International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Findings of the Effect of Compost on Above and Below Ground Biomass of Raphanus Sativus cv Pusa Chetki

Dr. Rajshree Gupta

Associate Professor Botany, B.B.D. Govt. College, Chimanpura, Shahpura, Jaipur
Email: *rajshreegupta[at]rocketmail.com*

Abstract: ***This study aimed to investigate the effect of compost on above and below ground biomass of Raphanus sativus (radish), specifically the cultivar Pusa chetki. Pot culture experiments were conducted using air-dried garden soil and seeds of the radish cultivar. Municipal compost was added to the soil in different concentrations (5%, 10%, 15%, and 20% on a weight basis), while control pots contained soil without compost. The plants were grown under natural environmental conditions, and data on biomass were recorded after 45 days. The results showed that the maximum above and below ground biomass of radish plants was observed when grown in soil with a 15% compost concentration. In the control group, the biomass was 180 g/plant and 195 g/plant, which increased to 215 g/plant and 225 g/plant, respectively, at the 15% compost level. However, when the compost concentration was increased to 20%, both above and below ground biomass were inhibited. These results were significantly different from the control. The findings indicate that compost concentrations between 5% and 15% were beneficial for the above and below ground biomass of Raphanus sativus cv Pusa chetki, compared to the control. Only the 20% compost level exhibited inhibitory effects. It is suggested that the inhibitory effect of higher compost levels may be due to the presence of trace metals, such as Pb, Zn, and Cu, which were reported in previous studies. These trace metals might negatively affect soil fertility and the growth of soil microbes, resulting in reduced biomass values for radish plants.***

Keywords: Compost, above and below ground biomass, Raphanus sativus, Cultivar Pusa chetki, Pot culture experiment

1. Objectives

1) Determine the impact of compost on the above and below ground biomass of Raphanus sativus cv Pusa chetki.
2) Assess the suitability of different concentrations of compost (5%, 10%, 15%, and 20%) for promoting plant growth and biomass production.
3) Compare the above and below ground biomass of radish plants grown in compost-amended soil with those grown in soil without compost (control group).
4) Identify the optimal compost concentration that results in the highest above and below ground biomass.
5) Determine if there is a threshold level of compost beyond which plant growth is inhibited.
6) Assess the significance of the observed differences in above and below ground biomass between the compost-treated groups and the control group using statistical analysis.
7) Explore the relationship between compost concentration, soil fertility, and the growth of soil microbes.
8) Validate and support the findings with reference to previous studies on the effects of compost and trace metals on plant growth.
9) Provide insights into the practical application of compost as a soil amendment for enhancing above and below ground biomass in radish cultivation.

2. Introduction

Raphanus sativus, specifically the Pusa chetki variety, is an early maturing radish cultivar that completes its growth cycle within 40-45 days. It features upright, dark green, slightly lobed leaves. Apart from its culinary use, radishes are also cultivated as a feed source for livestock.

This study aimed to investigate the effects of compost on the above and below ground biomass of Raphanus sativus cv Pusa chetki, a popular radish cultivar. Pot culture experiments were conducted under natural environmental conditions to simulate real-world scenarios.

A series of pots measuring 15 x 15 inches were filled with 10 kg of air-dried garden soil. Each pot had a control drainage hole, and 20 seeds of Raphanus sativus cv Pusa chetki were sown at a uniform depth of 5 cm and equal distances within the pots. The experiment included treatments with compost concentrations of 5%, 10%, 15%, and 20% on a weight basis, while the control group contained soil without compost. Each treatment was replicated three times, and normal cultural practices were followed throughout the experiment.

After 45 days of growth, the above and below ground biomass of radish plants were recorded. The results showed that the highest biomass was observed in plants grown in soil with a 15% compost concentration. In contrast, plants grown in soil treated with 20% compost showed inhibition in both above and below ground biomass. Statistical analysis revealed significant differences among the treatments.

The findings suggest that compost concentrations between 5% and 15% were beneficial for enhancing the above and below ground biomass of Raphanus sativus cv Pusa chetki compared to the control group. However, an increase in compost concentration beyond 15% was found to be ineffective and inhibitory for plant growth. This aligns with previous studies on other crops, indicating that excessive

compost levels may have negative impacts on biomass production. The reduced biomass at higher compost concentrations might be attributed to the presence of trace metals, such as Pb, Zn, and Cu, commonly found in municipal compost. The increased levels of trace metals may inhibit soil fertility and the growth of beneficial soil microbes, leading to reduced biomass values.

Understanding the optimal compost concentrations for maximizing plant growth while considering potential limitations is crucial for sustainable agriculture practices. This study contributes to the knowledge on utilizing compost as an organic soil amendment to promote biomass production in radish crops, aiding in the development of efficient and environmentally friendly agricultural strategies.

3. Material and Methods

In order to investigate the impact of compost on above and below ground biomass, pot culture experiments were conducted using the seeds of Raphanus sativus cv Pusa chetki. The plants were grown under natural environmental conditions, ensuring that the experimental setup resembled real-world scenarios. A set of pots measuring 15 x 15 inches in size was prepared, with each pot having a control drainage hole. Twenty seeds of Raphanus sativus cv Pusa chetki were sown at a uniform depth of 5 cm and equal distances within the pots. To ensure reliable results, each treatment was replicated three times.

