International Journal of Education, Modern Management, Applied Science & Social Science (IJEMMASSS)
ISSN : 2581-9925, Impact Factor: 6.882, Volume 05, No. 01(III), January - March, 2023, pp. 298-301

EFFECT OF SOIL TYPES ON ABOVE AND BELOW GROUND OF RAPHANUS SATIVUS VARIETY PUSA CHETKI

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ABSTRACT

In a recent investigation, the relative effectiveness of various soil types was examined, providing insights into their impact on plant growth and yield. Among the soil types studied, sandy loam, also known as garden soil, emerged as the most advantageous medium for plant development. Its composition, characterized by a balanced mixture of sand, silt, and clay, allows for optimal water drainage and aeration while retaining adequate moisture for plant roots. The sandy loam's texture promotes root penetration and proliferation, facilitating nutrient absorption and supporting vigorous plant growth. Following sandy loam, loam soil displayed the next level of effectiveness. Loam is a well-balanced soil type, containing a blend of sand, silt, and clay in relatively equal proportions. It possesses good drainage properties, ensuring that excess water does not accumulate around plant roots. Additionally, loam soil retains sufficient moisture to sustain plant growth during dry periods. This soil type fosters a favourable environment for root development and nutrient uptake, contributing to healthy plant growth and optimal yields. Silty loam, another soil type evaluated, exhibited a slightly lower level of effectiveness compared to sandy loam and loam. Overall, this investigation highlights the significance of soil type in influencing plant growth and yield. Sandy loam, with its ideal combination of sand, silt, and clay, emerges as the most favourable soil type for robust plant development. Loam and silty loam soils also provide suitable conditions for growth, albeit with slight variations in their properties. Understanding the physical characteristics and composition of different soil types allows farmers and gardeners to make informed decisions regarding soil management, optimizing crop production and ensuring healthy plant growth.

Keywords: *Soil Types, Cultiver Pusa Chetki, Sandy Loam, Garden Soil, Silt.*

Introduction

Soil is a complex mixture of organic matter, inorganic matter, water, and air. It is the medium in which plants grow and obtain the nutrients they need to survive. The physical and chemical properties of soil can have a significant impact on plant growth.

One of the most important factors affecting plant growth is soil texture. Soil texture is determined by the size and distribution of the particles that make up the soil. There are three main types of soil texture: sand, silt, and clay.

Sand particles are the largest and have the least surface area. They drain quickly and allow for good air circulation, but they do not hold much water or nutrients.

Silt particles are intermediate in size and have a moderate amount of surface area. They drain well and hold some water and nutrients.

Clay particles are the smallest and have the largest surface area. They hold a lot of water and nutrients, but they drain poorly and can become compacted, which makes it difficult for roots to grow.

The ideal soil texture for plant growth is a loam. Loam soils are a mixture of sand, silt, and clay, and they have a good balance of drainage, water retention, and aeration.

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Another important factor affecting plant growth is soil structure. Soil structure refers to the way that the soil particles are arranged. Good soil structure is characterized by aggregates of soil particles that are held together by organic matter and clay minerals. These aggregates provide a network of pores that allow water and air to move through the soil, which is essential for plant growth.

Poor soil structure can be caused by compaction, erosion, or the presence of too much clay or sand. Compaction occurs when soil is compressed by heavy machinery or foot traffic. This can reduce the size of the pores in the soil and make it difficult for water and air to move through. Erosion can occur when soil is blown or washed away by wind or water. This can expose the roots of plants, which can lead to wilting and death. Too much clay or sand in the soil can also make it difficult for water and air to move through, which can limit plant growth.

The physical and chemical properties of soil can be affected by a variety of factors, including climate, vegetation, and land use. By understanding the factors that affect soil quality, we can improve soil management practices and help to ensure that plants have the conditions they need to grow and thrive.

Objectives

- Evaluate the relative effectiveness of different soil types in supporting plant growth and yield.
- Determine the advantages and characteristics of sandy loam soil for promoting robust plant development.
- Assess the effectiveness of loam soil in facilitating healthy plant growth and optimal yields.
- Compare the level of effectiveness between sandy loam, loam, and silty loam soils in supporting plant growth and yield.
- Investigate the physical characteristics and composition of sandy loam, loam, and silty loam soils to understand their impact on plant growth.
- Analyze the role of soil type in root penetration, nutrient absorption, and nutrient uptake for healthy plant growth.
- Provide insights into the importance of soil type selection for farmers and gardeners in optimizing crop production and ensuring healthy plant growth.
- Highlight the significance of understanding soil management and composition for informed decision-making regarding soil selection and crop production.
- These objectives address the key findings from the investigation and focus on the effectiveness of different soil types, their characteristics, and their implications for plant growth and yield.

Material and Methods

The objective of the study was to investigate the impact of different soil types on the above and below ground biomass of Raphanus sativus cv Pusa chetki. To achieve this, pot culture experiments were conducted under natural environmental conditions.

