



Effects of container size and planting materials on growth of *Portulaca grandiflora* under different conditions

Portulaca grandiflora

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Abstract

This study compared the effects of soil compositions and container shapes on *Portulaca grandiflora* growth. Plants were grown in a 10:1 soil-to-azolla ratio using wide spherical (fan grille) and narrow cylindrical (bottle) containers. Results showed that soil mixed with fresh azolla increased nutrient levels by the second week, reaching higher concentrations (N: 10.74, P: 16.66, K: 37.66 mg/kg) than dried azolla. Optimal growth was observed in fresh azolla soil within fan grille containers, yielding an average height of 19 cm, 2 cm stem diameter, and 25 leaves. These containers also maintained superior soil moisture compared to bottles. Consequently, for best results, it is recommended to grow *Portulaca grandiflora* in wide, spherical containers using soil mixed with fresh azolla.

Keywords : *Portulaca grandiflora* , Container Geometry , Azolla Amendments , Plant Growth Performance , Soil Nutrient Properties

Research Questions

Asking Questions

1. Do the size and shape of planting containers result in differences in the growth of *Portulaca grandiflora*? If so, how?
2. Do planting materials consisting of soil mixed with dried azolla soil and fresh azolla soil differ in soil quality, and do they affect the growth of *Portulaca grandiflora*?

Introduction

Content Knowledge

Portulaca grandiflora, commonly known as *Portulaca grandiflora*, is a popular ornamental flowering plant due to its bright and attractive colors, ease of cultivation, and strong tolerance to various environmental conditions. This plant can grow well in hot climates, requires minimal water, and adapts easily to different soil types. Because of these characteristics, *Portulaca grandiflora* is widely grown for decorative purposes and is often used in basic agricultural learning activities, especially for beginners. In recent years, container gardening has gained increasing attention, particularly in areas with limited planting space such as urban environments. The size and shape of planting containers play an important role in plant growth, as they directly affect root development, water retention, soil aeration, and nutrient availability. Containers that provide adequate space for root expansion generally promote healthier plant growth, resulting in stronger stems and better overall development. Therefore, studying the influence of container characteristics is essential for improving planting efficiency. Another key factor affecting plant growth is the planting material or growing medium. Soil quality directly impacts nutrient supply and moisture retention, which are crucial for plant development. Organic materials are often added to soil to enhance its fertility and structure. Azolla, an aquatic fern rich in essential nutrients such as nitrogen, phosphorus, and potassium, is commonly used as an organic soil amendment. Azolla can be applied in both fresh and dried forms, each offering different benefits. Fresh azolla helps maintain soil moisture and releases nutrients gradually, while dried azolla improves soil structure and increases organic matter content. This project aims to study the effects of container size and shape, as well as different planting materials—specifically soil mixed with dried azolla and fresh azolla—on the growth of *Portulaca grandiflora*. Plant growth parameters such as plant height, stem size, and general growth characteristics are observed and compared under different planting conditions. The study focuses on identifying which combination of container type and planting material is most suitable for supporting optimal growth. The findings of this study are valuable for improving home gardening practices and enhancing the aesthetic quality of ornamental plants. In addition, the results provide a useful foundation for students and individuals interested in basic agricultural studies by promoting a better understanding of the factors that influence plant growth.

Research Methods

Planning Investigations

The research preparation process consists of four main steps: identifying the research topic, selecting the topic to be studied, reviewing and collecting relevant information and theories related to the research, defining the objectives of the study, planning and conducting the experiment. The planting materials consisted of soil mixed with red Azolla at a ratio of 10:1, planted in two different sizes and shapes of containers over a period of two months. Soil samples were randomly collected once a week, with three replications per sampling, for a total of five times. Soil quality was examined, including moisture content, pH value, NPK levels, soil temperature, and soil structure. The growth of *Portulaca grandiflora* was studied every two weeks by measuring plant height, stem size, and number of leaves.

