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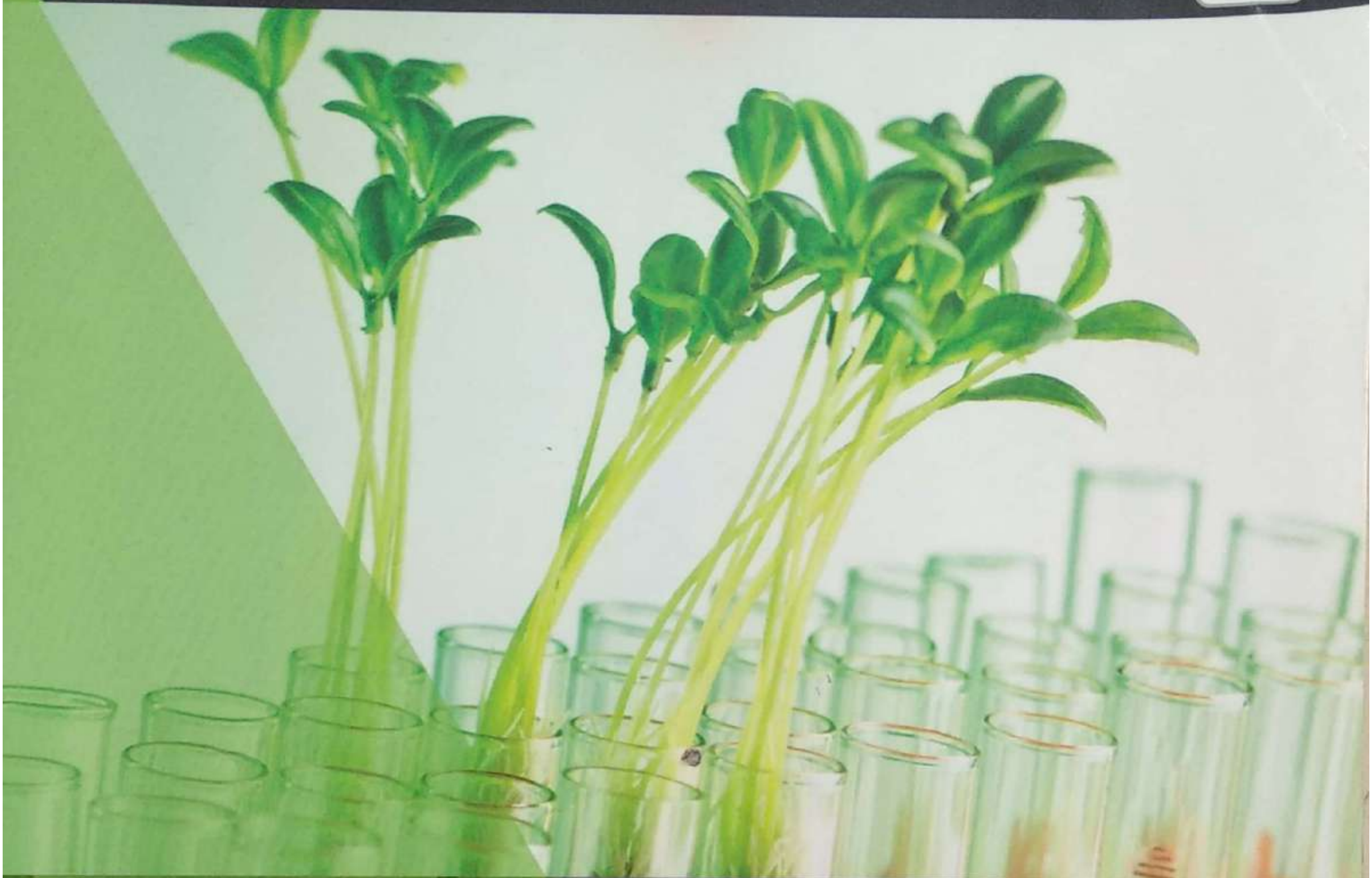

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LIST OF FULL LENGTH PAPERS

PREPARATION OF VERMICOMPOST AND ITS IMPACT ON PLANT GROWTH (*VIGNA UNGUICULATA*)

