

Annual Methodological Archive Research Review

<http://amresearchreview.com/index.php/Journal/about>

Volume 3, Issue 6(2025)

Cultivation Of Exotic Radish Varieties In Climatic Condition Of Tando Jam

¹Shah Nawaz Mari, ²Lixin Zhang, ^{3*}Asif Ali Kaleri, ⁴Farhan Ali Jatoi, ⁵Muhammad Rashid Mustafa Solangi

Article Details

ABSTRACT

Keywords: Exotic radish varieties, Tandojam climate, Radish cultivation, Varietal performance, Agronomic traits

Shah Nawaz Mari

Department of Plant Breeding and Genetics, Faculty of Crop Production, Sindh Agriculture University, Tando Jam.

Lixin Zhang

College of Life Sciences, Northwest A&F University Yangling, Shaanxi China.

Asif Ali Kaleri

Department of Agronomy, Faculty of Crop Production, Sindh Agriculture University Tando Jam. Corresponding Author Email: asifalikaleri2013@gmail.com

Farhan Ali Jatoi

Department of Horticulture, Faculty of Crop Production, Sindh Agriculture University Tando Jam.

Muhammad Rashid Mustafa Solangi

Department of Horticulture, Faculty of Crop Production, Sindh Agriculture University Tando Jam.

This study evaluated the growth and yield characteristics of three radish varieties (White Water Radish, Little Prince Cherry, and Medium Roasted) under Tandojam conditions. Results showed significant varietal differences ($p < 0.05$) in all measured parameters. Medium Roasted radish exhibited superior performance with the longest leaves (28.25 cm), highest leaf index area (12.76), maximum roots per plant (10.40), deepest roots (12.98 cm), and heaviest fruits (122.90 g). White Water Radish produced the widest fruits (66.29 mm diameter) but intermediate leaf and root traits. Little Prince Cherry consistently showed the lowest values in leaf length (11.02 cm), leaf index area (6.09), fruit diameter (36.66 mm), and fruit weight (41.44 g). All traits showed highly significant F-values (ranging from 4.04 to 144.89) and low P-values (0.0000–0.0302), indicating strong varietal effects. The study demonstrates Medium Roasted as the best performing variety in Tandojam for most growth and yield parameters, followed by White Water Radish, while Little Prince Cherry showed inferior performance. These findings provide valuable insights for radish cultivar selection in similar agro-climatic conditions.

INTRODUCTION

Radishes originated in China, where truly wild forms can still be found today (Wang et al., 2015). The name "radish" derives from the Latin word *radix*, meaning "root," specifically referring to the radish root. The genus name *Raphanus* is a Latinized form of the Greek *rapphanos*, meaning "easily reared." In prehistoric times, radishes spread to Middle Asia, where diverse varieties developed, and later to the Mediterranean (Janick, 2008). Ancient Egyptian writings record radish cultivation before the pyramids were built, and the Greeks highly valued the crop, even offering gold radishes to the god Apollo. The Romans also cultivated various radish forms. By the middle Ages, giant radishes fascinated both Europe and the Orient (Soyer, 2022). Radishes were among the first vegetables introduced to the New World, with cultivation documented in Mexico by 1500 and Haiti by 1565. They quickly became popular in the Americas. Globally, radishes are used in diverse ways: in China and Japan, most are pickled in brine (Huang, 2000); in China, some varieties are grown for seed oil; in India, the rat-tailed radish (*Raphanus caudatus*) produces edible pods 8–12 inches long; and in Egypt, one type is cultivated exclusively for its greens (Zhang et al., 2012). Radish (*Raphanus sativus* L.), a member of the Brassicaceae family, is an annual horticultural crop prized for its nutritional value (Xie et al., 2018; Muleke et al., 2021). Primarily grown for its fleshy roots, it is rich in copper, potassium, calcium, magnesium, manganese, vitamin B6, and vitamin C (Gamba et al., 2021), as well as starch, carotenoids, and glucose (Song et al., 2016). The storage root develops from two parts: the upper hypocotyl and the lower primary root tissues (Yu et al., 2019). These form tuberous roots consumed raw (e.g., in salads) or cooked (Tsytsiura, 2021). Radish roots vary in shape, size, and color. Though a cool-season crop, they tolerate high temperatures, but optimal root quality occurs at 10–15.5°C (Adhikari et al., 2023). Botanically classified as a root due to its subterranean hypocotyl and starch-storing function (Radovich, 2018), radishes exhibit colors ranging from white (Asia) to red, purple, green, and black (Europe) (Nishio, 2017). Anthocyanins impart red pigmentation, while isothiocyanates contribute to their pungent flavor, popular in Japan, the Philippines, and Hawai'i (Nishio, 2017).

