (25.0cm). The root length was short in T6 (06cm) and tall in T4 (11cm).Stem fresh weight was observed highest in T7 while lowest in FYM. Root fresh weigh was found highest in FYM (1.4g) and lowest inT2&T7 (0.8g). Highest stem dry weight in T1 and lowest in T3 (0.9g) and root dry weight was highest in T4 (Table 5).

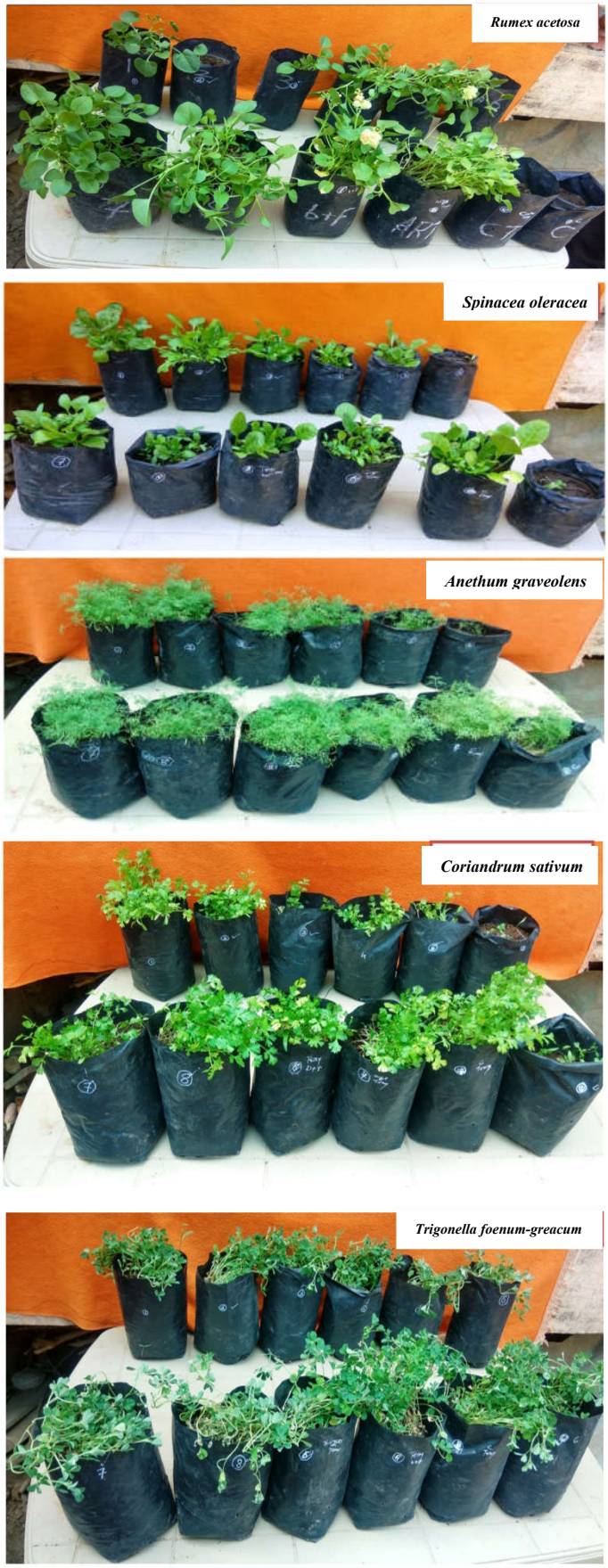

Figure 1 Effect of prepared compost on percent seed germination and vigour growth of Leafy vegetables.

Table 1. Effect of prepared compost on percent seed germination and vigour growth on *Rumex acetosa*.

