

Chemical nutrient analysis of different composts (*Vermicompost* and *Pitcompost*) and their effect on the growth of a vegetative crop *Pisum sativum*

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ABSTRACT

The importance of composts as a source of humus and nutrients to increase the fertility of soil and growth of plant has been well recognized in the present study. Different composts (Vermicompost and Pitcompost) and Garden soil (Control) were taken first for chemical analysis and then to find the effect of these composts on the growth of a vegetative crop 'Pisum sativum'. It was found that the vermicompost was rich in nutrients like Potassium, Nitrate, Sodium, Calcium, Magnesium, and Chloride and have the potential for improving plant growth than pit compost and garden soil (control). The optimal plant growth in our study conducted for a period of one month was found in pots containing vermicompost. The study also showed distinct differences between vermicompost, pitcompost and garden soil (control) in terms of their nutrient content and their effect on plant growth.

Keywords:- *Humus, Pisum sativum, Pitcompost, Vermicompost.*

INTRODUCTION

Environmental degradation is a major threat confronting the world, and the rampant use of chemical fertilizers contributes largely to the deterioration of the environment, loss of soil fertility, less agricultural productivity and soil degradation [1]. On one hand tropical soils are deficient in all necessary plant nutrients and on the other hand large quantities of such nutrients contained in domestic wastes and agricultural byproducts are wasted. It is estimated that in cities and rural areas of India nearly 700 million organic wastes are generated annually which is either burned or land filled [2]. In nature's laboratory there are a number of organisms that have the ability to convert organic waste into valuable resources containing plant nutrients and organic matter which are essential for maintaining soil productivity [3]. Microorganism and earthworms

are important biological organisms helping nature to maintain nutrient flow from one system to another and also minimize environmental degradation. The earthworm population is about 8-10 times higher in uncultivated area. This clearly indicates that earthworm population decreases with soil degradation and thus can be used as a sensitive indicator of soil degradation [4]. In this report a simple biotechnological process disposal of waste as well as the most needed plant nutrients for sustainable productivity is described, which could provide a 'win-win' solution to tackle the problem of safe disposal of waste as well as the most needed plant nutrients for sustainable productivity.

Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product. Similar is the process of pit composting in which biological aerobic transformation of an organic by product takes place and results into different organic product that can be added to the soil without detrimental effects of crop growth [5]. Vermicompost is nutritionally rich natural organic fertilizer, which releases nutrients relatively slowly in the soil and improves quality of the plants along with physical and biological properties of soil. It has a more beneficial impact on plants than soil [6]. Pit compost produces a natural fertilizer and improves the physical, chemical as well as biological properties of the soil. These composts provide all nutrients in readily available forms and also enhances uptake of nutrients by plants and plays a major role in improving growth and yield of different field crops [7]. The present study aims to analyze the chemical nutrients of different composts (vermicompost and pit compost) and their effect on the growth of a vegetative crop *Pisum sativum*.

MATERIALS AND METHODS

For the present study, the area chosen was "Biodiversity Conservation farm" at Navdanya research foundation run by an eminent environmentalist Dr. Vandana Shiva of India. It is located at Ramgarh in Dehradun district about 16km from Dehradun city. In the present investigation two types of composts were taken and analysed. These were Vermi compost and Pit compost. The compost samples were collected in Ziploc polythene bags and were brought to the laboratory for investigation. The soil aggregates were broken up for grinding with pestle and the mortar and the samples were spread for drying. After drying, the samples were passed through 2mm stainless steel or plastic sieve. Approximately 500g compost/soil samples were kept in clean polythene bags with proper labeling for analysis of different chemical parameters like pH, conductivity, TDS, sodium, potassium, chloride, nitrate, calcium, magnesium. These experiments were held for two months (January to February) [8]. Further investigation was carried in the glass house at $25\pm 2^{\circ}\text{C}$ at 15-30 day night photoperiod. Each treatment was conducted in triplicate (fig). First we took 9 pots and 3 pots were filled with vermicompost (1 kg each), 3 pots were filled with pit compost (1 kg each) and further three pots were fed with garden soil (control) (1 kg each). Five pea seeds were sown in each pot at the depth of 5cm. After that seeds were allowed to germinate for 1 week. It was checked regularly and was watered regularly for 1 month and the unwanted weeds were taken out. Water was poured after 2 to 3 days, till the pea plants were grown fully. After that the pea plants were measured every week along with the number of leaves. It was observed that the vermicompost treated plants showed maximum growth and the number of leaves as compared to pit compost which further showed much growth than the pea plants grown in the pots fed with the garden soil (control).

The main aims and objectives of the study were;

To determine the nutrients present in different composts (Vermicompost and Pit compost) and

To assess the impact of different composts (Pit compost and vermicompost) on the growth of a vegetative crop (*Pisum sativum*).



