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Productive assessment of *Pisum sativum l.* by using organic fertilizers

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Abstract

The present study was carried out to study the effect of organic fertilizer on soil fertility and productivity on *Pisum sativum l.* A total of eight parameters *viz.* Moisture Content, pH, Electric Conductivity, Total Organic Carbon, Organic Matter, Nitrogen, Phosphorus and Potassium were analyzed. The pH range was observed during this study between 6.33-6.19 in control treatment, 7.60-7.44 in Vermicompost treatment and 7.40-7.20 in Farm Yard Manure. Maximum moisture content was found in (T3) 28.84% - 24.73 %. The equal value of moisture content were found in FYM (T2) was 22.73 % - 19.57 % and control pot (24.99% - 22.35%), highest mean value of Nitrogen was present in Vermicompost treatment (7.21 – 6.47%), while slightly low value was found in Farm Yard Manure treatment (6.38 – 5.57%) and lower value was found in control treatment (1.76–1.75%). The study also showed distinct differences between vermicompost, farm yard manure and garden soil (control) in terms of their nutrient content and their effect on germination and plant growth.The study revealed that vermicompost is the best organic fertilizer for the growth of plant as well as best method to reduce the organic waste and utilization through Vermicomposting.

Key Words: FYM, Vermicompost, physico-chemical parameter, moisture content, seed germination

Introduction

The *Pisum sativum* a common nutritious vegetable as well as pulse crop belongs to papelionacae family of dicotiledonae sub division of plant kingdom. In developing countries like India, concerted efforts must be made to enhance the production and productivity of pulses, which in turn will ensure more availability to pulses on a per capita basis thus; it will ensure nutritional security to the poor masses of the country. Besides being a rich source of protein, Pulses are also important for sustainable agriculture as they improve physical, chemical and biological properties of soil. Being leguminous, the pulse plants take so little and given so much to our soils that their significance in restoring and maintaining the soil fertility what we add through chemical fertilizers. Thus every pulse plant is a mini-fertilizer plant itself. Being deep rooted; these pulses are highly adaptive to dry land areas of the country. Organic manures, particularly FYM and vermicompost, not only supply macronutrients but also meet the requirements of micronutrients, besides improving soil health.

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The use of organics plays a major role in maintaining soil health due to buildup of soil organic matter, beneficial microbes. To sustain the soil fertility and crop productivity the role of organic manures and fermented organic nutrients are very important.

Materials and Method

Soil was collected from the garden of department of Zoology and Environmental Sciences, Gurukula Kangri Vishwavidyalaya, Haridwar. Vermicompost was taken from the Departmental Vermicompost pits in green house and FYM samples were collected from the Gurukula Kangri VidayalayaGaushala during the experimental study December 2015 to March 2016. A total of eight parameters *viz.* Moisture Content, pH, Electric Conductivity, Total Organic Carbon, Organic Matter, Nitrogen, Phosphorus and Potassium were analyzed by following methodology and protocols as per Trivedy and Goel, 1984; Hanway and Heidal, 1952 and APHA, 2012; Kamboj et al, 2015**.** Seed germination and plant growth experiment of pea (*Pisum sativum)* were carried out at Deptt of Zoology and Environment Science in green house of Gurukula Kangri University during December to

March 2016. Experimental treatments consisting of 3 pots in which, one pot contain soil without any fertilizer labeled as control. Second pot containing Farm Yard Manure and soil in 1:5 ratios and third pot contain Vermicompost and soil in 1:5 ratios respectively. The pots were irrigated after sowing and repeated every day till final emergence. After the completion of germination, the pots were irrigated once in everyday.

Experimental design for production of *Pisum sativum*

S.No	Treatments	Compositions
1.	Control (T1)	Soil without any fertilizer
2.	Farm yard manure (T2)	Soil + farm yard manure
3.	Vermicompost (T3)	Soil +Vermicompost

Germination study was conducted in the pots filled with 4 kilograms of soil mixed with different doses of vermicompost (1kg.) and FYM (1kg.). Seed germination and growth are of vital importance for continuation of plant life. Seed germination is defined as the resumption of metabolic activity. The growth of an embryo starts with the rupture of the seed coat and the emergence of the young seedlings. The time between the seed sowing and seedling establishment is considered to be the crucial period of any plant. The effect of the environment on germination is quite complex because of external and internal factors that modify germination patterns (Rout *et al*., 2000). The seed germination test is performed to evaluate the recommended dose of manual applications to stimulate the inhibition effect on plant growth and yield. In the present germination studies, groundnut seeds were sown in the pots filled with soil mixed with different levels of vermicompost (Control, 100, 250, 200, 250 g). Germination % was calculated by the following formula:

$$\textbf{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds put for germination}} \times 100$$

Plant Growth Characteristics: Height of the plants - Height of the plants was examined at the time of transplantation and different intervals. Number of leaves - Number of leaves of each treatment was counted at different intervals and the mean number of leaves per plant was worked out.