In this experiment, soil moisture, pH, temperature, soil structure, and NPK values were examined in soil placed in two types of containers: fan pots and plastic bottles. Measurements were conducted once per week continuously throughout the study period in order to systematically compare the results obtained from both types of containers. The soil analysis procedures were as follows:

1. pH Measurement

Dry soil samples were heated, then 20 grams of soil were weighed and placed into a beaker. 20 or 100 mL of distilled water was added to obtain a soil-to-water ratio of 1:1. The mixture was stirred with a glass rod for 30 seconds, then allowed to stand for 3 minutes. This procedure was repeated five times. After stirring was completed, the soil was left to settle in the beaker. Clear water could be observed at the top. pH indicator paper was dipped into the clear water layer without disturbing the soil.

2. Nutrient Analysis (N, P, K)

Soil nutrients (N, P, and K) were measured using approximately 1 tablespoon of soil, mixed with water at a soil-to-water ratio of 1:5. The solution was filtered using filter paper and then analyzed using an NPK test kit, with the results compared to standard reference values.

3. Soil Moisture Measurement

Soil moisture was measured at every sampling point using a soil quality meter inserted to a depth of 5 centimeters, and the moisture value was recorded.

4. Soil Temperature Measurement

Soil temperature was measured using a soil thermometer inserted directly into the soil at a depth of approximately 5–10 centimeters (general plant depth), and left in place for 2–5 minutes before recording the reading.

In this experiment, the growth of *Portulaca grandiflora* was examined by measuring plant height, leaf size, and counting the number of leaves. The data were recorded on a weekly basis, with measurements taken once per week continuously throughout the study period in order to systematically compare the results obtained from the two types of planting containers.



Carrying Out Investigations

Table 1: Geographical Coordinates

Latitude	Longitude
7.50433° N	99.62846° E

GLOBE Badges

I AM A DATA SCIENTIST

I am a data scientist who uses data from the *Portulaca grandiflora* research project to analyze growth patterns. I collect, compare, and interpret data from different planting materials and containers. This helps identify the best conditions for...

I AM AN EARTH SYSTEM SCIENTIST

I am an earth system scientist who studies *Portulaca grandiflora* research project by examining interactions between soil, plants, and the environment.

I analyze soil moisture, pH, nutrients, and temperature to understand how Earth systems affect plant growth.

