



Assessment of Yield Contributing Traits Using Correlation Coefficient Analysis in Date Palm (*Phoenix dactylifera* L.) Cultivars from Southern India

Jenito Samuel, S K ^{a++}, V. Gopi ^{a*}, B. Gopu ^a and R. Sathya ^b

^a Department of Fruit Science, SRM College of Agricultural Sciences, SRM Institute of Science and Technology, Baburayanpettai, Chengalpattu, Tamil Nadu, India.

^b Department of Plant Breeding and Genetics, SRM College of Agricultural Sciences, SRM Institute of Science and Technology, Baburayanpettai, Chengalpattu, Tamil Nadu, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/ijpss/2025/v37i85636>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://pr.sdiarticle5.com/review-history/141010>

Original Research Article

Received: 25/05/2025
Published: 30/07/2025

ABSTRACT

Aims: The main objectives of the study is to evaluate the yield contributing characters in date palm cultivars at Ariyakulam village, Dharmapuri district of Tamil Nadu.

Study Design: Randomized block design (RBD).

Place and Duration of Study: The research experiment was carried out in 15 different date palm cultivars at Ariyakulam, Dharmapuri district, Tamil Nadu in the year 2024-2025.

⁺⁺PG – Scholar;

*Corresponding author: E-mail: gopiv@srmist.edu.in, gopipomo95@gmail.com;

Cite as: S K, Jenito Samuel, V. Gopi, B. Gopu, and R. Sathya. 2025. "Assessment of Yield Contributing Traits Using Correlation Coefficient Analysis in Date Palm (*Phoenix Dactylifera* L.) Cultivars from Southern India". *International Journal of Plant & Soil Science* 37 (8):348-53. <https://doi.org/10.9734/ijpss/2025/v37i85636>.

Methodology: The 15 date palm cultivars, such as Barhee, Khalas, Anand, Mijenas, Khadrawey, Sayas, Makdhoom, Elite, RB-1, Kanijee, Noor, Medjool, 0.91, 101, and Ajwa. The yield contributing characters such as tree age (year), tree canopy volume (m³), trunk circumference (cm), leaf length (cm), number of fronts/tree, number of leaves/fronds (NL), fruit weight (g), pulp weight (g), pulp thickness (mm), fruit length (cm), fruit diameter (cm), seed weight (g), pulp: ratio, seed: ratio, number of bunches/ tree, bunch weight, yield are correlated. The Correlation coefficient was generated using the CRAN (Comprehensive R Archive Network) programme version 4.5.0.

Results: The yield contributing traits are highly positively correlated with the number of bunches/tree (0.936), bunch weight (0.650) and fruit weight is positively correlated with pulp weight (0.974), thickness of the pulp (0.869), fruit length (0.854), fruit diameter (0.934), seed weight (0.934), and pulp ratio (0.818). However, tree age, trunk circumference, number of leaves/fronds, pulp: ratio, and seed: ratio had a negative indirect effect.

Conclusion: In this study, the phenotypic correlation analysis revealed that fruit weight, pulp weight, pulp thickness, fruit length, fruit diameter, seed weight, number of bunches/trees, and bunch weight are important factors in increasing yield. So, the findings of the study will aid in the germplasm management and conservation, as well as breeding strategies.

Keywords: Cultivars; pulp; seed weight; fruit diameter.

1. INTRODUCTION

The date palm (*Phoenix dactylifera* L.), a dioecious species belonging to the Arecaceae family (2n = 36; genome size: 670 Mb), commonly known as Khajoor or Kharek, is one of the earliest cultivated fruit crops. It is believed to have originated around 4000 BC in the Mesopotamian region along the Tigris and Euphrates rivers in present-day Iraq (Abdul Rahman, 2021). It has been traditionally grown in semi-arid and desert regions since ancient times (Zohary and Hopf, 2000). The date palm fruit is an excellent source of carbohydrates, proteins, vitamins, antioxidants, dietary fibers, carotenoids, anthocyanins, and minerals (Tang et al., 2013; Hatami et al., 2023). As a result, it has great nutritional content and is regarded as a basic part of the human diet in various nations (Mortazavi et al., 2015).