Akshita Devanga,[1] S. Preetheeswari,[1] A. Anjalai,[1] P. Kathireswari[1]* and K. Saminathan[2]

Abstract

Vermicompost enhance the nutrient uptake by the plants by increasing the permeability of root cell membrane, stimulating root growth and increasing proliferation of root hairs. Vermicompost have upper level of existing macronutrients and micronutrients like Carbon, Nitrogen, Phosphorous, Potassium, Magnesium and Calcium and derived from the waste and also rich in microbial population and diversity; predominantly fungi, bacteria and actinomycetes. The present paper endeavored to evaluate the impacts of plant growth by preparing a small vermicomposting unit using *Eudrilus eugeniae* and the vermicompost was collected and used in various concentrations with regular horticulture soil for the growth of cowpeas plant (*Vigna unguiculata*) and the results of germination rate, shoot and root growth and chlorophyll content was observed.

Introduction

Vermicomposts have beneficial effects on plant growth. It is used as soil additives to improve seed germination and enhanced the rates of seedling growth and development. It contains water soluble nutrients and is an excellent, nutrient rich organic fertilizer. The electrical conductivity of vermicompost was found to be increased, may be due to the presence of exchangeable Calcium, Magnesium and Phosphorus in the vermicast compared to the soil (Bhatnagar & Patta, 1996).

Earthworm is a segmented worm found in the Phylum Annelida. They are found living in soil, feeding on partially degraded organic matter. Earthworms have been long recognized by farmers as beneficial to soil and called "Friends of farmers" (Singh & Pillai, 1973). They play major role in the conversion of organic matter and improve the soil fertility. The compost prepared using earthworm is defined as a cost effective technology system for processing of biodegradable wastes (Hand *et al*., 1988). In the process of feeding, earthworms fragment the waste substrate; enhance microbial activity and the rate of decomposition of the materials leading to a composting mechanisn. The end product, commonly termed vermicompost rich in micro and macro nutrients, higher water holding capacity and microbial activity (Graff, 1971). Vermicompost increases the surface area, provides strong absorbability & retention of nutrients as well as retain more nutrients for a longer period of time.

Vermicompost enhance the nutrient uptake by the plants by increasing the permeability of root cell membrane, stimulating root growth and increasing proliferation of root hairs (Pramanit *et al*., 2007). Vermicompost also aids in protecting crop plants against pests and diseases. The effects of vermicomposts on the growth of a variety of crops has been demonstrated and proved beneficial by various scientists like Edwards & Burrows (1980), Atiyeh *et al*. (1999) The greatest plant growth responses and yields have occurred usually when vermicompost constituted a relatively small proportion (10 – 40%) of the total volume of plant growth medium in which they are incorporated (Atiyeh *et al*., 1999).Reddy and Reddy (1999) reported significant increases in micronutrients in the field soils after vermicompost applications compared to those in soils treated with animal manures.

The amounts of soil nutrients increased significantly after incorporating vermicomposts into soils reported by Kale (1992).Earthworms utilize microorganisms as their main source for degradation of the orgaic materials (Edwards and Fletcher, 1988), there are usually greatly increased numbers of bacteria, actinomycetes and fungi in freshly-deposited earthworm casts than in the surrounding soil (Edwards and Bohlen, 1996); which increases the microbial activity of vermicompost which may avoid pest attack to the plants. In our experiment we prepared the vermicompost in a small vermicomposting unit using *Eudrilus eugeniae* and the vermicompost was collected and used in various concentrations with regular horticulture soil for the growth of cowpeas (*Vigna unguiculata*) plant and the results were observed.

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Materials and Methods

Vermibed preparation:

The vermibed was prepared according to the method followed by the scientists in their experiments (Kale 2006), the vermicompost was obtained and utilized for the comparative study in different concentrations on Cowpeas (*Vigna unguiculata*) plant.

In order to test the effect of different combinations of vermicompost with soil on the growth of plants; fast growing cowpeas plant (*Vigna unguiculata*) was chosen. The seeds were collected from the seed shop in G. N. Mills, Coimbatore, Tamil Nadu.