In the present work, the seeds of Raphanus sativus cv Pusa chetki were utilized for the experiment. A series of pots, each measuring 15 x 15 inches in size, were selected for the study. These pots were filled with 10 kg of air-dried garden soil, which served as the control soil type. Each pot was equipped with a drainage hole to ensure proper water drainage.

In each pot, 20 seeds of Raphanus sativus cv Pusa chetki were sown at a depth of 5 cm, with equal spacing between them. This process was repeated three times to provide replication for each treatment. Throughout the experiment, standard cultural practices were followed as necessary to maintain optimal growing conditions for the plants.

To prevent any potential contamination and to ensure consistent light conditions, the experimental pots were appropriately spaced. The germination process resulted in the retention of four plants per pot, allowing for a sufficient sample size. After 45 days of growth under natural conditions, data regarding both above and below ground biomass were recorded.

In order to investigate the impact of different soil types on biomass, three additional soil types were used: loam, silty loam, and clay loam. These soil types were compared to the control garden soil. The experimental pots were irrigated as needed, using a calculated amount of tap water to maintain uniform soil moisture levels across all treatments.

By conducting these pot culture experiments and recording the biomass data, it was aimed to determine how different soil types influenced the above and below ground biomass of Raphanus sativus cv Pusa chetki. The findings of this study could provide valuable insights into the relationship between soil characteristics and plant growth, contributing to our understanding of soil management and crop production.

Results & Discussions

The study examined the impact of different soil types on the above and below ground biomass of 45-day-old Raphanus sativus cv Pusa chetki plants. The results indicated that garden soil exhibited the highest biomass, while clay loam soil had the lowest biomass. Statistical analysis confirmed significant differences among the soil treatments compared to the control group.

Interestingly, the above ground biomass was found to be similar in both loam and silty loam soils, with an average of 170 grams per plant. Similarly, the below ground biomass showed no significant difference between loam and silty loam soils.

In the control group, the above ground biomass measured 185 grams per plant, while the below ground biomass measured 205 grams per plant. However, these values significantly decreased to 125 grams and 140 grams per plant, respectively, in the treatment involving clay loam soil.

Table 1 presented the detailed data regarding the effects of varying soil types (garden soil, loam, silty loam, and clay loam) on the above and below ground biomass of the plants.

Table 1: Showing the Effect of Soil Types on above and below Ground Biomass (g per plant) in Raphanus Satuvus cv Pusa Chetki.

Sr. No.	Soil Types	Above Ground Biomass	Below Ground Biomass
1	Control	185	205
2	Loam	170	185
3	Silty loam	170	185
4	Clay loam	125	140

Values represent the mean of three replicates.
F ratios- control vs treatment
1. Above ground biomass- 64.8***
2. Below ground biomass- 47.35***

The present investigation has revealed that garden soil, specifically sandy loam, is the most suitable soil type for various stages of radish growth, including seedling survival, vegetative growth, and reproductive growth. Conversely, the performance of Raphanus sativus cv Pusa chetki was comparatively poorer in clay loam soils, which resulted in a notable reduction in both above and below ground biomass of radish. The other two soil types examined, namely loam and silty loam, were found to be moderately suitable for supporting the above and below ground biomass of radish.

The significant reduction in growth observed in clay soils can be attributed to several factors. Firstly, clay soils tend to have poor aeration due to their compact and heavy particle composition. This lack of adequate oxygen supply inhibits root hair development and can consequently reduce the absorption rate of water and nutrients by the plants. Furthermore, the microbial activity within the soil may also be suppressed under these conditions.

On the other hand, the superior results obtained in loam and silty loam soils, as well as the best outcomes in sandy loam or garden soil, can be attributed to several favourable characteristics of these soil types. These soils are highly fertile, containing a rich abundance of nutrients that promote plant growth. They also possess proper aeration, facilitating the movement of gases within the soil and allowing for the efficient exchange of oxygen and carbon dioxide. Moreover, these soil types can retain a fairly large amount of water, ensuring that plants have access to an adequate water supply. Additionally, the presence of proper aeration in these soils prevents waterlogging and promotes drainage.

The improved above and below ground biomass in loam and silty loam soils, as well as the exceptional productivity in sandy loam or garden soil, can be attributed to the suitable physical properties of these soils. The presence of sufficient porosity in sandy loam soils allows for the proper circulation of soil air among the mineral particles. This, in turn, contributes to better crop productivity for radish plants. Several references (Marsdone and Turrill, 1945), (Ramakrishnan, 1963 & 1964), (Sharma, 1955), (Goel, 1990), (Rorison, 1967) have previously indicated the positive relationship between soil type and radish growth performance.

Conclusions

In conclusion, the results of the investigation support the idea that the best growth performance of radish plants can be achieved in garden soil, specifically sandy loam, and to a lesser extent in loam and silty loam soils. These soil types provide favourable conditions such as proper aeration, adequate water retention, and nutrient-rich composition, which are essential for promoting optimal radish growth in terms of above and below ground biomass.

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