Sr.No	Treat.	G (%)	SL(cm)	RL(cm)	SFW(g)	RFW(g)	SDW(g)	RDW(g)
1	Control	80	10±2.1a	3±1.6a	08±2.2b	1.5±0.2a	2.3±1.4b	0.3±0.05a
2	T1	60	17±3.1b	5±1.9b	09±2.0b	2.0±0.8b	2.3±1.2b	0.6±0.08b
3	T2	70	15±2.3b	4±1.5a	06±1.9a	1.5±0.9a	1.9±0.6a	0.4±0.06a
4	T3	90	26±4.2c	10±2.1d	12±2.5d	3.0±1.0c	2.5±1.2b	0.8±0.09b
5	T4	90	34±4.0e	11±2.3d	14±2.3d	3.4±1.5c	2.4±1.4b	0.8±0.07b
6	T5	100	24±2.5c	6±1.3b	09±1.8b	1.0±0.3a	1.4±0.8a	0.3±0.04a
7	T6	70	21±3.3c	6±1.4b	09±2.1b	1.6±0.9a	1.9±1.1a	0.5±0.03a
8	T7	90	30±3.7e	12±2.5e	10±2.4c	2.6±1.3b	2.3±1.5b	0.6±0.05b
9	T8	80	29±3.5d	9±2.2c	10±2.3c	1.9±0.6a	2.1±1.3b	0.6±0.04b
10	FYM	80	24±2.8c	8±2.0c	08±2.4b	1.6±1.0a	1.7±0.9a	0.4±0.03a
11	VC	70	28±2.3d	9±2.4c	09±2.2b	1.9±1.1a	1.9±0.8b	0.5±0.08a
12	PM	80	10±1.2a	4±1.1a	07±2.0a	1.2±0.8a	1.3±0.6a	0.3±0.07a
CD(p=0.05)			15.60	5.14	6.25	1.33	1.27	0.33

Legends: G-germination, SL-Shoot length, RL-Root length, SFW-shoot fresh weight, RFW-Root fresh weight, SDW-shoot dry weight, RDW-root dry weight,Each value is the mean of three replicates, Standard error ±,Column means with the same letter (s) are not significantly different.

Table 2 Effect of prepared compost on percent seed germination and vigour growth on *Spinacea oleracea.*

Sr.No	Treat.	G (%)	SL(cm)	RL(cm)	SFW(g)	RFW(g)	SDW(g)	RDW(g)
1	Control	40	6.1±1.9a	1.9±1.0a	0.03a	0.01	0.00	0.00
2	T1	50	6.5±1.5a	1.5±1.1a	0.02a	0.00	0.00	00.00
3	T2	50	7.8±1.3b	2.0±1.0b	0.09a	0.02a	0.02a	0.00
4	T3	70	7.5±1.8b	2.3±1.2b	0.07a	0.01a	0.01a	0.00
5	T4	60	9.00±2.1	2.5±1.4b	0.10b	0.03a	0.02a	0.00
6	T5	80	6.8±1.4a	2.1±1.3b	0.06a	0.02a	0.00	0.00
7	T6	80	5.3±1.6a	1.2±1.1a	0.02a	0.00	0.00	0.00
8	T7	90	10.0±2.4d	3.2±1.5c	0.17b	0.07a	0.04a	0.01
9	T8	80	8.0±1.7c	2.7±1.3b	0.12b	0.05a	0.03a	0.00
10	FYM	80	8.3±1.8c	2.7±1.9b	0.09a	0.02a	0.01a	0.00
11	VC	70	7.7±1.5b	2.4±1.7b	0.08a	0.02a	0.01a	0.00
12	PM	60	8.8±2.0c	1.3±1.2a	0.07a	0.01a	0.01a	0.00
CD(p=0.05)			5.11	0.66	0.03a	0.01a	0.00	0.00

Table 3 Effect of prepared compost on percent seed germination and vigour growth on *Anethum graveolens.*

