International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: SJIF: 5.995
Available Online at www.journalijcar.org
Volume 6; Issue 8; August 2017; Page No. 5032-5034
DOI: http://dx.doi.org/10.24327/ijcar.2017.5034.0639

Research Article

VERMICOMPOST AS SOIL SUPPLEMENT TO IMPROVE GERMINATION AND GROWTH OF TRIGONELLA FOENUM- GRAECUM LINN

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ARTICLE INFO

Article History:

Received 13th May, 2017
Received in revised form 11th June, 2017 Accepted 25th July, 2017
Published online 28th August, 2017

Key words:

Vermicompost, *Trigonellafoenum-graecum,* biomass

ABSTRACT

Vermicompost are produced through the interaction between earthworm and microorganism by break down of large organic waste materials into easily utilizable nutrient form. Vermicompost plays a major role in improving soil fertility and productivity of different field crops.The present study was conducted to determine the effect of vermicompost on seed germination and seedling growth of *T. foenum-graecum* Linn. The high seed germination percentage and seedling growth, number of leaves, fresh and dry weight of the plant was observed in 20g vermicompost supplemented seeds.

INTRODUCTION

Vermicompost technology has played an important role and solved most of the problem in environment by degrading the waste (Parr and Colacicco, 1987). One of the unique features of vermicompost is that during the process of conversion of various organic wastes by earthworms, many of the nutrients are changed to their available forms in order to make them easily utilizable by plants. Therefore, vermicomposts have higher-level of available nutrients like nitrate or ammonium nitrogen, exchangeable phosphorous and soluble potassium, calcium and magnesium derived from the wastes (Buchanan *et al*., 1988). Vermicomposting is the process of converting all biodegradable waste materials into organic manure with the help of composting (Edwards & Burrows, 1988; Bhawalkar, 1991, Rajendran *et al.*, 2008). The earthworms consume and digest decomposing plant material, their digestive tracts process the organic matter and important nutrients are returned to the soil through castings, or worm waste. Worms not only play an important role in the nutrient cycle of soil, but also helps in increasing the percentage of macronutrients (Umamaheswari, 2005) improves soil porosity, soil aggregation, water and nutrient conservation in the soil (Ellerbrock *et al.*, 1999).

The earlier studies show the integration of vermicompost with inorganic fertilizers inclined to upsurge the yield of crops viz-potato, rapeseed, mulberry and marigold over other traditional composts. Growing consciousness on some of the adverse economic and environmental influences of agrochemicals in crop making has stimulated better interest in the exploitation of organic amendments such as vermicomposts or composts for crop production (Follet *et al.*, 1981). *Trigonella foenum-graecum* Linn. is usually known as fenugreek belonging to the family Fabaceae. Leaves and seeds have been used in food items as a flavoring agent since ancient times. The leaves and the seeds are known for their medicinal value. The plant is cultivated worldwide as a semi-arid crop. *T.foenum-graecum* is one of the oldest medicinal herbs that originated from the Mediterranean region and Asia It was a part of Indian diet even before 3000 years. Fenugreek is known to stimulate digestive and metabolic process. It is used for the management of diabetes and hypertension (Saranya *et al.*, 2014).

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MATERIALS AND METHODS

Collection and Preparation of leaf litter vermicomposting

Leaf litter was collected periodically from the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and kept in large plastic containers. The collected leaf litter was sun dried, cut into small pieces of 4 to 5 cm length and kept ready for composting. Compost mixture was prepared in the ratio of 1:1 (w/w) of leaf litter and cow dung (13kg) in round pot, sprinkled with water to maintain moisture content and was allowed for pre-digestion. Pre-digestion of consort mixture has been carried out for 21 days with regular mixing and turning of the mixture for pre-decomposition by the microbes. On 21St day of pre-digestion,

the weight of the predigested compost mixture is noted. After 21 days of pre-digestion, 10 kg of predigested mixture was transferred to the mud pot and 100 clitellate adult (45 days old) added to the content. Sample of the epigenic earthworms, *Eudrilus eugeniae* (Kinberg) were obtained from Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu and maintained under laboratory conditions. The acclimatized earthworms were used for periodical vermicomposting of leaf litter collected from the college campus. *Eudrilus eugeniae* (total biomass of 520g) were introduced into each container containing the predigested mixture.