Pitcompost



Vermicompost



Control
(Pots without showing plant growth in Week 1st)



(Plants showing growth in Week 2nd)



Pitcompost



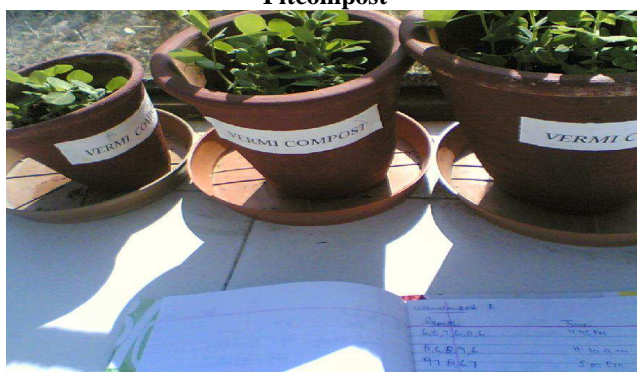
Vermicompost



Control
(Plants showing growth in Week 3rd)



Control

**Pitcompost****Vermicompost**(Plants showing growth in Week 4th)**RESULTS AND DISCUSSION**

Vermicompositing appears to be the most promising as high value biofertilizer which not only increases the plant growth and productivity by nutrient supply but also is cost effective and pollution free. Use of vermicompost promotes soil aggregation and stabilizes soil structure. This improves the air- water relationship of soil, thus increasing the water retention capacity and encourages extensive development of root system of plants. The mineralization of nutrients is observed to be enhanced, therefore results into boosting up of crop productivity. The vermicomposts have a higher base exchange capacity and more exchangeable calcium, magnesium, potassium than the soil in which worms live [9].

Table 1 below shows the nutrient content of different composts (vermicompost, pitcompost) and Garden soil (control).

S. No.	Chemical parameters	Control	Pit compost	Vermicompost
1.	pH	8.75	8.66	8.41
2.	Conductivity	0.42Mmho	2.89Mmho	3.21Mmho
3.	TDS	266mg/l	1932mg/l	2260mg/l
4.	Na⁺	25mg/l	85mg/l	92mg/l
5.	K⁺	27mg/l	1520mg/l	1575mg/l
6.	Chloride	9 mg	14 mg	15 mg
7.	Nitrate	1.018	1.506	1.494
8.	Calcium	9 mg	11 mg	15 mg
9.	Magnesium	5.5 mg	6 mg	10 mg

The results showed that vermicompost has a rich source of nutrient content than pitcompost and garden soil (control).

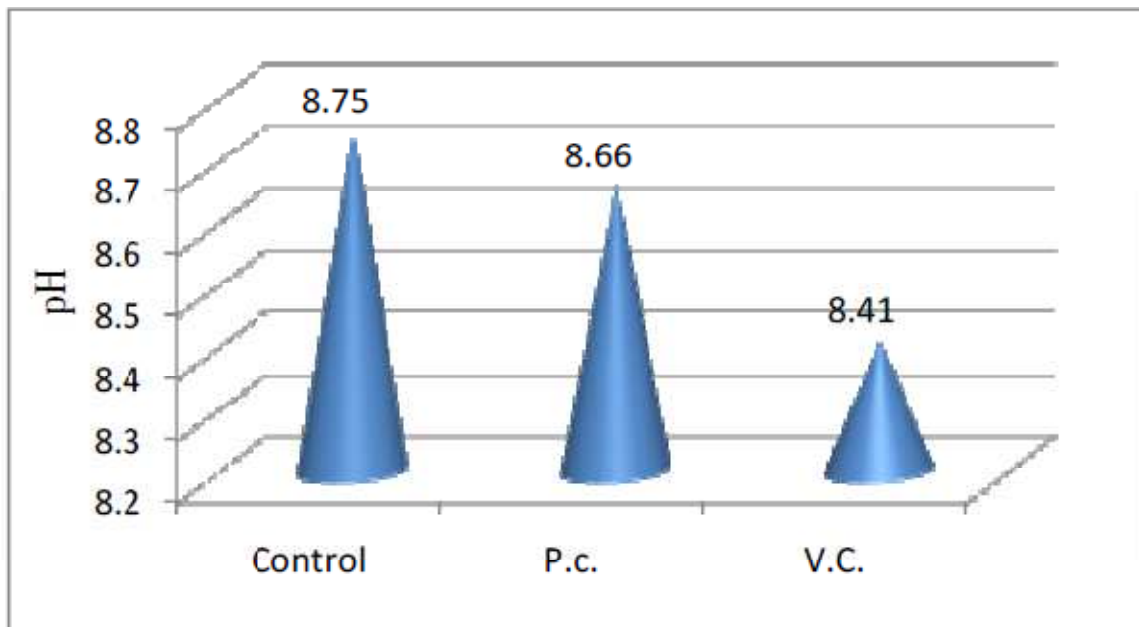


Fig.1: Showing the pH of Pit Compost, Vermi Compost and Control (Garden Soil).