I AM A COLLABORATOR

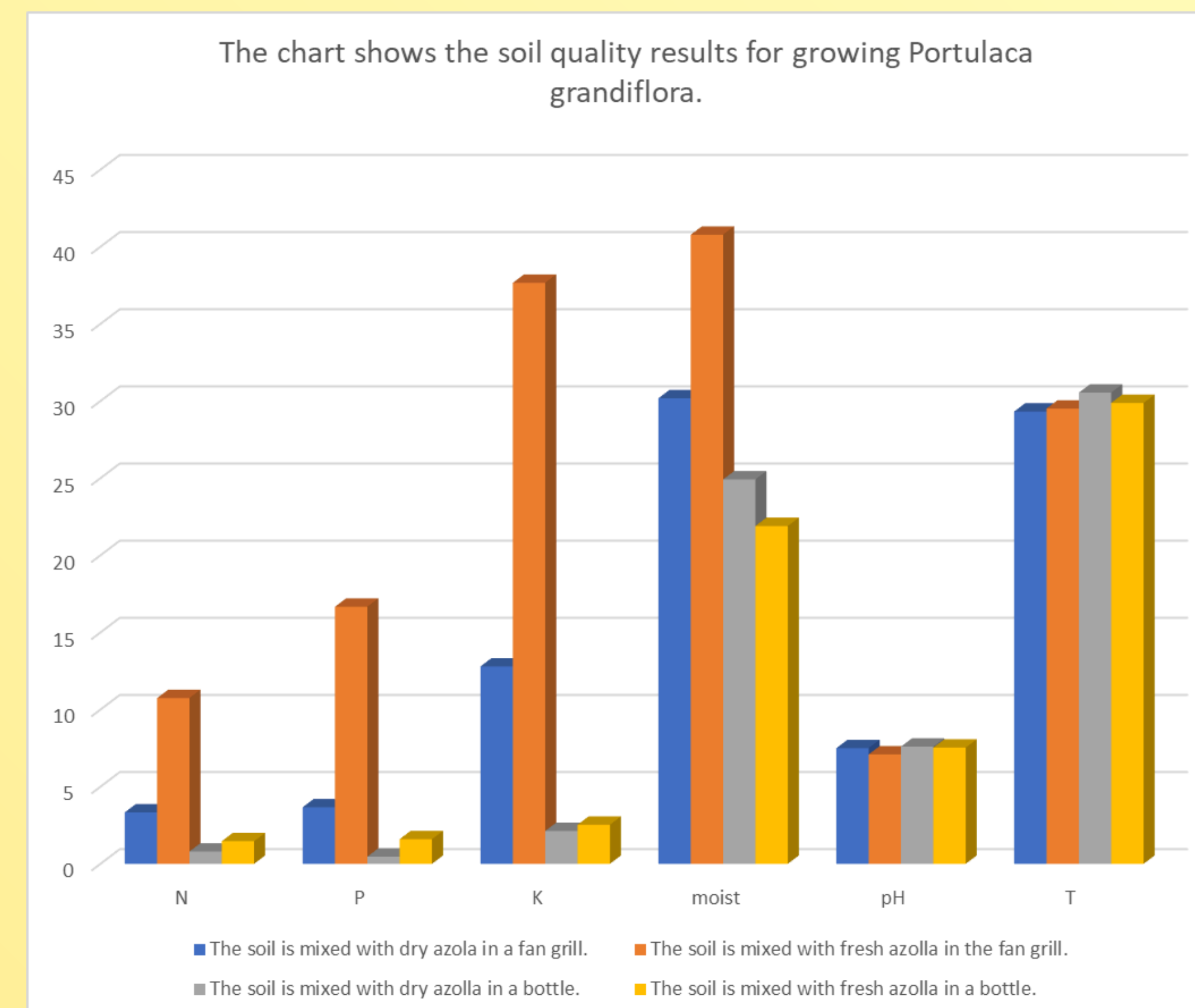
I am a collaborator in *Portulaca grandiflora* research project, working closely with my team to plan and conduct the experiment.

I help collect data, share ideas, and support teamwork to achieve accurate and reliable results.