Vermicomposting was allowed for 90 days with regular sprinkling of water to maintain the moisture content (65-70% RH) in the mixture. At the end of 90 days of vermicomposting, the vermicompost from the container were spread separately on a polythene sheet. From the vermicompost adult worms and young ones were handpicked and isolated. The vermicompost thus obtained by composting leaf litter was dried and used for cultivation of plants.

Biometric Studies

Treatment set ups under pot culture

Pots of 4kg capacity (25cm X 22cm) wereindividually filled with growth medium containing soil + sand (1:1 ratio) along with supplemented substrate for different treatments. The treatment details are as below

- To- Control (only sand and soil)
- T1- sand + soil + vermicompost (15g)
- T2- sand + soil + vermicompost (20g)
- T3.-sand + soil + vermicompost (15g) + Azospirillum
- T4- sand + soil + vermicompost (15g) + Azatobactor

Seed Sowing and Maintenance of Experimental set up

Fifteen seeds of *T. foguem-graecum* were sown with equal spacing between the seeds at uniform depth of 3cm in each treatment pots individually after moistening the soil and ten replications were maintained. The culture medium in bags were watered regularly twice (in the morning and evening) and kept in sunlight. Care was taken to avoid damage to the treatment set-ups

Seed Germination

The day of sowing was taken as the first day and the treatment set up were observed for germination in the morning every day. The total number of seeds germinated on each day was counted and recorded. In addition the germination percentage and plant height were observed for 30, 45 and 60 days old plants.

Germination Percentage

After 30 days of sowing the number of normal seedling germinated were counted and expressed in percentage. The germination percentage was calculated by using the formula outlined by ISTA (1999).

$$\text{Germination percentage} = \frac{\text{No of seeds germinated}}{\text{Total no of seeds sown}} \times 100$$

Shoot Length

The length of the shoot from the base to the tip of the shoot was measured using the centimeter scale and the mean length was expressed in cm.

Root Length

The length of the root was measured from the root collar region to the tip of the root using the centimeter scale and mean length was expressed in cm.

Number of Leaves

The plant samples were collected periodically (30, 45 and 60 days) and the number of leaves were counted and recorded.

Fresh weight and Dry weight

At the end of the 30, 45, and 90 days after sowing, the fresh weight (FW) and dry weight (DW; determined by oven drying at 70 °C for 24 h) of the plants were noted.

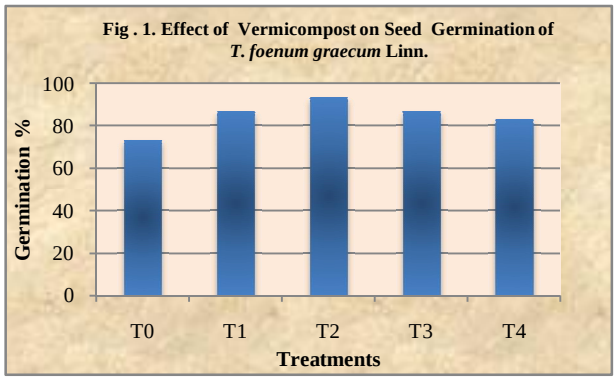
Statistical Analysis

Standard errors of means (of three replicates) were calculated for all the parameters. Data obtained were subjected to one way analysis of variance (ANOVA) in SPSS for windows 16.0.20. Least Significant Differences (LSD) among means were used to test the significance of different between treatment means at different levels of probability ($P \leq 0.05$ and 0.01).

RESULT AND DISCUSSION

Vermicompost is a nutrient rich with microbiologically active organic amendment, which results from the interactions between earthworms and microorganisms by the breakdown of organic matter. It is a stabilized, finely-divided peat-like material with a low C: N ratio and high water-holding capacity that constitutes a source of plant nutrients which are released gradually, through mineralization, as the plants need them (Dominguez *et al*., 1997).