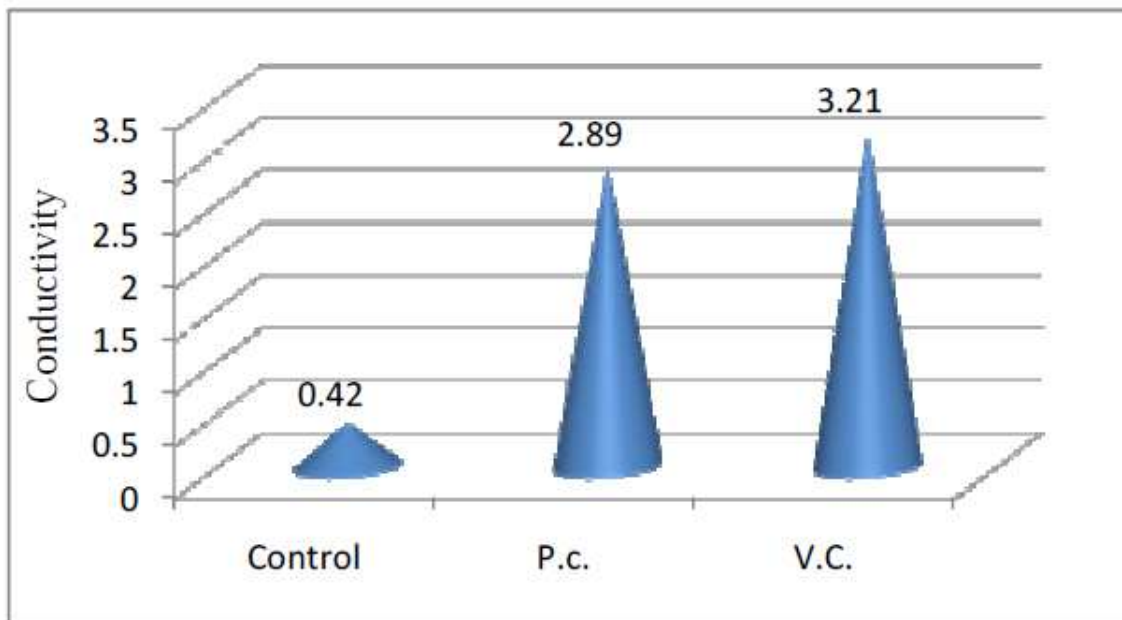


Fig.2: Showing the Conductivity of Pit Compost, Vermi Compost and Control (Garden Soil).

From the results (Fig. 1 to 9) it was found that the pH of vermicompost , pitcompost and garden soil (control) was 8.4,8.6 and 8.7 respectively. The results demonstrate a significant increase in conductivity (3.21Mmho), TDS (2260 mg/l), Na^+ (92 mg/l), K^+ (1575 mg/l), Ca^{++} (1 mg), Mg

(10 mg) and Cl^- (15mg) in vermicompost, when compared to pit compost, Conductivity was (2.89 Mmho), TDS (1932 mg/l), Na^+ (85 mg/l), K^+ (1520 mg/l), Ca^{++} (11mg) Mg (6 mg) and Cl^- (14 mg) which further increases when compared to control (Garden soil) as conductivity was (0.42 Mmho), TDS (266 mg/l), Na^+ (25 mg/l), K^+ (27 mg/l), Ca^{++} (9 mg), Mg (5.5 mg) and Cl^- (9 mg) respectively. This indicates that vermicompost has higher nutrient content than pit compost which further shows more nutrient content than Garden soil (control). Due to high nutrient content in vermicompost the pea plants showed a maximum growth than in pit compost and Garden soil (control).