Careful arrangements were made to avoid any potential contamination and provide uniform light conditions by properly spacing the experimental pots. Four plants were retained in each pot, allowing them to grow naturally. After a period of 45 days, data on above and below ground biomass were recorded. Throughout the experiment, regular cultural practices were followed, and the pots were irrigated as needed to maintain consistent soil moisture conditions.

For this study, municipal compost was used as the experimental amendment. Compost concentrations of 5%, 10%, 15%, and 20% were added to the soil on a weight basis. Daily watering was carried out to ensure optimal growth conditions. The control group consisted of pots containing only 10 kg of soil without compost.

This experimental setup allowed for the evaluation of the effect of different compost concentrations on the above and below ground biomass of Raphanus sativus cv Pusa chetki. By comparing the biomass measurements across the different treatments, valuable insights into the impact of compost on plant growth and development can be gained.

4. Result and Discussion

The findings of this study revealed that the maximum above and below ground biomass of radish (Raphanus sativus) plants, specifically the cultivar Pusa chetki, was achieved when grown in soil containing a compost concentration of 15%. In comparison, the control group exhibited biomass measurements of 180 g/plant and 195 g/plant, which significantly increased to 215 g/plant and 225 g/plant, respectively, at the 15% compost level. However, when the compost concentration was raised to 20%, both above and below ground biomass showed inhibition. These results were statistically significant compared to the control group (Table 1).

The data clearly demonstrate that compost concentrations play a crucial role in determining the biomass production of radish plants. The optimal compost concentration of 15% resulted in the highest biomass, while the 20% level had inhibitory effects. These findings provide valuable insights into the relationship between compost concentration and plant growth.

Table 1: Showing the findings of the effect of compost on above and below ground biomass (g/plant) of Raphanus sativus cv Pusa chetki

Sr. No.	Compost	Above ground biomass (g/plant)	Below ground biomass (g/plant)
1	Control	180	195
2	5%	185	200
3	10%	190	210
4	15%	215	225
5	20%	175	190

(Values represent the mean of three replicates)

F- ratios (Control Vs Treatment):
(i)Above ground biomass = 16.1666***
(ii)Below ground biomass = 13.5882***

The results of the present study demonstrated that compost concentrations ranging from 5% to 15% had a beneficial impact on the above and below ground biomass of Raphanus sativus cv Pusa chetki, compared to the control group. However, when the compost concentration was increased to 20%, a clear inhibitory effect on biomass was observed. These findings align with previous research conducted by Purves (1973), who also reported similar results in a one-year trial on potatoes.

Furthermore, the inhibitory effect of higher compost levels can be attributed to the presence of trace metals such as lead (Pb), zinc (Zn), and copper (Cu) in municipal compost, as previously reported by Gray and Biddlestone (1977). The increased concentration of these trace metals in the soil at the 20% compost level may negatively affect soil fertility and hinder the growth of beneficial soil microbes. Consequently, this leads to reduced above and below ground biomass values in radish plants.

The association between trace metals, soil fertility, and the growth of soil microbes highlights the importance of carefully managing compost concentrations to avoid detrimental effects on plant growth. By maintaining compost levels within the range of 5% to 15%, farmers and growers can optimize biomass production in radish cultivation while minimizing the potential negative impacts of trace metals.

Overall, this study provides valuable insights into the effects of compost concentrations on above and below ground biomass in Raphanus sativus cv Pusa chetki. It underscores the need for sustainable agricultural practices that consider the optimal use of compost as an organic soil amendment.

Further research is warranted to delve deeper into the mechanisms underlying trace metal effects and to develop strategies for mitigating their negative impacts on plant growth.

5. Conclusion

This study investigated the effect of compost on Raphanus sativus cv Pusa chetki, a radish cultivar, and its above and below ground biomass. Results indicated that compost concentrations of 5% to 15% were beneficial in enhancing biomass compared to the control. The highest biomass was observed at a 15% compost concentration, while a 20% level inhibited both above and below ground biomass. Statistical analysis confirmed significant differences between treatments.

Excessive compost levels, containing trace metals like Pb, Zn, and Cu commonly found in municipal compost, negatively affected biomass production by inhibiting soil fertility and beneficial soil microbe growth. Optimal compost concentrations should be determined to maximize plant growth while avoiding inhibitory effects.

This study contributes to understanding compost use as an organic soil amendment for radish crops, emphasizing sustainable practices and the need for balanced compost concentrations. Future research should focus on investigating trace metal effects and developing strategies to mitigate their negative impacts.

References

[1] Gray, K. R. and Biddlestone, A. J. 1977. Agricultural use of composted town refuse. Proceedings of a conference, ADAS, Reference book 326, p. 279
[2] Purves, D. 1973. Solid wastes and the environment land. The Institute of Public Cleansing. 75th annual conference, Torbay