Sr.No	Treat.	G (%)	SL(cm)	RL(cm)	SFW(g)	RFW(g)	SDW(g)	RDW(g)
1	Control	70	14±2.4c	5±1.4c	3.5±1.2c	0.99±0.1b	1.7±0.03a	0.48±0.04
2	T1	60	15±1.9c	7±2.4e	4.0±0.9d	1.0±0.04c	2.0±05b	0.50±0.01
3	T2	70	17±5.2d	7±1.3e	5.2±1.2e	1.2±0.2c	2.6±0.6b	0.60±0.04
4	T3	90	19±4.1f	9±2.8f	6.7±2.1f	1.5±0.3c	3.3±1.0c	0.75±0.05
5	T4	90	18±3.5e	6±2.1d	5.6±1.5e	1.4±0.1c	2.3±0.8b	0.70±0.03
6	T5	70	14±3.5b	5±1.6a	3.5±1.3c	0.99±0.1b	1.7±0.2a	0.48±0.05
7	T6	90	12±4.3b	4±1.3a	2.2±1.0b	0.78±0.06a	1.1±0.06a	0.36±0.02
8	T7	90	10±2.6a	3±1.1a	1.5±0.5a	0.46±0.05a	0.75±0.02	0.23±0.05
9	T8	80	15±3.6c	6±2.1d	4.0±1.2d	1.1±0.3c	2.0±0.8b	0.55±0.02
10	FYM	80	19±4.3	9±2.7f	6.7±2.0f	1.5±0.8c	3.3±1.1c	0.75±0.01
11	VC	100	13±4.2b	5±1.9c	2.6±0.7b	0.85±0.08a	1.3±0.3a	0.42±0.04
12	PM	80	14±2.8c	6±2.1b	3.5±0.8c	0.99±0.1b	1.7±0.7a	0.48±0.03
CD(p=0.05)			10.08a	4.11	2.88	0.70	1.38	0.33

Table 4 Effect of prepared compost on percent seed germination and vigour growth on *Coriandrum sativum.*

Sr.No	Treat.	G (%)	SL(cm)	RL(cm)	SFW(g)	RFW(g)	SDW(g)	RDW(g)
1	Control	70	16±3.0	6±2.0b	4.5±1.6c	1.4±0.1b	2.3±0.8c	0.70±0.02
2	T1	60	20±4.2e	8±2.7c	6.4±2.3d	1.6±0.1b	3.2±1.0d	0.80±0.04
3	T2	70	15±3.2c	4±1.4b	4.0±1.5c	1.1±0.4b	2.0±0.6c	0.55±0.03
4	T3	90	15±4.1c	5±1.2b	4.1±1.3c	1.2±0.3b	2.1±0.8c	0.60±0.05
5	T4	90	19±2.5d	7±1.6c	5.4±2.0d	1.5±0.2b	2.8±0.8c	0.75±0.02
6	T5	70	15±4.0c	6±1.6b	4.4±1.7c	1.3±0.5b	2.2±0.4c	0.65±0.01
7	T6	90	0.8±0.02a	0.3±0.01a	1.2±0.6a	0.50±0.01a	0.8±0.05a	0.25±0.01
8	T7	90	21±4.3f	9±2.3d	6.7±1.8	1.8±0.02b	3.4±.09d	0.90±0.05
9	T8	80	19±2.9d	7±1.5c	5.4±1.4d	1.5±0.4b	2.7±0.6c	0.75±0.02
10	FYM	80	16±4.1c	6±1.7b	4.5±1.3c	1.4±0.4b	2.3±0.7c	0.70±0.01
11	VC	100	13±2.1b	4±1.6b	2.2±0.6b	0.98±0.05a	1.1±0.04b	0.48±0.02
12	PM	80	20±3.4	8±2.1c	6.4±1.2	1.6±0.3	3.2±1.0d	0.80±0.01
CD(p=0.05)			11.00	4.13	3.20	0.88	1.61	0.42

Table 5 Effect of prepared compost on percent seed germination and vigour growth on *Trigonella foenum-greacum*.