Preparation of Substrate at different concentration:

The plants were grown in plastic bags used generally for saplings. Five bags in triplicates were utilized for this experiment viz. The five different combinations of substrates were used. The weight of substrate in single bag was 1 kg. The combinations used for plant growth as follows:

(A) 100% horticulture soil

= 1 kg of red soil only

(B) 25% vermicompost + 75% horticulture soil= 250g of vermicompost along with 750 g of red soil.

(C) 75% vermicompost + 25% horticulture soil = 750gof vermicompost along with 250 g of red soil.

(D) 50% vermicompost + 50% horticulture soil= 500gof vermicompost along with 500g of red soil.

(E) 100% vermicompost = 1 kg of vermicompost only.

Seven seeds were sown in each substrate. Their germination rate was calculated and the difference in their growth was observed. The shoot height was measured every alternated day after germination. Chlorophyll content of each substrate plant was calculated. Shoot weight androot weight was also measured for the interpretation.

Germination test in percentage was calculated using the formula as described by the method Vavrek & Campbell (2002).

Percentage of germination =

$$\frac{\text{Number of seeds germinated} \times 100}{\text{Number of seeds sown}}$$

The Chlorophyll was extracted in 80% acetone & the absorption at 663nm & 645nm were read in a spectrophotometer. Using the adsorption coefficients, the amount of chlorophyll contents a, b & c was calculated. The chlorophyll estimation was carried out following the method of Aaron (1949).The results were represented in turns of mg/g.

The amount of chlorophyll present in the extract was calculated using following equation:

Mg chlorophyll a/g tonic =

$$\frac{12.7(A663) - 2.69(A654) \times V}{1000 \times W}$$

Results and Discussion

Germination rate and their chlorophyll content have been determined (Figure 1) andthe germination rate is increased in 100% vermicompost when compared to the horticulture soil and other concentration of substrates.

The Chlorophyll content of the plant leaves was determined in different concentration of vermicompost as shown in Figure 2.

Green revolution is the result of boosting the production of yield during the time of food crisis. This has resulted in good harvests and more production and also have an adverse impacts on soil. Conditions and environment: The cheapest solution to overcome this adversity is to adopt the old agricultural methods and use natural, organic and economic practices like Vermitechnology. Biodegradable wastes broken down rapidly by earthworms, resulting in a stable non – toxic material with rich macro and micro nutrients which has a potentially high economic value as soil

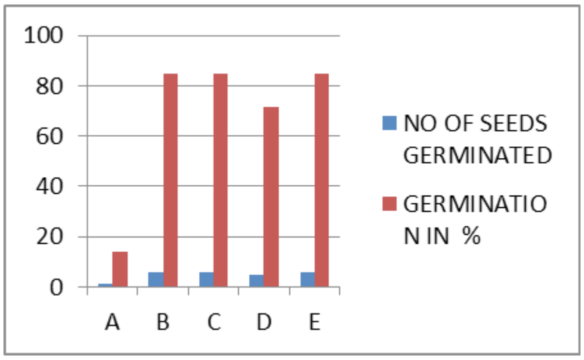

Figure 1. Germination Rate

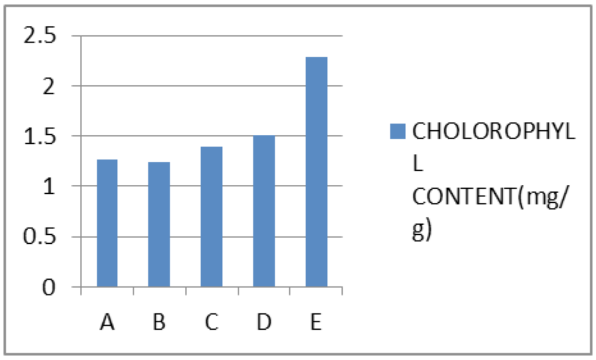

Figure 2. Chlorophyll content

conditioner for plant growth. Evidently as Edwards (1988) has reported that vermicompost could promote early and vigorous growth of seedlings in plants. Humic acid provides many binding sites for plant nutrient such as calcium, iron, potassium, sulfur and phosphorus in available form for plants uptake.

