

EFFECT OF ORGANIC AND INORGANIC FERTILIZER ON PLANT GROWTH

Sakshi Shirish Hajare and Sukhada Akole*

Department of Biotechnology, P. E. S. Modern College of Arts, Science and Commerce, Shivajinagar, Pune- 05.

*Corresponding Author: Dr. Sukhada Akole

Department of Biotechnology, P. E. S. Modern College of Arts, Science and Commerce, Shivajinagar, Pune- 05.

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ABSTRACT

Fertilizers are made up of organic and inorganic materials of natural or synthetic origin that are added to soil to supply one or more nutrients that are essentials to plant. Chemical fertilizers contain nutrients for the growth of crops made by chemical means for example Urea and DAP. Organic fertilizers help to increase the organic matter of the soil, promotes the reproduction of microorganisms, and changes the physical and chemical properties of the soil. This paper aims at checking the effect of organic (Vermicompost) and chemical fertilizers (Urea, DAP) on moong plant. It was seen that the application of vermicompost increased the rate of germination whereas application of chemical fertilizer especially DAP increased the root length.

KEYWORDS: Fertilizer, Urea, DAP, vermicompost, Moong seeds.

1. INTRODUCTION

Fertilizers are organic and inorganic substances that are given to plants for their growth and they increasing the food substances for the soil. The basic purpose of fertilizer application in soil is to improve the nutrient status and quality of soil by enriching it with nutrients which it lacks. (Mercy.S.et.al.2009). Synthetic fertilizers are man-made combinations of chemicals and inorganic substances. Organic fertilizer are made from biological means. Inorganic fertilizers, which are fertilizers from industries, are made from a mixture of high-nutrient chemicals. Different types of inorganic fertilizers include nitrogen fertilizer, potash fertilizer, phosphorus fertilizer, etc. are found in the market (Sheila *et al.*, 2020). Urea is the most important chemical fertilizer with the highest nitrogen content. It is a white crystalline organic chemical compound. Another name for urea is carbamide. Its formula is H_2NCONH_2 . It is a colourless, crystalline substance that melts at 132.7°C (271°F) and decomposes before boiling. Because of its readily convertible nitrogen, urea is one of the most used fertilizers. Urea is made up of four elements i.e. carbon, nitrogen, oxygen, and hydrogen. Di-ammonium Phosphate popularly known as DAP is a favoured fertilizer in India as it contains both Nitrogen and Phosphorus which are a part of 18 essential plant nutrients. It is perfect for any agriculture crop as it provides full phosphorus nutrition throughout the growth period, as well as a starter dose of nitrogen and low sulphur. Molecular formula of DAP is $(\text{NH}_4)_2\text{HPO}_4$ and is composed of 18% Nitrogen and 46% P_2O_5 . Organic fertilizers are derived from biological or living materials.

These fertilizers take longer time to release the nutrients in the soil. Vermicompost is made by using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast. Vermicompost is becoming popular as a major component of organic farming system.

2. MATERIALS AND METHODS

The seeds used for the experiments were moong seeds which were collected from Local grocery shop (Hari Om traders) located in – Pimple gurav, Pune- 411061. Pots and soil sample were collected from local plant nursery (Famous agro) located in –Dapodi, Pune- 411027.

2.1 Effect of urea (Chemical) Fertilizer on plant growth

Materials: Urea Fertilizer was obtained from a Local Fertilizer store (Greenpeace Agro Industries), located at Sai Vasti, near SBI bank, Pune 411027, pH paper.

Method: The experiment was conducted in four plastic pots collected from local nursery shop. All pots were filled with 400g soil. Out of the four pots, urea was added to only three pots which were test pots and named as T1, T2, T3 respectively. Urea was added to pots in powder form in concentration of 2g in T1, 4g in T2, 10g T3. No urea was added to pot number four and it acted like the control. After addition of soil and Urea, ten seeds of moong were added to every pot. Pots were kept in a place where moderate amount of sunlight would reach

them. Every day about 4-5 tablespoon water was given to seeds for their development (Sharangi and Nanda, 2011; Yagoub *et al.*, 2012).

2.2 Effect of DAP (Diammonium phosphate) chemical fertilizer on plant growth

Materials: DAP fertilizer was obtained from a Local fertilizer store (Greenpeace Agro Industries) located at Sai Vasti, near SBI bank, Pune 411027.

Methods: The experiment was conducted in four plastic pots collected from local nursery shop. All pots was filled with 400g soil. Out of the four pots, DAP was added to only three pots which were test pots and named as T1, T2, T3. respectively. DAP was added to pots in powder form of concentration 2g in T1, 4g in T2, 10g T3. No DAP was added, to pot number four and it acted like the control. After addition of soil and DAP, we have added ten seeds of moong were added per pots. Pots were kept in a place where moderate amount of sunlight would reach them. Every day about 4-5 tablespoon water was given to seeds for development. (Bekalu and Tenaw, 2015).