Initially, date palm farming was started in 2007 in India, and at present now the major states grown are Rajasthan, Maharashtra, Tamil Nadu, Kerala, and Gujarat. Kutch District in Gujarat currently stands as the primary date palm producer in India (Azizollahi & Moallemi, 2015). While Gujarat remains a key state, date palm cultivation is also expanding in Rajasthan, Maharashtra, Tamil Nadu, and Kerala (Ahmad et al., 2023). Despite this domestic production, India is a significant importer of dates, sourcing 38% of its supply mainly from Iran, Iraq, the United Arab Emirates, and Pakistan. Nationally, there's potential to decrease reliance on imports by increasing the area under date palm cultivation and enhancing the quality of

production in states with available irrigation, such as Rajasthan, Gujarat, Punjab, Haryana, and Tamil Nadu. Interestingly, India also exports a small volume of dates and processed date products to neighboring countries, including Nepal, Bhutan, the Maldives, and Sri Lanka (Shah, 2014).

In southern India, Tamil Nadu stands out as a key state for date palm cultivation due to favorable climate, soil, and irrigation conditions, especially in coastal districts like Tirunelveli, Tuticorin, and Ramanathapuram. Currently, around 809 hectares in Tamil Nadu are dedicated to the cultivation of Arabian date varieties (Alqahtani et al., 2024). Date palms are highly cross-pollinated due to their heterozygous nature; however, knowledge about the genetic diversity of this crop remains limited in southern India (Bhatt, 1973). There exists a rich diversity present in the Date palm plantation. In a plant breeding program, having a good understanding of the relationships between yield and its contributing characteristics is important. The correlation coefficient analysis provides a good description of the genetic link between various features (Bhat, 1973). So, this study was assessed based on the UPOV (International Union for the Protection of New Varieties of Plants, 2016) descriptors for both qualitative and quantitative traits. The research is being conducted to assess the yield contributing traits in Date palm cultivars of Southern India.

2. MATERIALS AND METHODS

The research experiment was carried out in a date palm field at Ariyakulam village in

Dharmapuri district, Tamil Nadu, during the period from 2024 to 2025. Observations and evaluations were conducted on 15 date palm cultivars: Barhee, Khalas, Anand, Mijenas, Khadrawey, Sayas, Makdhoom, Elite, RB-1, Kanijee, Noor, Medjool, 0.91, 101, and Ajwa. The study site is situated at an elevation of 467 meters above sea level, with geographic coordinates of 12°7'33.6" N latitude and 78°9'14.4" E longitude.

The quantitative traits were done on the selected date palm cultivars to describe the tree age (year), tree canopy volume (m³), trunk circumference (cm), leaf length (cm), number of fronts/tree, number of leaves/fronds (NL), fruit weight (g), pulp weight (g), pulp thickness (mm), fruit length (cm), fruit diameter (cm), seed weight (g), pulp: ratio, seed: ratio, number of bunches/tree, bunch weight, yield.

2.1 Statistical Analysis

The correlation coefficient for the yield attributes was analyzed using the CRAN (Comprehensive R Archive Network) programme version 4.5.0.

3. RESULTS AND DISCUSSION

The correlation analysis of 15 date palm cultivars demonstrated substantial connections between numerous yield and yield-contributing attributes, showing the major elements influencing productivity in date palm under southern Indian conditions.

The tree's age is indirectly and significant correlation was recorded with the fruit weight (-0.677), pulp weight (-0.632), pulp thickness (-0.518), fruit length (-0.597), diameter (-0.652), and seed weight (-0.652) and also with pulp ratio (-0.532) and seed ratio (-0.532).

The tree canopy volume is significantly positively correlated with trunk circumference (0.543) and front length (0.777). So, it indicates that the larger canopies and trunks are mutually supportive structural traits.

Fruit weight is positively correlated with pulp weight (0.974), thickness (0.869), fruit length (0.854), diameter (0.934), seed weight (0.934), and pulp ratio (0.818). This result indicates that the increase in fruit weight is directly correlated with increases in pulp weight, pulp thickness, fruit length, fruit diameter, seed weight, and pulp ratio.

Pulp weight correlates positively with pulp thickness (0.909), fruit length (0.886), fruit diameter (0.945), seed weight (0.945), and pulp ratio (0.892), and negatively correlated with seed ratio (-0.892).

Fruit length positively correlates with fruit diameter (0.897), seed weight (0.897), pulp ratio (0.886), and is indirectly associated with seed ratio (-0.886). Because the fruit length was increased, the fruit diameter and the seed weight, pulp ratio, and seed ratio also increased gradually. Bahurmuz et al. (2022) confirmed that the cultivar factor had a clear impact on the length and size of the fruit.