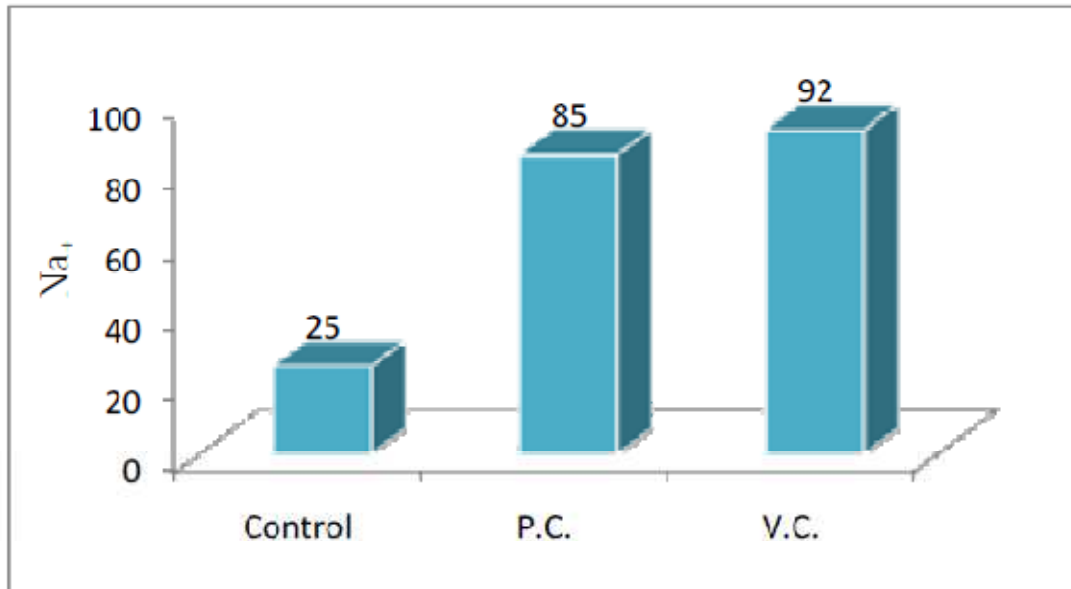


Fig.3: Showing the Na^+ of Pit Compost, Vermi Compost and Control (Garden Soil).

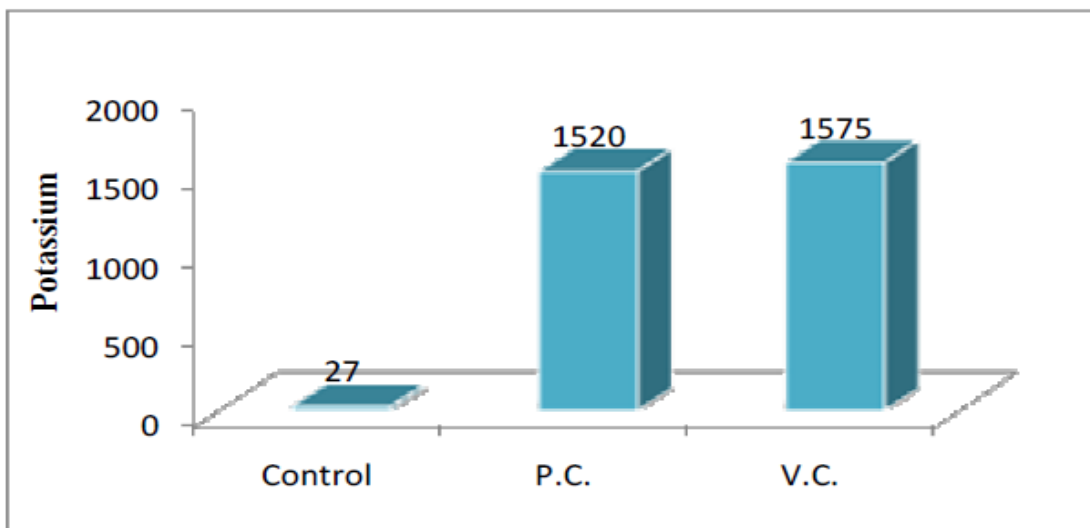


Fig.4: Showing the K^+ of Pit Compost, Vermi Compost and Control (Garden Soil).

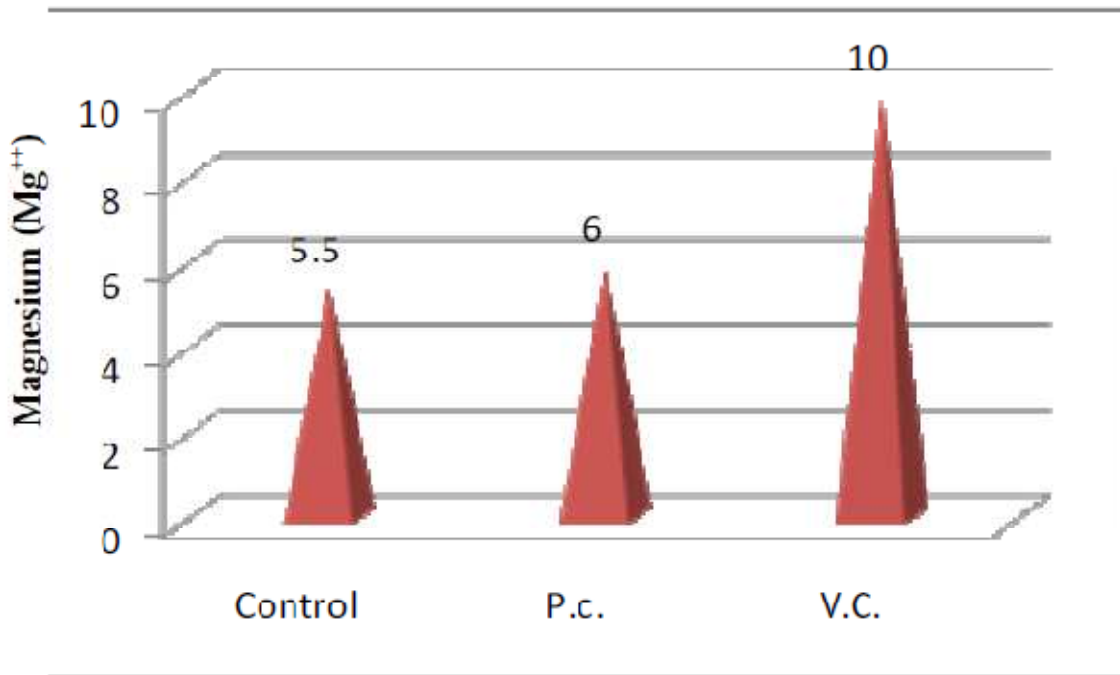


Fig5: Showing the Mg⁺⁺ of Pit Compost, Vermi Compost and Control (Garden Soil).