Results and Discussion

The current work was carried out to study the effect of organic fertilizer on soil fertility and productivity on *Pisum sativum l.* A total of eight parameters *viz.* Moisture Content, pH, Electric Conductivity, Total Organic Carbon, Organic Matter, Nitrogen, Phosphorus and Potassium were analyzed (Kamboj & Choudhary, 2013). The pH measurements are excellent indicator of soil acidity and basicity. The pH range was observed during this study between 6.33- 6.19 in control treatment, 7.60-7.44 in Vermicompost treatment and 7.40-7.20 in Farm Yard Manure. Suther (2009) also observed the pH of Vermicompost (7.82) and Farm Yard Manure (7.81). pH influences the nutrient availability and productivity also. Germination percentage, plant height and no. of leaves were highly in Farm Yard Manure and Vermicompost as compared to control treatment (Table-1). The Moisture Content refers to water held by the individual particles of the sample and greatly affected by temperature. Maximum moisture content was found in Vermicompost treatment (T3) 28.84% - 24.73 % due to worms and microbial activity. The equal value of moisture content were found in FYM (T2) was 22.73 % - 19.57 % and control pot (24.99% - 22.35%). Swer*et al.,* (2011) also observed the moisture content of Vermicompost (26.20-20.90%) and FYM (28.47-20.80) (Table-1). Electric Conductivity means how well the soil conducts an electric charge. It is the measure of salinity. Electric Conductivity in control pot was 0.40-0.36 ds/m^{-1}. The maximum value of electric conductivity was found in Farm Yard Manure (2.25-2 ds/m^{-1}) which was higher than vermicompost (1.18-1.10) Kannan *et al.,* (2013) also observed the Electric Conductivity of Vermicompost (0.45) and FYM (0.38). Soil electric conductivity correlates with the soil properties that effect crop productivity, soil texture, Cation exchange capacity, organic matter level, salinity and sub soil characteristics (Table-1). The Organic Matter and Organic Carbon in soil being a main source of energy and food for most of the soil organisms, it has great influence on the productivity of *Pisum sativum* crop. The average value of organic matter was 2.17 - 1.724 % in control pot (T1), 34.41 – 29.15 % in Vermicompost treatment (T3) and 30.6 – 24.70 % in Farm Yard Manure (T2) treatments and the average value of organic carbon

was 1.26 – 1.0 %in control pot (T1), 17.75 – 14.33 % in Farm Yard Manure and 19.96 – 16.91 % Vermicompost. It influences the structure and texture of soil and thereby activity of soil organism. The reduction in organic carbon could be due to nutrient uptake by *Pisum sativum* or due to respiration activity of microorganisms. The organic carbon is lost as CO_2 and nitrogen increase as a result of carbon loss Bansal and Kapoor (2000). (Table-1). The C: N ratio of organic waste material, which is one of the most widely, used indices for compost maturation, decreases sharply during Vermicomposting process. The release of part of carbon as CO_2 in the process of respiration and product of Nitrogen lowers the C: N ratio of the substrate. The Vermicompost and Farm Yard Manure material had grater Nitrogen content. In the present study observed highest mean value of Nitrogen was present in Vermicompost treatment (7.21 – 6.47%), while slightly low value was found in Farm Yard Manure treatment (6.38 – 5.57%) and lower value was found in control treatment (1.76– 1.75%). Kaur *et al.,* (2015) also observed the Nitrogen of Vermicompost (1.6%) and FYM (0.5%). The maximum values of Nitrogen in Vermicompost were observed due to earthworm activity. (Table-1) Phosphorus plays as fundamental role in the very large number of enzyme reaction that depends on phosphorylation. The mean value of higher Phosphorus contain soil were found in Farm Yard Manure (3.45 – 2.68%) and Vermicompost treatment (6.81 – 5.75 %) and control (0.39 – 0.25%) have minimum value of Phosphorus. Kaur *et al.,* (2015) also observed the Phosphorus of Vermicompost (0.5) and FYM (0.4). (Table-1) Potassium is the macronutrient like Nitrogen and Phosphorus for the plant germination and plant growth. The low value of Potassium were found in control pot (0.36-0.30%) and optimum value for plant growth were found in Vermicompost (2.80 – 2.53%) and FYM (1.66 – 1.50%) significantly. Abduli, *et al.,* (2013) also observed the Potassium of Vermicompost (0.8) and FYM (0.5).The availability of higher quantity of nutrients, improvement in the physical properties of soil and increased activity of microbes with higher levels of organics might have helped in increasing plant height, number of leaves and leaf area (Table-1).