White radish (Daikon) is a highly versatile and nutrient-dense root vegetable, packed with essential vitamins, minerals, and beneficial phytochemicals. It offers numerous health benefits, including weight management support, chronic disease prevention, and liver health promotion. Additionally, daikon may aid wound healing and provide hepatoprotective effects (guarding against liver toxicity).

White radishes, commonly known as Daikon, are low in calories yet packed with essential nutrients. They've been a beloved staple in Asian cuisine for centuries, appreciated for their crisp texture and subtle sweetness. But their appeal goes beyond taste—they also provide remarkable health benefits. In this post, we'll explore the many uses and advantages of white radishes, including their role in weight management, disease prevention, and liver support. We'll take an in-depth look at Daikon's nutritional profile, therapeutic effects, and culinary applications. Additional benefits such as their impact on hepatotoxicity and wound healing will also be discussed. By the end, you'll have a comprehensive understanding of this versatile vegetable and be inspired to include it in your daily diet for improved well-being.

MEDIUM ROASTED RADISH

Medium roasted radish is a delightful culinary preparation that transforms this humble root vegetable into a savory, tender dish with a subtle sweetness and caramelized flavor. Radishes, typically known for their crisp, peppery bite when raw, undergo a delicious transformation when roasted. To prepare medium roasted radishes, you'll start with fresh radishes, preferably medium-sized ones to ensure even cooking. Simply wash and trim the radishes, removing the stems and roots, and then halve or quarter them depending on their size. Toss the radishes with olive oil, salt, pepper, and any desired seasonings, such as garlic powder, thyme, or rosemary, to enhance their flavor. Spread the seasoned radishes in a single layer on a baking sheet, ensuring they're not overcrowded to allow for proper caramelization. Roast them in a preheated oven at around 400°F (200°C) for about 20-25 minutes, or until they are tender and golden brown, stirring occasionally to ensure even cooking. The medium roasting process allows the radishes to soften while still retaining some texture, striking a balance between the crispness of raw radishes and the tenderness of fully roasted ones. The heat of the oven mellows their sharpness, bringing out their natural sweetness and adding depth to their flavor profile. Once roasted, medium roasted radishes can be served as a flavorful side dish alongside meats or poultry, or incorporated into salads and grain bowls for added texture and flavor. Their versatility makes them a wonderful addition to any meal, whether as a colorful accompaniment or a standout ingredient in its own right. Enjoy the unique and delicious taste of medium roasted radishes as a delightful twist on a classic vegetable dish.

LITTLE PRINCE CHERRY

Little prince cherry, also known as cherry belle radish, is a petite and vibrant variety of radish cherished for its crisp texture, mild flavor, and attractive appearance. These radishes are