Fruit diameter is positively correlated with seed weight (1.000) and pulp ratio (0.875), and also indirectly associated with seed ratio (-0.875). Rahman and Oghidni (2021) revealed that the traits of the fruit are one of the most important features through which the cultivars can be distinguished, including the length, diameter, weight, color, appearance of the external crust, and length of the seed, width, and weight.

Seed weight is directly correlated with pulp ratio (0.875) and indirectly correlated with seed ratio (-1.000). The number of bunches per tree and bunch weight are positively correlated with yield. Because the increase in yield will be directly proportional to the number of bunches per tree and the bunch weight. Pulp ratio is positively correlated with fruit weight (0.818), pulp weight (0.892), pulp thickness (0.878), fruit length (0.886), fruit diameter (0.875), and seed weight (0.892).

The number of bunches/trees is directly and positively correlated with the yield (0.936). The yield of the tree is always dependent on the number of bunches present on the tree.

The weight of the bunches is directly and positively correlated with the yield (0.650). The yield of the tree is always dependent on the weight of the bunch.

The yield of the tree is directly positively correlated with the number of bunches/tree (0.936) and the weight of the bunches (0.650). Because the Number of bunches/tree and the weight of the bunches always influence the yield, and by promoting the significance of bunch management in increasing productivity.

Table 1. Correlation coefficient between yield contributing characters in Date palm (*Phoenix dactylifera* L.) cultivars

Traits	TA	TCV	TC	LL	NFT	NL	FW	PW	PT	FL	FD	SW	PR	SR	NBT	BW	Y
TA	1																
TCV	0.067	1															
TC	-0.23	0.543*	1														
LL	0.207	0.777**	0.275	1													
NFT	0.314	0.459	0.226	0.271	1												
NL	-0.172	0.419	0.451	0.261	0.372	1											
FW	-0.677**	-0.094	-0.022	-0.156	-0.179	0.101	1										
PW	-0.632*	-0.133	-0.12	-0.199	-0.248	-0.003	0.974**	1									
PT	-0.518*	-0.122	-0.14	-0.163	-0.078	-0.151	0.869**	0.909**	1								
FL	-0.597*	-0.047	-0.093	-0.044	-0.204	0.274	0.854**	0.886**	0.805**	1							
FD	-0.652**	-0.109	-0.065	-0.217	-0.159	0.079	0.934**	0.945**	0.887**	0.897**	1						
SW	-0.652**	-0.109	-0.065	-0.217	-0.159	0.079	0.934**	0.945**	0.887**	0.897**	1.000**	1					
PR	-0.532*	-0.051	-0.118	-0.195	-0.043	0.101	0.818**	0.892**	0.878**	0.886**	0.875**	0.875**	1				
SR	-0.532*	0.051	0.118	-0.195	0.043	-0.101	-0.818**	-0.892**	-0.878**	-0.886**	-0.875**	-0.875**	-1.000**	1			
NBT	0.355	0.056	0.038	0.074	0.037	-0.138	-0.455	-0.338	-0.251	-0.229	-0.215	-0.215	-0.109	0.109	1		
BW	0.114	0.252	0.057	0.289	0.272	0.339	-0.314	-0.239	-0.125	0.057	-0.169	-0.169	-0.008	0.008	0.386	1	
Y	0.257	0.15	0.133	0.178	0.063	-0.002	-0.435	-0.316	-0.233	-0.149	-0.215	-0.215	-0.085	0.085	0.936**	0.650**	1

** Significance at 0.01, * Significance at 0.05

TA- Tree age, TCV - Tree canopy volume, TC - Trunk circumference, LL - Leaf length, NL - No. of fronts/tree, NL- No. of leaves/fronts, FW - Fruit weight, PW - Pulp weight, PT - Pulp thickness, FL - Fruit length, FD - Fruit diameter, SW - Seed weight, PR - Pulp ratio, SR- Seed ratio, NBT- No. of bunches/tree, BW- Bunch weight, Y- Yield

Gopi et al. (2021) reported that phenotypic correlation analysis in avocado fruit revealed fruit weight, fruit length, tree age, tree canopy, tree height, and seed weight as important factors contributing to increased yield. Similarly, Al-Yahyai and Manickavasagan (2021) emphasized that datepalm cultivar, climatic factors, and agronomical practices significantly influence fruit yield traits.