Sr.No	Treat.	G (%)	SL(cm)	RL(cm)	SFW(g)	RFW(g)	SDW(g)	RDW(g)
1	Control	60	30±4.8	9±1.6d	5.0±1.1c	1.0±0.3b	1.3±0.1b	0.3±0.04
2	T1	80	34±4.6	8±1.4c	6.2±1.5d	0.9±0.04a	1.6±0.2b	0.2±0.03
3	T2	80	30±3.9	10±2.1e	4.5±1.3b	0.8±0.03a	1.2±0.2	00
4	T3	90	39±4.5	10±2.0e	3.9±1.6a	1.2±0.1b	0.9±0.3a	0.3±0.05
5	T4	100	40±5.0	11±2.2f	4.9±1.2b	1.6±0.4b	1.5±1.1b	0.4±0.06
6	T5	90	31±4.1	8±1.7c	5.6±1.4c	1.4±0.2b	1.2±0.9b	0.2±0.01
7	T6	90	29±3.2	6±1.5a	5.8±1.5c	0.9±0.3a	1.3±0.8b	0.1±0.01
8	T7	80	25±3.1	9±1.4d	7.0±1.9d	0.8±0.2a	1.5±1.1b	00
9	T8	70	36±4.7	8±1.3c	6.1±1.0d	1.3±0.4b	1.4±1.0b	0.2±0.02
10	FYM	90	44±5.1	10±2.0e	3.5±1.6a	1.4±0.5b	1.0±0.8b	0.2±0.01
11	VC	80	36±3.5	8±1.9c	5.4±1.2c	1.1±0.1	1.5±0.5b	0.1±0.02
12	PM	60	38±3.6	7±1.6b	6.1±1.5d	1.0±0.1b	1.3±0.6b	0.3±0.06
	CD(p=0.05)		21.87	9.20	3.57	0.70	0.80	0.10

The matured compost had a positive effect on plant height, leaf length, leaf number, and leaf diameter of Kale (*Brassica oleracea)* (Gebeyehu and Mulugeta 2013). Parbhankar and Mogle (2017) reported the productivity of spinach shows maximum amount of yield produced by weed vermicompost, weed compost and green manure as compared to chemical fertilizers and control. Tindall (1975) reported that amaranthus require soils with high organic content, and adequate mineral nutrients favoured the production of higher plant height.

Abou El-Magd *et al*. (2006) the highest vegetative growth of broccoli plants was recorded by plants which were supplied with 100% cattle manure, however, the highest total yield and quality of broccoli were recorded by adding poultry manure in the two seasons. Taha *et al.,* (2011) In light of the results it is concluded that *Azotobacter* and sheep residues do have an additive impact on the growth and yield of squash plants.

Fawzy *et al.* (2012) studied the evaluate response of sweet pepper *(Capsicum annuum* L.) plants to nitrogen fertilizer source under field conditions and results showed that sweet pepper fertilizer plants with the mineral nitrogen as a chemical fertilizer had increased the vegetative growth, yield and fruit quality.Gajalakshmi and Abbasi (2004) reported the impact of application of vermicompost obtained from neem leaves utilizing *E. eugeniae* on the growth and yield of the brinjal (*Solarium melongena* Linn.) plant. Smith *et.al.* (1992) reported that cabbage (*Brassica oleracea capitata*) and onion (*Allium cepa*) grown on a soil fertilized with 25% compost N + 75% NH4NO3-N had significantly higher yields than those fertilized with NH4NO3 alone. Ufere *et.al.* (2013) reported the application of cow dung, poultry droppings and NPK fertilizers had significant effects on all the parameters assessed in *Abelmoschus esculentus* and the poultry droppings gave plants with the greatest plant height, leaf area and fresh weight, while cow dung application gave the greatest dry weight.

CONCLUSION

In this study discussed that compost was analyzed on some important vegetables and crops and evaluated the rate of seed germination and seedling growth in polythene bags, after six days of application, in case vegetable crop, generally T4 treatment was found more significant available compost. In case of weight all plant showed significant result in T4 type of composts In case of mass productivity by T6, T5, T4 types of composts were recorded significant result in over compost. Therefore the study concluded that, the application of prepared compost recommended to vegetables crops farmers in order to bring about improved the germination and growth rate.

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