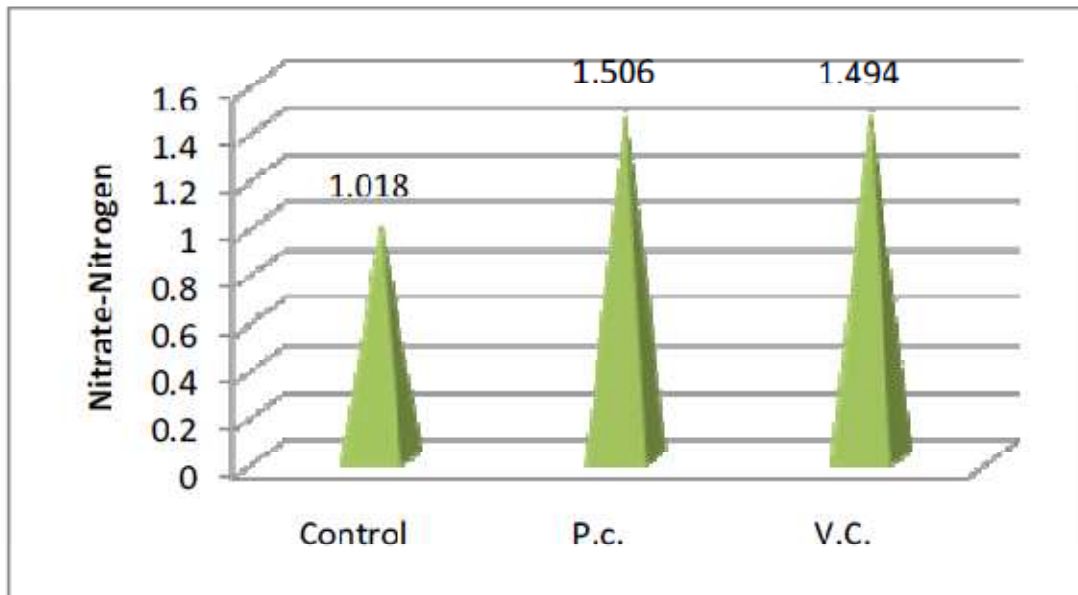


Fig.6: Showing the Nitrate-NNitrogen of Pit Compost, Vermi Compost and Control (Garden Soil).

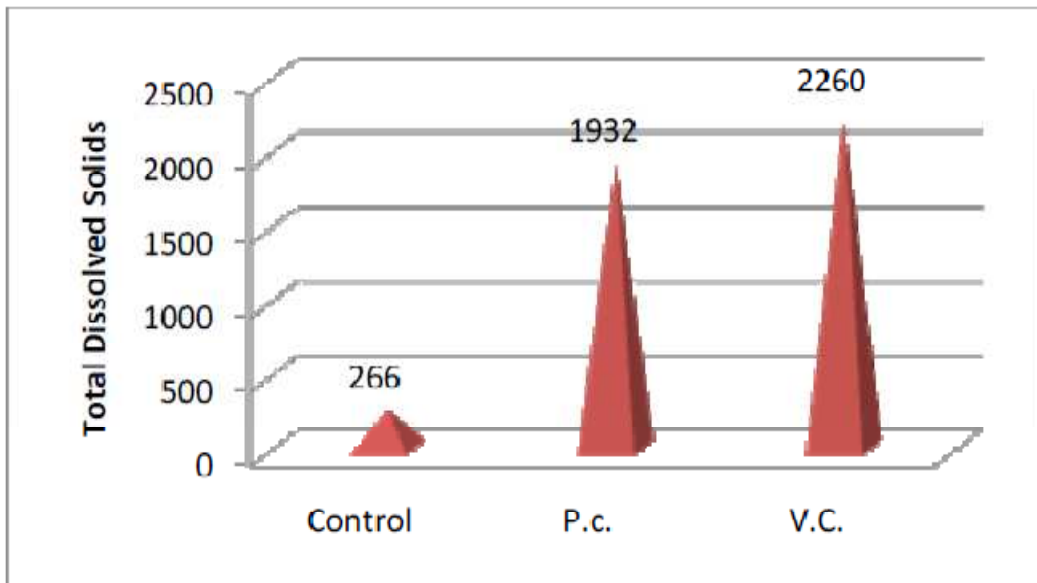


Fig.7: Showing the TDS of Pit Compost, Vermi Compost and Control (Garden Soil).