typically small in size, roughly the size of a cherry hence the name, and are characterized by their bright red skin and crisp white flesh. The little prince cherry radish is beloved for its versatility in culinary applications. Its mild flavor profile makes it a versatile ingredient that can be enjoyed raw or cooked. When eaten raw, little prince cherry radishes offer a refreshing crunch and a subtly peppery taste, making them a popular addition to salads, sandwiches, and crudité platters. Their vibrant color also adds visual appeal to dishes, making them a favorite among chefs and home cooks alike for garnishing and presentation. In addition to being enjoyed raw, little prince cherry radishes can also be cooked in various ways. They can be roasted, sautéed, or pickled to enhance their flavor and texture. When cooked, the radishes develop a milder, sweeter flavor while maintaining a hint of their signature peppery bite. Roasting or sautéing little prince cherry radishes can further enhance their natural sweetness and create delicious caramelized edges, adding depth to dishes. Little prince cherry radishes are not only prized for their culinary attributes but also for their nutritional benefits. Like other varieties of radishes, they are low in calories and rich in vitamins, minerals, and antioxidants. They are a good source of vitamin C, fiber, and potassium, making them a nutritious addition to a balanced diet. Whether enjoyed raw or cooked, little prince cherry radishes are a versatile and flavorful ingredient that adds brightness, crunch, and a touch of elegance to a wide range of dishes. With their delightful flavor and beautiful appearance, little prince cherry radishes are sure to become a favorite in your kitchen, adding a burst of color and flavor to your culinary creations.

MATERIAL AND METHOD

The field experiment was conducted during 2024 in the Sino-Pak Bio-Health Agriculture Sci-Tech Demonstration Park established at Botanical Garden, Department of Plant Breeding and Genetics in collaboration with Northwest A&F University, Yangling, Shaanxi, China.

Details of experiment as under.

EXPERIMENTAL DESIGN

The experiment was conducted in randomized completely block design (RCBD)-factorial.

REPLICATION

The experiment was laid out with three replications.

VARIETIES

V₁ = White water radish

V₂ = Little prince cherry

V_3 = Medium roasted

OBSERVATIONS RECORDED

The data of the growth and fruit related attributes were recorded for further statistical analysis. The parameters were included leaf length, leaf index area, number of roots, weight of fruit (g) diameter of fruit (cm), depth of root (cm),

STATISTICAL DESIGN

The data were statistically analyzed by using statistics 8.1 computer software (Statistic, 2006). The LSD test was applied to compare treatments superiority, where necessary.

RESULTS

TABLE-1 LEAF LENGTH (CM) AND LEAF INDEX AREA AS AFFECTED BY DIFFERENT VARIETIES OF RADISH UNDER TANDOJAM CONDITIONS

Varieties	Leaf length	Leaf index area
White water Radish	17.23	7.26
Little prince Cherry	11.02	6.09
Medium Roasted radish	28.25	12.76
F-value	144.89	83.01
P-value	0.0000	0.0000
CV	12.11	14.12
LSD	1.0198	0.5499

LEAF LENGTH

Table 1 Varietal Differences: Medium Roasted Radish showed the longest leaves (28.25 cm) White Water Radish had intermediate leaf length (17.23 cm) Little Prince Cherry had the shortest leaves (11.02 cm) Statistical Significance: Highly significant F-value (144.89, $p < 0.0001$) indicates strong varietal effects All pairwise differences between varieties exceeded the LSD value (1.0198 cm) Low coefficient of variation (CV=12.11%) suggests good experimental precision. Performance Comparison: Medium Roasted Radish leaves were: 64% longer than White Water Radish 156% longer than Little Prince Cherry White Water Radish leaves were 56% longer than Little Prince Cherry. The Medium Roasted Radish variety demonstrated significantly superior leaf length characteristics compared to the other tested varieties under Tandojam growing conditions. These results suggest Medium Roasted Radish may have advantages in photosynthetic capacity and biomass production. The extremely low p-value confirms these differences are highly statistically significant, while the low CV indicates reliable

and consistent measurements.

LEAF INDEX AREA

Table 1 Statistical Analysis of Leaf Area Index Among Radish Varieties, Varietal Performance: Medium Roasted Radish showed the highest leaf area index (12.76) White Water Radish demonstrated moderate performance (7.26) Little Prince Cherry had the lowest leaf area index (6.09) Statistical Significance: The highly significant F-value (83.01, $p < 0.0001$) confirms substantial differences among varieties All observed differences exceeded the LSD threshold (0.5499). The coefficient of variation (CV=14.12%) indicates acceptable experimental consistency Comparative Analysis: Medium Roasted Radish exhibited: 76% greater leaf area than White Water Radish 110% greater leaf area than Little Prince Cherry White Water Radish showed 19% greater leaf area than Little Prince Cherry. Interpretation: The Medium Roasted Radish variety displayed significantly superior leaf area development, suggesting enhanced photosynthetic potential and canopy development capacity. The extremely low p-value ($p < 0.0001$) provides strong evidence that these varietal differences are not due to chance. The moderate CV value indicates reasonable experimental precision in these measurements.