In the present study the seed germination and plant growth have increased in all the treatment when compare to control and T4. The highest seed germination percentage was observed with sand + soil+ vermicompost (20g) (T2) applied pots (Fig.1).



The root and shoot length, number of leaves, fresh and dry weight of the plant was also significantly high in 20 g. vermicompost supplemented pots (Fig. 2, 3 & 4). This finding correlated the previous reports, which notes that soil augmented with vermicompost additional substances and diverse microbial population are not found in chemical

fertilizers and nutrient depleted native soils (Kale *et al.*, 1992). Atiyeh *et al.*, (2002) also reported that the growth regulating materials present in the vermicompost could be the probable reason for the better germination, growth and yield ofcrops. Tomati *et al.*, (1983) observed the significant effects of vermicomposts on growth parameters of *Begonia* species and *Coleus* species, especially in root growth, lengthening of internodes and time of flowering.

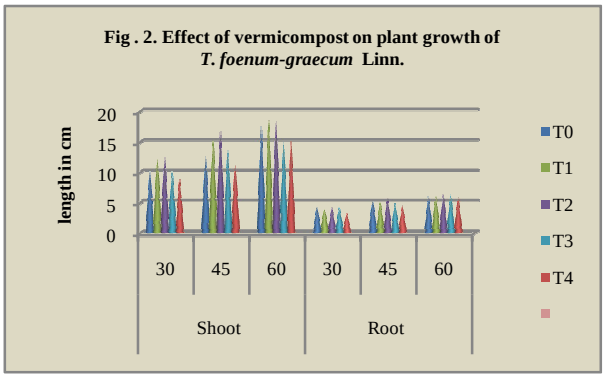


Fig . 2. Effect of vermicompost on plant growth of *T. foenum-graecum* Linn.

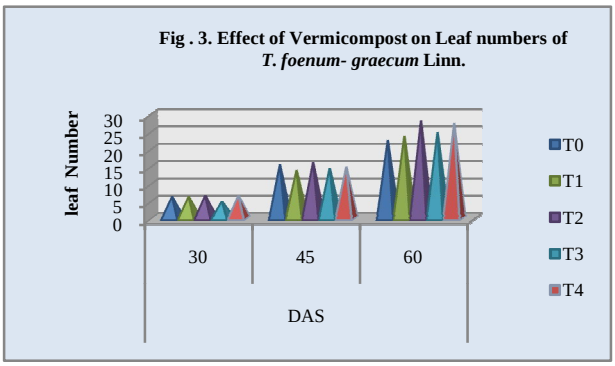


Fig . 3. Effect of Vermicompost on Leaf numbers of *T. foenum- graecum* Linn.

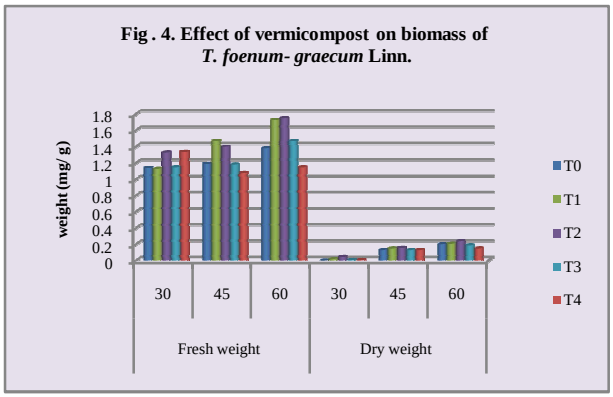


Fig . 4. Effect of vermicompost on biomass of *T. foenum- graecum* Linn.

CONCLUSION

Vermicompost always place a significant role in plant germination and growth. During the process of conversion of various organic wastes by earthworms, many of the nutrients are changed to their available forms in order to make them easily utilizable by plants.The present study proved the effect of vermicompost on seed germination and plant growth of *T. foenum-graecum* Linn. The high seed germination percentage and growth, number of leaves, fresh and dry weight of the plant was observed in 20g. vermicompost supplemented seeds of *T. foenum-graecum* Linn.

Acknowledgement

The Authors wish to express their sincere and heartfelt gratitude to Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for providing funds to carry out this research project.

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