

ASSESSMENT OF THE EFFECT OF IRRIGATION INTERVALS ON SHOOT LENGTH AND ROOT LENGTH OF RAPHANUS SATIVUS CV PUSA CHETKI

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ABSTRACT

This pot culture experiment aimed to investigate the impact of different irrigation intervals on root and shoot length in Raphanus sativus var. Pusa chetki. The study involved using pots filled with air-dried garden soil, with each pot containing 20 seeds of the specific cultivar. The irrigation intervals tested included 24, 48, 72, and 96 hours, along with a waterlogged condition. After a growth period of 45 days, the shoot and root lengths were measured and subjected to statistical analysis. The findings revealed significant differences in shoot and root lengths between the control group and the various irrigation intervals. The waterlogged treatment resulted in unsuccessful seed germination and subsequent plant mortality. Longer irrigation intervals led to reduced shoot and root growth compared to the control. Additionally, the control group exhibited a higher root length compared to shoot length, whereas plants subjected to irrigation intervals showed the opposite trend. This study reaffirmed that the most favourable results in terms of shoot and root lengths were achieved with a 24-hour irrigation interval (control), while longer intervals yielded inferior outcomes. These findings align with previous research highlighting the negative effects of waterlogging, including decreased respiration rate, impaired water and mineral uptake, and altered hormonal activities in different plant species. Understanding the impact of irrigation intervals on shoot length and root length can inform agricultural practices and optimize crop growth and development.

Keywords: *Irrigation Intervals Treatment, Pot Culture Experiment, Cultivar Pusa Chetki, Shoot - Root Length, Raphanus Sativus.*

Introduction

This research was conducted to explore the impact of irrigation intervals on shoot length and root length in Raphanus sativus var. Pusa chetki. The study involves pot culture experiments conducted under natural environmental conditions.

Pots measuring 15 × 15 inches were filled with 10 kg of air-dried garden soil, each equipped with a drainage hole for control. Twenty seeds of Raphanus sativus variety Pusa chetki were evenly sown at a depth of 5 cm in each pot. The experiment was replicated three times, following standard horticultural practices. To ensure accurate results and avoid contamination, the pots were arranged with sufficient spacing and provided uniform light conditions. After ten days, the pots were observed for seed germination under different irrigation intervals. Garden soil of sandy loam texture served as the growth medium.

The irrigation intervals tested were 24, 48, 72, and 96 hours, along with a waterlogged condition. One litre of tap water was poured into each pot at the specified intervals, except for the waterlogged treatment. The control group received irrigation every 24 hours. After 15 days, seedling survival was recorded, and four plants were retained in each pot under natural conditions. After a total growth period of 45 days, the shoot length and root length were measured.

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The results showed significant differences in shoot length and root length between the control group and the various irrigation intervals. Waterlogged pots exhibited failed germination and plant mortality. The control group, irrigated every 24 hours, showed the maximum shoot and root lengths. Increasing irrigation intervals resulted in inferior growth outcomes.

This study highlights the importance of irrigation intervals in promoting seed germination, shoot length and root length. It confirms the detrimental effects of waterlogging on growth, consistent with previous research. Understanding these findings can contribute to improved agricultural practices and enhanced crop yield. By optimizing irrigation schedules, farmers can maximize the germination potential and overall productivity of *Raphanus sativus* var. Pusa chetki.

Objectives

- To investigate the impact of different irrigation intervals on shoot length and root length in *Raphanus sativus* var. Pusa chetki.
- To examine the survival of seedlings under different irrigation treatments, including waterlogged conditions.
- To measure shoot length and root length after a growth period of 45 days under various irrigation intervals.
- To compare the shoot and root lengths between the control group (24-hour irrigation interval) and other irrigation intervals (48, 72, and 96 hours).
- To analyze the statistical significance of the differences in shoot length and root length between the control and different irrigation intervals.
- To evaluate the relationship between shoot length and root length under different irrigation intervals.
- To contribute to existing knowledge on the detrimental effects of waterlogging, such as decreased respiration rate, inhibition of water and mineral uptake, and altered hormonal activities in plant species.

Material and Methods

In order to investigate the impact of different irrigation intervals on shoot length and root length, pot culture experiments were conducted using *Raphanus sativus* var. Pusa chetki. The plants of this specific cultivar were grown under natural environmental conditions to mimic real-life scenarios.

For the experiments, a series of pots measuring 15 × 15 inches were utilized and filled with 10 kg of air-dried garden soil. Each pot was equipped with a drainage hole to ensure proper water management. In each pot, 20 seeds of *Raphanus sativus* variety Pusa chetki were sown at a depth of 5 cm, with equal spacing between them. The entire experiment was replicated three times to ensure reliable results. Standard horticultural practices were followed throughout the experiment.