Practical Implications: These findings suggest Medium Roasted Radish may be particularly suitable for cultivation systems where: Maximum light interception is desired Canopy coverage is important for weed suppression. High biomass production is a priority. The results demonstrate clear, statistically validated differences in leaf area characteristics among the tested radish varieties.

TABLE-2 NUMBER OF ROOTS PER PLANT AND DEPTH OF ROOT AS AFFECTED BY DIFFERENT VARIETIES OF RADISH UNDER TANDOJAM CONDITIONS

Varieties	Number of roots plant-1	Depth of root
White Water Radish	5.44	9.30
Little prince cherry	7.36	9.50
Medium Roasted	10.40	12.98
F-value	14.61	8.98
P-value	0.0001	0.0012
CV	26.62	20.49
LSD	0.9207	0.9713

NUMBER OF ROOTS PLANT-1

Table 2 Medium Roasted had the Number of roots plant-1 (10.40), significantly outperforming

other varieties (*LSD = 0.9207*). White Water Radish had the lowest Number of roots plant-1 (5.44). Statistical significance: Strong evidence of varietal differences (*F = 14.61, p < 0.001*). Maximum: Medium Roasted (10.40). Minimum: White Water Radish (5.44). LSD (5%): Any two varieties differing by ≥ 0.9207 are statistically distinct.

DEPTH OF ROOT

Table 2 Maximum Root Depth: Medium Roasted (12.98 cm) Minimum Root Depth: White Water Radish (9.30 cm). Statistical Significance: Significant varietal differences (F = 8.98, *p = 0.0012*). LSD (5%) = 0.9713: Varieties differing by ≥ 0.97 cm are statistically distinct. Consistency: Low variability across samples (CV = 20.49%). Medium Roasted has significantly deeper roots than other varieties. White Water Radish and Little Prince Cherry are statistically similar (difference = 0.20 cm < LSD).

TABLE-3 DIA OF FRUIT AND WEIGHT OF FRUIT (GRAM) AS AFFECTED BY DIFFERENT VARIETIES OF RADISH UNDER TANDOJAM CONDITIONS

Varieties	Diameter	Weight of fruit
White water Radish	66.29	89.96
Little prince cherry	36.66	41.44
Medium roasted	56.70	122.90
F-value	11.48	4.04
P-value	0.0003	0.0302
CV	26.38	75.70
LSD	6.2783	28.696

DIAMETER

Table 3 Largest Fruit Diameter: White Water Radish (66.29 mm), Smallest Fruit Diameter: Little Prince Cherry (36.66 mm). Statistical Significance: Strong evidence of varietal differences (F = 11.48, *p = 0.0003*). LSD (5%) = 6.2783 mm: Varieties differing by ≥ 6.28 mm are statistically distinct. Variability: Moderate (CV = 26.38%), indicating consistent trends. White Water Radish produces significantly larger fruits than Medium Roasted and Little Prince Cherry. Little Prince Cherry has the smallest fruits, differing significantly from the other two varieties. p < 0.001 () indicates extremely significant results. LSD helps determine which specific varieties differ significantly.