2.3 Effect of Vermicompost (Organic) Fertilizer on plant growth

Materials: Vermicompost fertilizer was obtained from a Local fertilizer store (Greenpeace Agro Industries), located at Sai Vasti, near SBI bank, Pune 411027.

Method: The experiment was conducted in four plastic pots collected from local nursery shop. All pots was filled with 400g soil. Out of the four pots, Vermicompost was added to only three pots which was test pots and named as T1, T2, T3. respectively. Vermicompost was

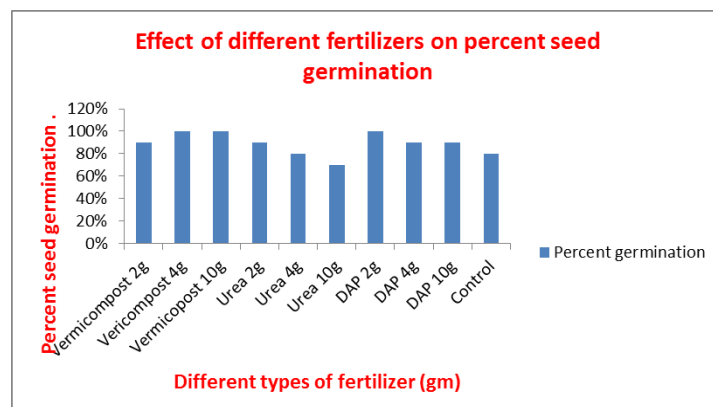
added to pots in powder form of concentration 2g in T1, 4g in T2, 10g T3. No vermicompost was added to pot number four and it acted like the control. After addition of soil and vermicompost, we have added ten seeds of moong were added per pots. Pots were kept in a place where moderate amount of sunlight would reach them. Every day about 4-5 tablespoon water was given to seeds for development (Mariappan and khandakar, 2017).

3. RESULT AND DISCUSSION

Various parameters of the plant growth were studied such as seed germination rate, shoot length, root length, etc.

3.1 Seed germination

Seed germination may be defined as the fundamental process by which different plant species grow from a single seed into a plant. This process influences both crop yield and quality. 10 seeds were sown in each pot and after 21 days of observation it was seen that (Graph no. 1) vermicompost containing pots had the highest rate of germination i.e. 100% germination in T2 and T3 plant (4g and 10g) and 90% germination in T1 (2g), as vermicompost helps the plants to resist drought and stimulates seed germination, the seed germination containing vermicompost fertilizers was faster. It was seen that germination was more in pots with less DAP i.e. 100% in T1, followed by 90% in T2 and T3. Also, in case of urea application 90% germination was seen in T1 followed by only 80% germination in T2 and T3. Application of more urea reduces the seed germination. Lowest seed germination was seen in control plant where no fertilizer was applied.



Graph no. 1: Effect of Organic and Inorganic fertilizers on percent seed germination.

3.2 Plant height (Shoot and Root length)

Plant height is defined as the shortest distance between upper boundary of the main photosynthesis tissues and the ground level. Plant height is combination of shoot length and root length.

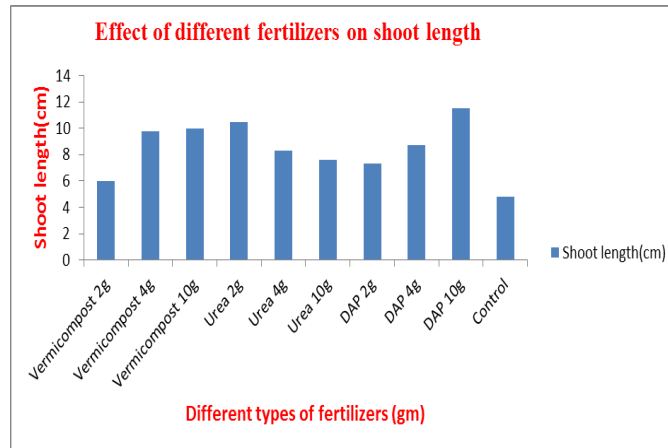
3.2.1 Shoot length

The total shoot length per plant is calculated by summing of the shoot length of all the plant pieces in all images

which were analyzed per plant. In case of shoot length (graph no. 2), the maximum height was seen in case of vermicompost containing pots. Govindapillai. Seenan Rekha.*et.al.*, 2018 reported that marigold plant treated with 50% vermicompost had shown good improvement when compared with untreated plant. Vermicompost treatment enhanced the availability of nutrient in the soil (Singh *et al.* 2011), so it helps in faster shoot growth. The overall shoot length decreased from vermicompost

to urea fertilizer to DAP to control. Atiyeh et al. (2000) showed that vermicomposts have the potential for improving plant growth when added to soil as they

contain humic acids and adequate nutrients which help in maximum growth (Ganeshnauth et al. 2018) (Fig no. 1).