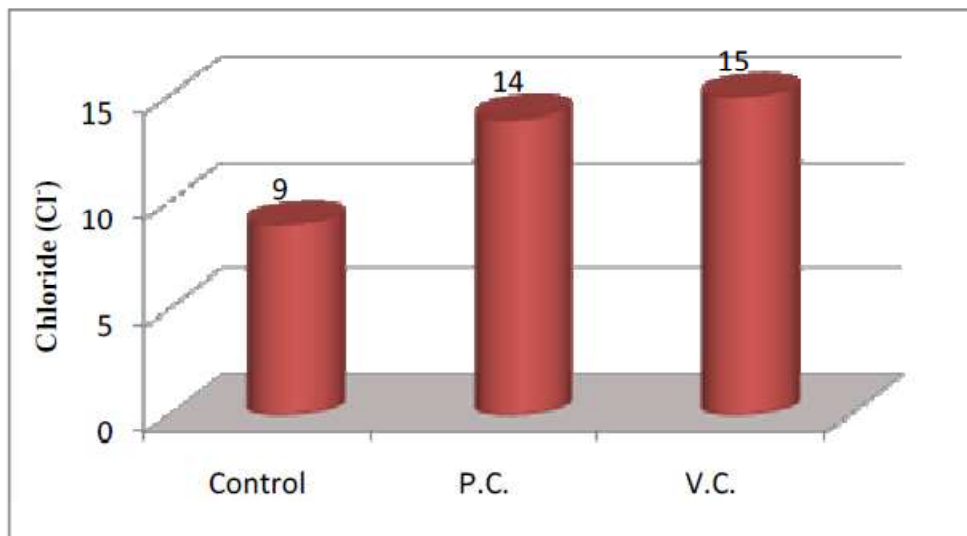


Fig.8: Showing the Cl⁻ of Pit Compost, Vermi Compost and Control (Garden Soil).

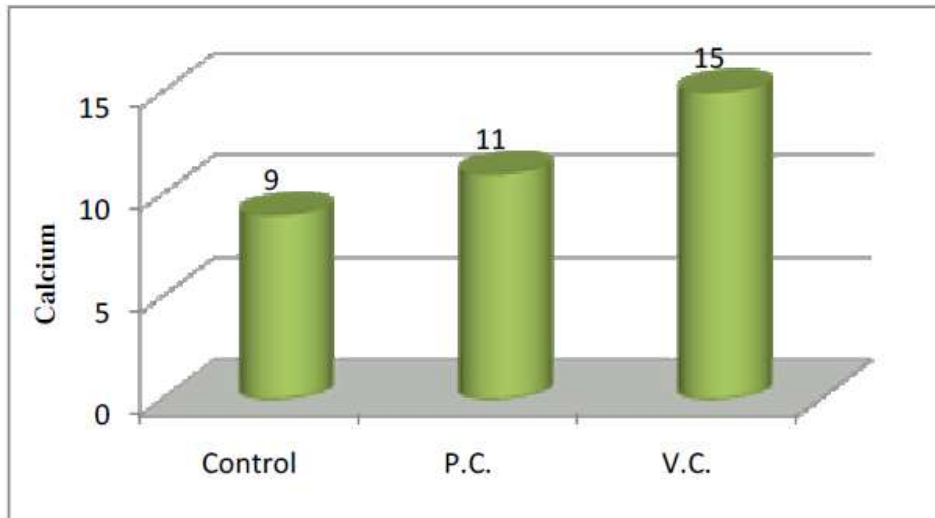


Fig.9: Showing the Ca⁺⁺ of Pit Compost, Vermi Compost and Control (Garden Soil).

Table 2 below shows:

a) The average height (Fig.10) of pea plants in different pots.

b) The average number of leaves (Fig.11) of pea plants in different pots.

		Pot 1 Control	Pot 2 PitCompost	Pot 3 VermiCompost
Weak 1	Average height (in cm)	2 cm	3 cm	4cm
	Average no. of leaves	5	7	10
Weak 2	Average height (in cm)	5 cm	6 cm	9 cm
	Average no. of leaves	12	18	21
Weak 3	Average height (in cm)	7 cm	8 cm	12 cm
	Average no. of leaves	20	26	35
Weak 4	Average height (in cm)	10 cm	12 cm	18 cm
	Average no. of leaves	28	46	51

