



Research Article

Effect of Foliar Application of Urea on Growth and Yield of Radish (*Raphanus sativus* L.) under Field Conditions in Parwan, Afghanistan

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Received : June 15, 2025

Revised : July 17, 2025

Accepted : August 12, 2025

Available online : September 20, 2025

How to Cite: Abdul Jabar Charkhi, & Agha Mohammad Mohammadi. (2025). Effect of Foliar Application of Urea on Growth and Yield of Radish (*Raphanus sativus* L.) under Field Conditions in Parwan, Afghanistan. *INTERDISIPLIN: Journal of Qualitative and Quantitative Research*, 2(5), 319-323. <https://doi.org/10.61166/interdisiplin.v2i5.123>

Abstract. This study investigated the effect of foliar application of urea on the growth and yield of radish (*Raphanus sativus* L.) under field conditions in Parwan province, Afghanistan. A randomized complete block design (RCBD) with five treatments (0 g/L, 1 g/L, 2 g/L, 3 g/L, and 4 g/L urea) and three replications was used. Results indicated that foliar application of urea significantly improved plant growth and yield parameters. The highest values for plant height, leaf number, root length, root diameter, and root fresh weight were recorded at 3 g/L and 4 g/L urea concentrations, with 4 g/L producing the maximum. These findings suggest that foliar urea application enhances nitrogen use

efficiency, increases radish productivity, and offers a sustainable approach to vegetable production in Afghanistan.

Keywords: Radish, Urea, Foliar application, Growth, Yield.

INTRODUCTION

Radish (*Raphanus sativus* L.) is a fast-growing and short-duration root vegetable belonging to the family Brassicaceae. It is cultivated worldwide for its edible roots and leaves, which are consumed either fresh or cooked. Due to its rapid growth cycle, radish can be harvested 60 days after sowing, making it an attractive crop for smallholder farmers (Shilpa et al., 2023; Lavanya et al., 2017). Nutritionally, radish is rich in vitamins (A, C, and B-complex) and minerals (calcium, potassium, magnesium, and iron) (Abd, F. A., and Ibrahim, N. S. 2025). Nutrient management, especially nitrogen supply, plays a crucial role in its productivity. Urea, a concentrated nitrogen fertilizer, is widely used but often suffers losses when applied to soil (Motasim, et al. 2024). Foliar application improves efficiency by direct absorption through leaves. Despite positive results elsewhere, limited studies exist under Afghan agro-climatic conditions (Gulab, G. et al., 2019). Therefore, this study aimed to evaluate the effect of different concentrations of foliar-applied urea on radish growth and yield in Parwan province, Afghanistan.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Faculty of Agriculture, Parwan University, during the 1404 cropping season. The site experiences cold winters and mild summers, with sandy loam soil. Soil analysis indicated pH 7.3, 1.4 g/L organic matter, and 54 kg ha⁻¹ available nitrogen.

Experimental Design and Treatments

A Randomized Complete Block Design (RCBD) with five treatments and three replications was used. Treatments included: T₀ (0 g/L urea), T₁ (1 g/L urea), T₂ (2 g/L urea), T₃ (3 g/L urea), and T₄ (4 g/L urea).

Crop Management

Local radish seeds were sown in 2.0 m × 1.5 m plots with 20 cm row spacing and 10 cm plant spacing. Standard agronomic practices were applied. Foliar spraying of urea was conducted at 20 and 35 days after sowing using a knapsack sprayer. Basal fertilizers (40 kg P₂O₅ ha⁻¹ and 30 kg K₂O ha⁻¹) were applied uniformly.

Data Collection

Data were recorded on plant height, number of leaves, leaf length, leaf width, leaf fresh weight, root length, root diameter, and root fresh weight. Measurements were taken from five randomly selected plants per plot.

Statistical Analysis

Data were analyzed using ANOVA in SPSS (v25). Means were separated using LSD at the 5% significance level. Coefficients of variation (CV) were also calculated.

RESULTS

Growth Parameters

Foliar application of urea significantly affected plant growth. The highest plant height (29.86 cm) was observed in 4 g/L urea, followed by 3 g/L urea (26.02 cm), while the control had the lowest (20.28 cm). Number of leaves, leaf length, and width also increased significantly with higher urea levels.

Table 1. Effect of foliar urea application on growth parameters of radish

Treatment	Plant height (cm)	No. of leaves plant ⁻¹	Leaf length (cm)	Leaf width (cm)	Leaf fresh weight (g)
T ₀ (0 g/L)	20.28 c	8.6 c	18.4 c	6.2 c	38.5 c
T ₁ (1 g/L)	22.34 bc	9.5 bc	19.6 bc	7.1 bc	45.2 bc
T ₂ (2 g/L)	24.10 b	10.4 b	21.7 b	7.8 b	52.9 b
T ₃ (3 g/L)	26.02 ab	11.3 ab	23.9 ab	8.9 ab	61.7 ab
T ₄ (4 g/L)	29.86 a	12.5 a	25.3 a	9.8 a	68.4 a

Values followed by different letters within a column are significantly different at $p \leq 0.05$ according to LSD test.

Yield Parameters

Root traits were significantly influenced by foliar urea application. The maximum root length (16.7 cm), root diameter (4.6 cm), and root fresh weight (156.2 g) were obtained from 4 g/L urea, followed by 3 g/L urea. The lowest values were recorded in the control.

Table 2. Effect of foliar urea application on yield parameters of radish

Treatment	Root length (cm)	Root diameter (cm)	Root fresh weight (g)
T ₀ (0 g/L)	11.4 c	3.1 c	102.8 c
T ₁ (1 g/L)	12.6 bc	3.4 bc	116.3 bc
T ₂ (2 g/L)	14.2 b	3.9 b	128.7 b
T ₃ (3 g/L)	15.3 ab	4.2 ab	141.6 ab
T ₄ (4 g/L)	16.7 a	4.6 a	156.2 a

Values followed by different letters within a column are significantly different at $p \leq 0.05$ according to LSD test.

DISCUSSION

The superior performance of 3–4 g/L urea application in radish can be explained by enhanced nitrogen assimilation, promoting chlorophyll synthesis, leaf expansion, and carbohydrate accumulation in roots. Similar effects were reported by Shirani and Seran (2009) and Bharathi and Kamalakannan (2024). Nitrogen-deficient control plants showed poor growth and yield, consistent with Muñoz-Huerta, et al. (2013). While 4 g/L urea was most effective, excessive application may reduce nitrogen use efficiency or cause leaf scorching (Fageria et al., 2010). These results suggest that foliar urea improves nitrogen efficiency and radish productivity under Afghan conditions. Further multi-location and multi-season trials are recommended.

CONCLUSION AND RECOMMENDATIONS

This study demonstrated that foliar application of urea at 3–4 g/L significantly improves the growth and yield of radish in Parwan. Plants treated with 4 g/L urea exhibited maximum values for plant height, leaf traits, and root parameters. Foliar feeding enhanced nitrogen efficiency and reduced potential losses compared to soil-only applications. From an economic perspective, 3–4 g/L foliar urea is cost-effective for smallholder farmers, while environmentally it minimizes nitrogen leaching and volatilization. Therefore, foliar urea is recommended as a sustainable practice for radish production in Afghanistan. Future studies should explore long-term effects, economic benefits, and integration with organic fertilizers or biostimulants.

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