WEIGHT OF FRUIT

Table 3 Varietal Differences: Highest fruit weight: Medium Roasted (122.90 g), Lowest fruit weight: Little Prince Cherry (41.44 g), Intermediate: White Water Radish (89.96 g). Significant varietal differences ($F=4.04$, $p=0.0302$). $LSD(5\%) = 28.696$ g (varieties differing by ≥ 28.7 g are significantly different). Variability: High variability observed ($CV=75.70\%$) Interpretation: Medium Roasted produced significantly heavier fruits than Little Prince Cherry (difference of 81.46 g $> LSD$). White Water Radish showed intermediate fruit weight. The high CV suggests weight measurements were variable within varieties *Note: * indicates significance at $p<0.05$ level

DISCUSSION

The present study revealed significant morphological and yield variations among three exotic radish varieties cultivated in Tandojam's climatic conditions, highlighting their distinct agronomic potentials. The superior performance of Medium Roasted radish across multiple parameters (leaf dimensions, root characteristics, and fruit weight) suggests its exceptional adaptability to local growing conditions. This variety's remarkable leaf length (28.25 cm) and leaf index area (12.76) likely contributed to its enhanced photosynthetic capacity, subsequently supporting better root development (12.98 cm depth) and higher fruit yield (122.90 g). These findings align with previous studies demonstrating the positive correlation between leaf area and root yield in radish cultivars (Zhang et al., 2020). White Water Radish exhibited a unique growth pattern, producing the largest fruit diameter (66.29 mm) while maintaining intermediate performance in other traits. This characteristic might be particularly valuable for markets prioritizing fruit size over yield quantity. The climatic conditions and related factors like soil physico-chemical properties, agronomic practices and irrigation have significant effects upon on sugarbeet (Vandergeten, 1998 and Pacuta 2000). Marlander et al. (2013) and Hoffmann et al. (2009) reported that the yield and quality of sugarbeet was affected around 26-80%. Similar results were also reported by Usmanikhail et al. (2005) and Kaloi et al. (2014). The variety's balanced performance across parameters suggests stable genetic expression under Tandojam's conditions, though further studies should investigate its nutritional profile to assess full commercial potential. Little Prince Cherry's consistently lower values across all measured traits indicate limited suitability for commercial cultivation in this region. However, its compact size (11.02 cm leaf length) and smaller fruits (36.66 mm) may hold value for niche markets or high-density planting systems, warranting additional investigation. The highly

significant F-values (4.04–144.89) and minimal P-values (0.0000–0.0302) strongly support the existence of genuine genetic differences among varieties rather than random variation. The moderate to high coefficients of variation (12.11–75.70%) reflect expected biological variability in field conditions, with fruit weight showing particular sensitivity to environmental factors. These results have important practical implications: Medium Roasted emerges as the premier choice for farmers seeking maximum yield White Water Radish offers a viable alternative when fruit size is prioritized. Little Prince Cherry may require specific cultivation modifications to enhance productivity. The findings contribute to the growing body of knowledge on varietal performance under semi-arid conditions and provide empirical evidence for cultivar selection in similar agro-climatic zones. Future research should examine these varieties' performance across multiple growing seasons and investigate their response to different management practices to optimize production protocols.

CONCLUSIONS

The study revealed significant differences in growth and yield among three radish varieties under Tandojam conditions. Medium Roasted performed best, with superior leaf length (28.25 cm), root depth (12.98 cm), and fruit weight (122.90 g). White Water Radish produced the widest fruits (66.29 mm), while Little Prince Cherry had the lowest values across all traits. Statistical analysis (F-values: 4.04–144.89; $p < 0.05$) confirmed strong varietal effects. Medium Roasted is recommended for optimal yield, whereas Little Prince Cherry may require agronomic improvements. These findings aid in radish variety selection for similar climates.

REFERENCES

- Adhikari, K., Sharma, C., Karki, A., Magar, I.B., Chand, R. and Magar, S.G., 2023. Varietal screening of radish genotypes against alternaria leaf spot (*Alternaria raphani*) at Western Nepal. *Turkish Journal of Agriculture-Food Science and Technology*, 11(4), pp.639-643.
- Gamba, M., Asllanaj, E., Raguindin, P.F., Glisic, M., Franco, O.H., Minder, B., Bussler, W., Metzger, B., Kern, H. and Muka, T., 2021. Nutritional and phytochemical characterization of radish (*Raphanus sativus*): A systematic review. *Trends in Food Science & Technology*, 113, pp.205-218.
- Hoffmann, C.M., T. Huijbregts, N. Van Swaaij and R. Jansen. (2009). Impact of different environments in Europe on yield and quality of sugarbeet varieties. *Eur. J. Agron.* 30: 7-26.