Graph no. 2: Chart showing effect of different fertilizers on shoot length.

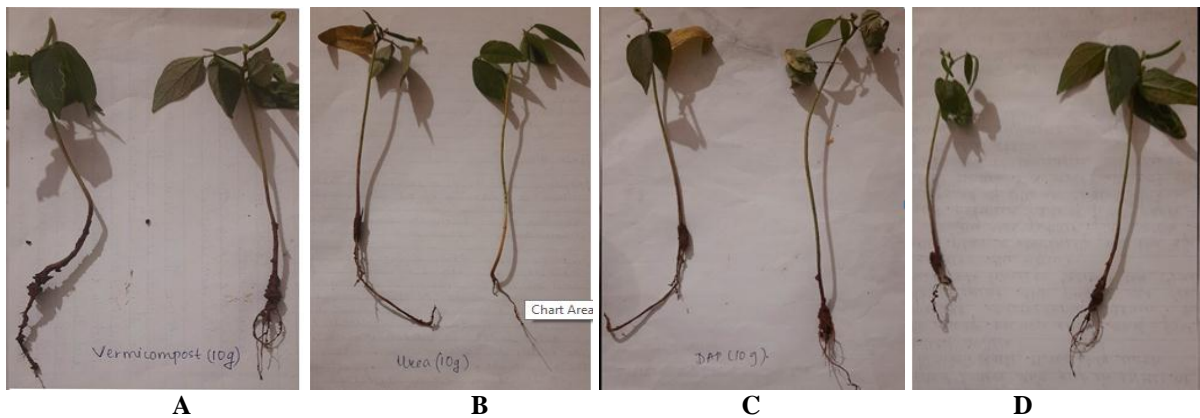
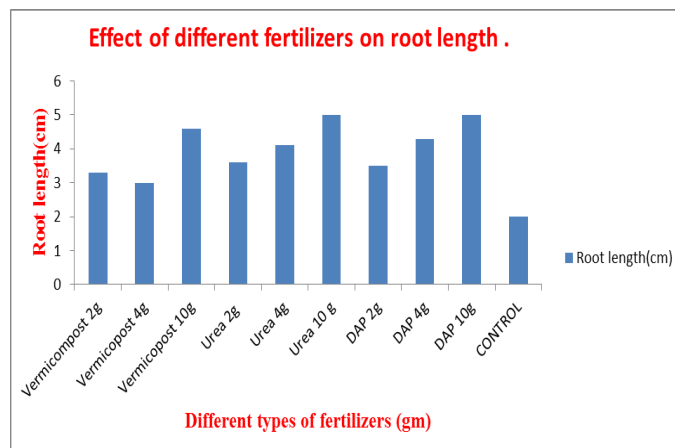


Fig. no. 1: Effect of a. Vermicompost, b. Urea and c. DAP fertilizer on plant growth (Shoot and Root length) as compared to d. Control.

3.2.2 Root length

Specific root length is probably the most frequently measured morphological parameters of fine roots (Fig no. 1). In the study (graph no. 3) it was seen that as the concentrations of fertilizers increased so did the root

lengths. The highest length was seen in the pot containing 10 g of urea and DAP respectively. These results are in sync with the studies conducted by Hussein Mahmood Shukri, et. al, 2016 on sage plants.



Graph no. 3:- Chart showing effect of different fertilizers on root length.

3.3 pH of soil

A pH value is actually a measure of hydrogen ion concentration. In our study the pH of soil without any fertilizer was found to be 6.24 which is nearly neutral. The pH of soil after adding vermicompost changed to 6.08. The addition of DAP changed it to 6.04 and that of urea changed it to 5.98. Premalatha Shetty et.al ,2019 found that plants tend to grow mostly in soil having neutral or near to neutral pH. It can be seen from the above observations that the pH of the soil changed drastically to acidic after addition of urea, but it can also be seen that plants grew on this soil as well. This is because when urea is added to the soil it undergoes a reaction to form bicarbonate and ammonium-N. This bicarbonate then reacts with H⁺ ions in the soil solution, which temporarily reduces acidity, but acidity is again produced when ammonium-N undergoes nitrification.

4. CONCLUSION

The results of this study showed that soil treated with organic fertilizer i.e. vermicompost showed great potency to increase the performance, growth and improvement soil quality, given the highest plant height, compared to soil treated with inorganic fertilizer that is Urea and DAP fertilizer . Also by analyzing the pH of soil of all the three types of fertilizer, we have come to an understanding that as the soil pH decreases the growth also decreases. This study supports the notion that optimum nitrogen and phosphorus contents in the soil are essential for optimum growth of the plants.

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