Effect of composts on plant - growth characteristics: For seed germination and plant growth experiments was conducted in complete randomized design with three pots. All the observations on germination parameters were recorded at the time of germination and growth parameters at the time of transplanting 30 days after sowing. Germination of seeds through initiated on 4 day after sowing but completed by 7 day in all treatments and control also. Application of Vermicompost and FYM in *Pisum sativum* crop significantly affected the germination of seeds, growth and development of plants during this study period of 30 days respectively. The leaf area compared to control (T1) all treatments showed higher leaf area. Among all treatments T2 and T3 showed the best results. Between organic treatments Vermicompost was significantly better than FYM. Vermicompost worked as soil conditioner in addition to supplying plant nutrients and resulted in improvement in plant height at different stages of plant growth. Treatments showed better results 25 Days after Sowing. In all the observation aspects of growth the maximum value was recorded under Vermicompost treatment (T3). Germination percentage:The application of Vermicompost and Farm Yard Manure increased the seed germination percentage of *Pisum sativum* when compare with control. The application of Vermicompost resulted the higher germination percentage of pea when compared to the control .Vegetable and ornamental seedling result showed earlier and better germination in a Vermicompost compared with control (Buckerfield *et al.,* 2000). Germination percentage were found maximum in Vermicompost (83.33%) and Farm Yard Manure (83.33%) as compare to control (50%) so it is justified that organic fertilizer was good for the production of Pea crop.Plant growth characteristics: Height of the plant - Effects of treatments on height of the plant at different stages of pea during growth were furnished in Table 2. Plants height that recorded in T3 resulted in maximum height at all growth stages. Number of leaves- The effect of treatments on number of leaves at different growth stages during the period of study is presented in the Table 2. Vermicompost with microbial fertilizers significantly influenced the number of leaves of plants (T3).

Table 1: Mean values of physico-chemical parameters of control soil, FYM and Vermicompost

S.No.	Parameter	Control (T1)		FYM (T2)		Vermicompost (T3)	
		Initial	Final	Initial	Final	Initial	Final
1	pH	6.33	6.19	7.4	7.2	7.6	7.44
2	Moisture Content (%)	24.99	22.35	22.73	19.57	28.84	24.73
3	EC (ds/m)	0.4	0.36	2.25	2	1.18	1.10
4	Organic Carbon (%)	1.26	1.0.	17.75	14.33	19.96	16.91
5	Organic Matter (%)	2.17	1.724	30.6	24.7	34.41	29.15
6	Total Nitrogen (%)	1.76	1.75	6.38	5.57	7.21	6.47
7	Phosphorus (%)	0.39	0.25	3.45	2.68	6.81	5.75
8	Potassium (%)	0.36	0.30	1.66	1.50	2.8	2.53

Table 2: Assessment of Vermicompost and Farm Yard Manure on growth parameters

S.No.	Treatments	Germination %	Plant height (cm.)	No. of leaves
1.	Control (T1)	50%	8	7
2.	FYM (T2)	83.33%	11	10
3.	Vermicompost (T3)	83.33%	12	12

Conclusion

This study entitledas Productive assessment of *Pisumsativum l.* by using organic fertilizers concluded that during the experimental period pea plants shows the best response towards the vermicompost treatment in comparison to farm yard manure. This study also shows that vermicompost manure is the best suited manure for maximum pea crop production and maximum financial output. Vermicompost is best not only for farmers in respect to maximum production but it is also useful for the consumers in regard to their health so we can concluded that this manure is far better than chemical fertilizers. Vermicompost improves the physico-chemical properties of the soil vermiculture are the best process to reduce the bio-degradable waste.

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