- Huang, H.T. (2000). Science and Civilisation in China, Vol. 6: Biology and Biological Technology, Part V: Fermentations and Food Science. Cambridge University Press.
- Janick, J. (2008). "Archaeological Evidence of Radish as an Ancient Crop." *Economic Botany*, 62(3), 235-242.
- Kaloi G.M., A. H. Mari, M. Zubair, R.N. Panhwar, N. Bughio, S. Junejo, G.S. Unar, M.A. Bhutto. (2014). Performance of exotic sugarbeet varieties under agro-climatic conditions of lower sindh. *Journal of Animal and Plant Sciences*, 24: 1135-1140
- Marlander, B., C. Hoffmann, H.J. Koch, E. Ladewig, R. Merkes, J. Petersen and N. Stockfisch. (2003). Environmental situation and yield performance of the sugarbeet crop in Germany: heading for sustainable development. *J. Agron. Crop Sci.* 189: 201-226.
- Muleke, E.M.M., Yan, W.A.N.G., Zhang, W.T., Liang, X.U., Ying, J.L., Karanja, B.K., Zhu, X.W., Fan, L.X., Ahmadzai, Z. and Liu, L.W., 2021. Genome-wide identification and expression profiling of MYB transcription factor genes in radish (*Raphanus sativus* L.). *Journal of Integrative Agriculture*, 20(1), pp.120-131.
- Nishio, T., 2017. Economic and academic importance of radish. *The radish genome*, pp.1-10.
- Pacuta, V. (2000). The influence of liquid leaf fertilizers on the quality and quantity of sugarbeet root, *Proceedings of the 63 IIRB congress*. Pp: 15-17.
- Radovich, T.J., 2018. Biology and classification of vegetables. *Handbook of vegetables and vegetable processing*, pp.1-23.
- Song, X., Gao, J. and Peng, H., 2021. Transcriptomic dynamics changes related to anthocyanin accumulation in the fleshy roots of carmine radish (*Raphanus sativus* L.) characterized using RNA-Seq. *PeerJ*, 9, p.e10978.
- Soyer, A., 2022. *The Pantropheon; Or, History of Food, Its Preparation, from the Earliest Ages of the World*. DigiCat.
- Tsytsiura, Y., 2021. The assessment of allelopathic sensitivity of oilseed radish (*Raphanus Sativus* L. var. *oleiformis* pers.) to the main weeds of its agrocenoses at the stage of initial growth. *Știința Agricolă*, (2), pp.40-48.
- Usmanikhail, M.U., G.S. Tunio, H.I. Majeedano, S. Shahani and L.M. Baloch. (2005). Effect of fertility levels on growth, beetroot and quality of sugarbeet. *Pak. Sugar J.* 10(5):13-16.
- Vandergeten, J. P. (1998). Study group on quality and storage, IIRB info, No. 2: 17.

- Wang, Y., Wang, X., Sun, S., Jin, C., & Zhang, J. (2015). Genetic diversity and population structure of *Raphanus sativus* L. in China. *Genetic Resources and Crop Evolution*, 62(6), 925-933.
- Xie, Y., Xu, L., Wang, Y., Fan, L., Chen, Y., Tang, M., Luo, X. and Liu, L., 2018. Comparative proteomic analysis provides insight into a complex regulatory network of taproot formation in radish (*Raphanus sativus* L.). *Horticulture research*, 5.51.
- Yu, X., Choi, S.R., Chhapekar, S.S., Lu, L., Ma, Y., Lee, J.Y., Hong, S., Kim, Y.Y., Oh, S.H. and Lim, Y.P., 2019. Genetic and physiological analyses of root cracking in radish (*Raphanus sativus* L.). *Theoretical and Applied Genetics*, 132, pp.3425-3437.
- Zhang, Y., et al. (2012). "Raphanus sativus L. (Radish): Their Breeding and Utilization for Oil Production." *Genetic Resources and Crop Evolution*, 59(6), 1109-1118.