Supportively Russel (1909) has reported that earthworms decompose the organic matter quickly & increase the nitrification, which are responsible for increasing yield. Vermicompost increases the surface area and provides strong absorbability and retention of nutrients as well and retain more nutrients for a longer period of time. It is known that vermicompost enhances germination, plant growth and crop yield. It improves root growth and structure and enriches the soil with micro-organisms.

The present study supports that vermicompost accelerates germination process and biomass production & also that in 20-30% of vermicompost in combination to soil yield better result.

The plant showed different percentage of germination rate & growth and this may be due to the beneficial microorganisms, natural plant hormones, enzymes, balanced micro & macro nutrients. Nainawat (1997) observed that the addition of vermicast in different ratio increased crop production. The highest germination rate was found in 100% vermicompost substrate. The least rate was observed in 100% soil substrate. The presence of micro and macro nutrients and plant growth hormones may be the reason for fast germination in 100% vermicompost substrate.

The greatest plant growth responses and yields have occurred usually when vermicompost constituted relatively small proportions (10 – 40%) of the total volume of plant growth medium in which they are incorporated. Usually lesser proportions of vermicomposts substituted in plant growth give positive results than the higher proportions (Atiyeh *et al*., 1999). The result of our studies is similar to the results provided by Atiyeh 1999, the best growth result was found in 75% soil + 25% vermicompost substrate.

The presence of nitrogen in soil and chorophyll in plants are in direct proportion. Therefore chorophyll may be used as an indirect indicator of nitrogen levels in fertilizer management. In our experiment the highest chorophyll content was obtained in 100% vermicompost substrate, which indicates that vermicompost have high nitrogen content than the normal horticulture soil.

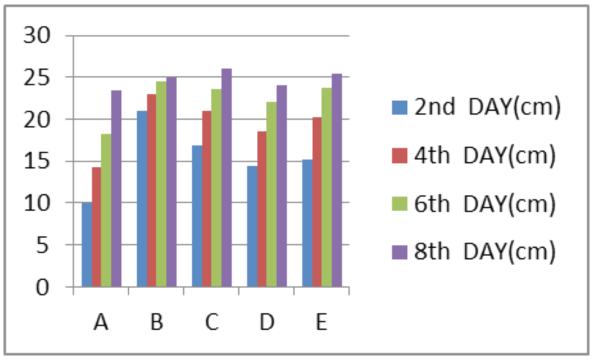

Figure 3. Shoot Height

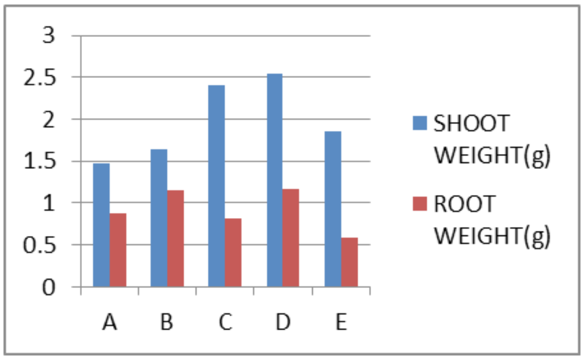

Figure 4. Shoot and Root weight

The plant shoot heights were also measured and showed the various results in different substrates (Figure 3). The best results were obtained in 25% vermicompost + 75% soil substrate. This shows that the mixture of 20 - 40% vermicompost in any soil will provide best results (Atiyeh, *et al*., 1999). The nutrient level, especially the macro or micro – nutrients were found to be always higherin vermicompost than the compost derived from other methods (Kale, 1998). The biomass of the plant was higher in 50% vermicompost + 50% soil which indicates that the nutrients required for plant growth were equally provided by both the soil and vermicompost.(Figure 4).

Conclusion

Vermicompost can be used in organic farming to increase the crop yield and it is also economical to the farmers. There are many advantages of vermicompost regarding the plant growth which can be utilized in the field for commercial production.

From the present study we can conclude that 100% vermicompost is required for higher plant germination and 25% vermicompost is sufficient for the growth of the Cowpea plant.

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