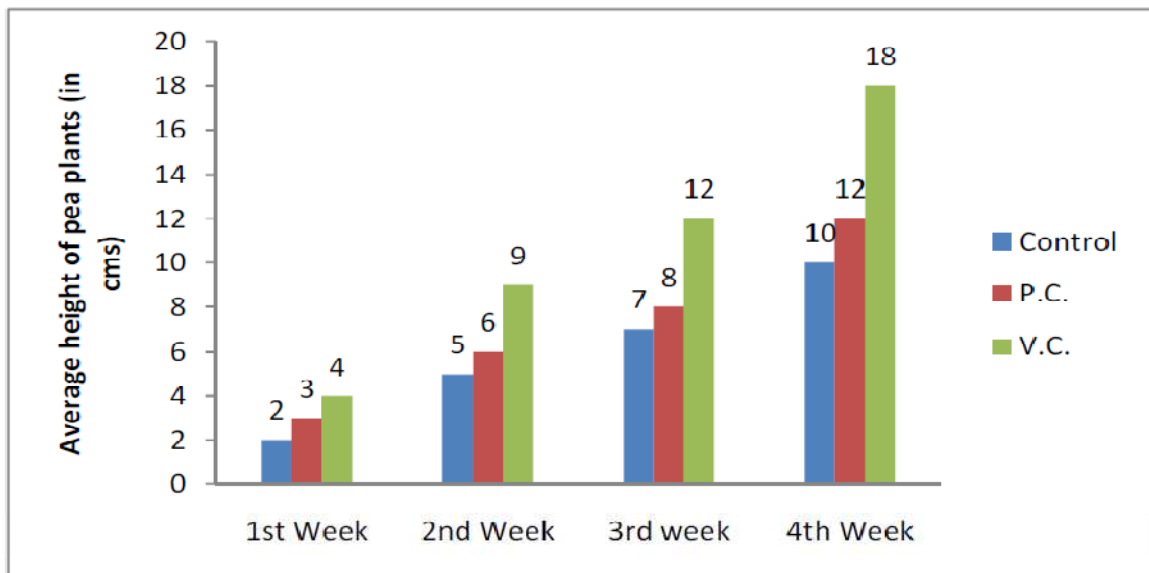


Fig.10: Showing the comparative impact of Pit Compost, Vermi Compost and Control (Garden Soil) on the hight of pea plants.

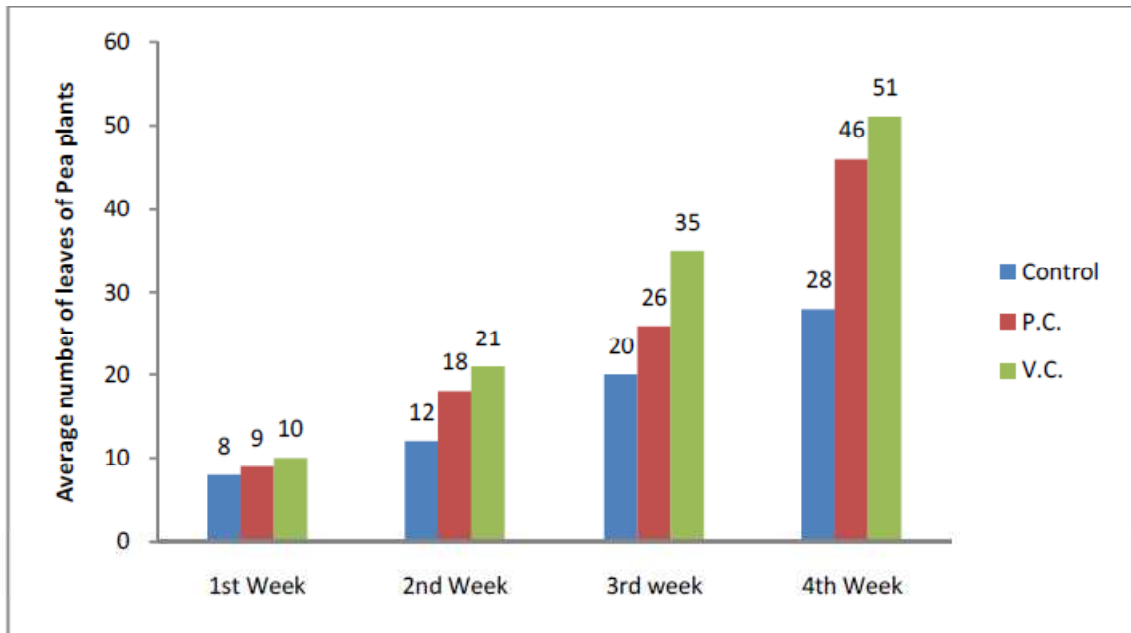


Fig.11: Showing the comparative impact of Pit Compost, Vermi Compost and Control (Garden Soil) on the number of leaves of pea plants.

Table 3 below shows;

- a) The average length (Fig.12 to 15) of roots of pea plants in different trays.
- b) The average weight (Fig.16) of roots of pea plants in different trays.