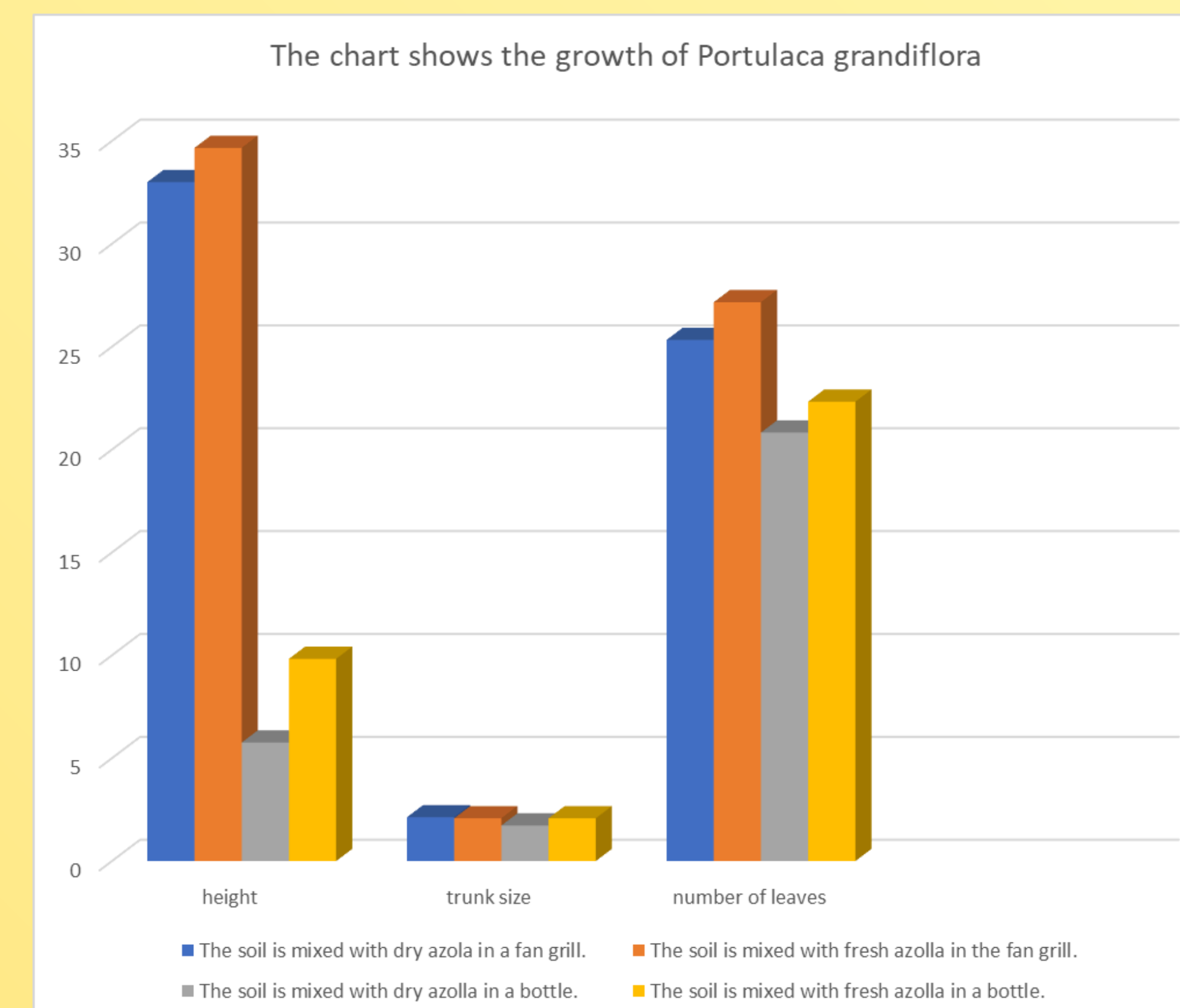
Results

The collection of growth data for *Portulaca grandiflora* should consider environmental factors that affect growth, including soil characteristics, moisture, temperature, light, and nutrient availability. Data were collected regularly, such as plant height, number of leaves, leaf color, and stem strength. The data were then compared across different time periods to analyze the relationships between environmental conditions and plant growth, helping to determine which factors most strongly influence the growth of *Portulaca grandiflora*.

The chart shows the soil quality results for growing *Portulaca grandiflora*.



The chart shows the growth of *Portulaca grandiflora*.



Discussion

The results showed that *Portulaca grandiflora* grown in fabric pots exhibited better growth. This may be due to the fabric pots having a more open structure, which allows better air circulation in the soil, improved drainage, and more appropriate moisture control. As a result, the plant roots were able to grow more effectively. In contrast, planting in plastic pots, which have limited space, may lead to poor air and water drainage, negatively affecting plant growth. Additionally, the use of fresh red azolla as fertilizer provided higher nutrient content in the soil than dried red azolla, because fresh azolla decomposes more rapidly and releases nutrients more efficiently, particularly nitrogen. This increased nutrient availability promotes better growth of *Portulaca grandiflora*, making fresh azolla more effective than dried azolla.

Conclusions

Portulaca grandiflora grown in fan grille covers showed better growth because the fan grille covers have more open space, allowing better air circulation, drainage, and moisture control in the soil. As a result, plant roots can develop more effectively. In contrast, planting in bottles provides limited space, leading to poor air circulation and drainage. In addition, the use of fresh azolla as fertilizer provides more nutrients to the soil than dried azolla because fresh azolla decomposes more quickly and releases nutrients, especially nitrogen, into the soil in greater amounts. Therefore, for farmers or individuals interested in growing *Portulaca grandiflora*, it is recommended to use wide containers to allow better soil aeration and drainage, and to use fresh azolla as fertilizer to enrich the soil, as fresh azolla decomposes rapidly.

Bibliography

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