To maintain consistent conditions and prevent contamination, the experimental pots were carefully arranged with sufficient spacing. Uniform light conditions were provided to all pots. Ten days after sowing, the pots were examined to assess seed germination under different irrigation intervals. Sandy loam soil was used as the growing medium for the plants.

The irrigation intervals tested included 24, 48, 72, and 96 hours, as well as a waterlogged condition. Except for the waterlogged treatment, each pot received 1 L of tap water at the specified intervals. The control group was subjected to irrigation every 24 hours.

After 15 days of growth, seedling survival was recorded, and four healthy plants were retained in each pot under natural conditions. The shoot length and root length of these plants were measured after a total growth period of 45 days. These experimental procedures allowed for the assessment of the effects of different irrigation intervals on shoot length and root length in *Raphanus sativus* var. Pusa chetki. By carefully controlling the variables and replicating the experiment, reliable data was obtained to analyze the impact of irrigation intervals on the growth and development of the plants.

Result and Discussion

The study assessed the effects of different irrigation intervals on the shoot and root length of *Raphanus sativus* var. Pusa chetki over a 45-day growth period. Statistical analysis revealed highly significant differences between the control group (irrigated every 24 hours) and the various irrigation intervals.

In the waterlogged treatment, the germinated seeds could not survive, resulting in plant mortality. After 45 days, no growth was observed in the waterlogged pots. In contrast, the control group exhibited a shoot length of 20.8 cm and a root length of 19.2 cm. However, under the 96-hour irrigation interval, the shoot length decreased to 12.8 cm, while the root length decreased to 15.9 cm. A slight inhibition in shoot-root length was observed in the 48-hour irrigation interval compared to the control. Notably, in the control group, the root length was slightly greater than the shoot length, whereas in plants subjected to irrigation intervals, the shoot length was less than the root length.

The results demonstrated that the most favourable shoot and root lengths were achieved with a 24-hour irrigation interval (control). Increasing the irrigation intervals beyond 24 hours resulted in inferior growth outcomes. Reduced shoot and root growth due to flooding was also reported by Minchin et al (1977) in cowpea, Scott et al (1989) in soybean and Singh and Singh (1991) in Brassica juncea.

The findings from this study contribute to the understanding of the relationship between irrigation intervals and plant growth in *Raphanus sativus* var. Pusa chetki. The results highlight the importance of maintaining optimal irrigation schedules to promote shoot and root development. By implementing appropriate irrigation practices, farmers can optimize crop growth and productivity.

It is worth noting that further research could explore additional factors, such as temperature, nutrient availability, and hormonal treatments, to gain a comprehensive understanding of their influence on plant growth. This would enhance our knowledge of how to effectively manage irrigation and maximize crop yields while minimizing the negative impacts of waterlogging.

Table 1: Showing the assessment of the effect of irrigation intervals on shoot length and root length of *Raphanus sativus* cv Pusa chetki

Sr. No.	Irrigation Intervals (hours)	Shoot length (cm)	Root length (cm)
1	Control (24 hrs)	20.8	19.2
2	48 hrs	18.2	18.2
3	72 hrs	15.5	16.0
4	96 hrs	12.8	15.9
5	Water logging	-	-

(Values represent the mean of three replicates)

F-ratios: (Control vs Treatment)

- Shoot length = 2978.545***
- Root length = 2788.208***

Waterlogging has detrimental effects on plants, including decreased respiration rate, inhibition of water and mineral uptake, and altered hormonal activities. In a study on *Cicer arietinum* (cv H355), Krishnamurthy et al. (1987) observed these effects, while Orchard et al. (1984) reported similar findings in Sorghum and sunflower. These studies highlight the negative consequences of waterlogging on plant physiology and emphasize the importance of preventing waterlogging in agricultural systems to ensure optimal growth and development.

Conclusion

In conclusion, this experiment looked at how different irrigation intervals affect the growth of *Raphanus sativus* var. Pusa chetki seeds. The results showed that the control group, which received irrigation every 24 hours, had the best shoot and root growth. On the other hand, longer intervals between irrigation led to less growth in both the shoot and root. The waterlogged treatment had a negative impact, with the seeds failing to germinate and the plants dying. Interestingly, in the control group, the roots were longer than the shoots, but in the other groups, it was the opposite.

These findings emphasize the importance of getting the right balance in irrigation intervals to support seed germination and plant growth. Farmers can use this knowledge to make better decisions and improve their crop yields. It's also important to provide good drainage to prevent waterlogging, as this can harm plant growth.

Overall, this study highlights the significance of irrigation intervals in helping seeds grow and develop into healthy plants. It provides useful information for farmers and researchers who want to optimize their agricultural practices and overcome the challenges of waterlogging.

- **Conflict of Interest:** The author declares no conflict of interest.
- **Data Availability Statement:** The data will be made available on suitable request.

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