	Tray 1 plants grown in control	Tray 2 Pitcompost	Tray 3 Vermicompost
Average length of roots (cm)	14 cm	20 cm	23 cm
Average weight of roots (fresh weight in gm)	14.21	20.87	58.53
Average weight of roots (dry weight in gm)	3.19	6.22	10.42
Total weight of roots (fresh weight- dry weight in gm)	11.02	14.65	48.11



Fig 12. Showing the length of roots of pea plants grown in Garden Soil (Control)



Fig 13: Showing the length of roots of pea plants grown in Pit Compost



Fig.14: Showing the length of roots of pea plants grown in Vermicompost

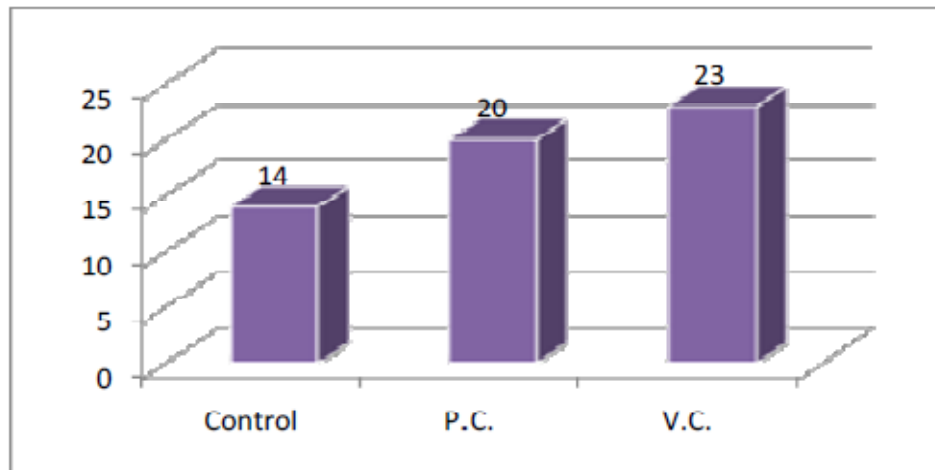


Fig.15: Showing the comparative impact of Pit Compost, Vermi Compost and Control (Garden Soil) on the roots length of pea plants.

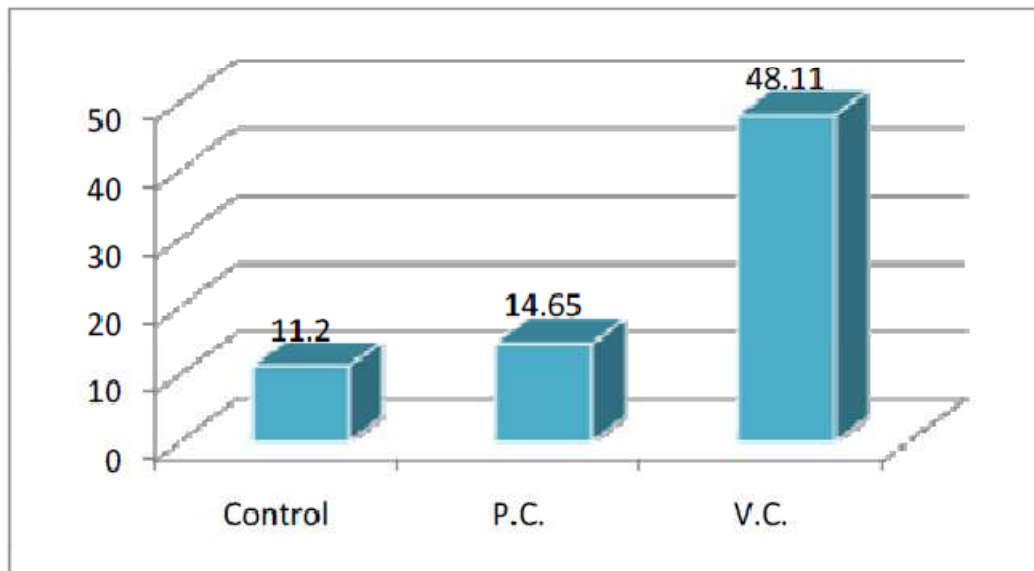


Fig.16: Showing the comparative impact of Pit Compost, Vermi Compost and Control (Garden Soil) on the total weight (total dry weight) of the roots of pea plants.

The result in the two tables demonstrate that the growth of pea plants grown in vermicompost soil was maximum (18 cm) along with number of leaves (51), height (48.11cm) and length of roots (23 cm) as compared to growth of pea plants grown in pit compost (12 cm), number of leaves (46), height (14.65cm) and length of roots 14 cm which was further maximum than the pea plants grown in garden soil (control) (28 cm), number of leaves (28), height (11.02 cm) and length of roots (14 cm) respectively. It was also found that the total weight of roots was higher in the pea plants grown in vermicompost (48.11g) than pitcompost which was (14.65g) and garden soil (11.02g). Thus it was observed that the vermicompost contains nutrient content to such an extent that enhance the growth of pea plants at a faster rate in comparison to pit compost and garden soil. Unlike other composts, vermicompost also contains worm mucus which helps

prevent nutrients from washing away, holds moisture better and thus helps in increased plant growth [10].

CONCLUSION

Thus the results indicate that integrated effect of all the nutrients present in vermicompost results in the increased growth of *Pisum sativum* plants in a very short period of time. Vermicompost also played a crucial role in improving soil properties, increases crop yield and has a tremendous effect on the growth of *Pisum sativum* as compared to pit compost and garden soil (control).

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