4. CONCLUSION

The yield contributing traits are highly positively correlated with the number of bunches/tree (0.936), bunch weight (0.650) and fruit weight is positively correlated with pulp weight (0.974), thickness of the pulp (0.869), fruit length (0.854), fruit diameter (0.934), seed weight (0.934), and pulp ratio (0.818). However, tree age, trunk circumference, number of leaves/fronds, pulp: ratio, and seed: ratio had a negative indirect effect. Moreover, the phenotypic correlation analysis revealed that fruit weight, pulp weight, pulp thickness, fruit length, fruit diameter, seed weight, number of bunches/tree, and bunch weight are important factors in increasing yield. These traits can be exploited for improving new cultivars of Date palm by clonal selection. After, they can also the crossing for recovering recombination. According to the phenotypic correlation analysis should be given preference for selection of superior cultivars (Gopi et al., 2021).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Abdul Rahman, Q. H. O. (2021). *A morphological study of some varieties of date palm (Phoenix dactylifera L.) growing in the Ziban region (Biskra)* (Master's thesis). University of Brothers Mentouri - Constantine 1. 58 pp.
- Ahmad, R., Ali, H. M., Lisek, A., Mosa, W. F., Ercisli, S., & Anjum, M. A. (2023).

Correlation among some phenological and biochemical traits in date palm (*Phoenix dactylifera* L.) germplasm. *Frontiers in Plant Science*, 14, 1118069.

- Alqahtani, M. M., Saleh, M. M., Alwutayd, K. M., Safhi, F. A., Okasha, S. A., Abdelsatar, M. A., ... & Salem, K. F. (2024). Performance and genotypic variability in diverse date palm (*Phoenix dactylifera* L.) cultivars for fruit characteristics. *Genetic Resources and Crop Evolution*, 71(5), 1759–1772.
- Al-Yahyai, R., & Manickavasagan, A. (2012, June). Quality of dates: Influencing factors and assessment methods. In *VII International Postharvest Symposium 1012* (pp. 1241–1246).
- Azizollahi, M. H., F., & Moallemi, N. (2015). Some quality attributes and biochemical properties of nine Iranian date (*Phoenix dactylifera* L.) cultivars at different stages of fruit development. *International Journal of Horticultural Science and Technology*, 2, 161–171.
<https://doi.org/10.22059/ijhst.2015.56433>
- Bahurmuz, Y. S., & Bahwerth, M. A. (2022). Comparison of some date palm cultivars, *Phoenix dactylifera* L., planted in Hadramout coast, Yemen, morphologically for leaves and fruits. *Syrian Journal of Agricultural Research*, 9(4), 115–126.
- Bhatt, G. M. (1973). Significance of path coefficient analysis determining the nature of character association. *Euphytica*, 22, 338–343.
- Gopi, V., Ananthan, M., Aneesa Rani, M. S., Kumar, M., Jeyakumar, P., & Krishnamoorthy, V. (2021). Correlation analysis of avocado (*Persea americana* Mill.) genotypes from Lower Pulney Hills of Tamil Nadu. *Biological Forum – An International Journal*, 13(4), 468–470.
- Gopi, V., Ananthan, M., Aneesa Rani, M. S., Kumar, M., Jeyakumar, P., & Krishnamoorthy, V. (2021). Diversity analysis in avocado (*Persea americana* Mill.) accessions from Lower Pulney Hills of Tamil Nadu, India. *International Journal of Plant and Soil Science*, 33(24), 400–408.
- Hatami, A., Abootalebi Jahromi, A., Ejraei, A., Mohammadi-Jahromi, A. H., & Hassanzadeh Khankahdani, H. (2023). Study of biochemical traits and mineral elements in date palm fruits under pre-harvest foliar application of organic fertilizers and micronutrients. *International Journal of Horticultural Science and*

- Technology, 10, 125–140.
<https://doi.org/10.22059/ijhst.2022.334068>.
517
- International Union for the Protection of New Varieties of Plants. (2016). *UPOV*.
<https://www.upov.int/portal/index.html.en>
- Mortazavi, S. M. H., Azizollahi, F., & Moalemi, N. (2015). Some quality attributes and biochemical properties of nine Iranian date (*Phoenix dactylifera* L.) cultivars at different stages of fruit development. *International Journal of Horticultural Science and Technology*, 2(2), 161–171.
- Shah, J. (2014). Date palm cultivation in India: An overview of activities. *Emirates Journal of Food and Agriculture*, 26(11), 987.
<https://doi.org/10.9755/ejfa.v26i11.18986>
- Tang, Z. X., Shi, L. E., & Aleid, S. M. (2013). Date fruit: Chemical composition, nutritional and medicinal values, products. *Journal of the Science of Food and Agriculture*, 93, 2351–2361.
<https://doi.org/10.1002/jsfa.6154>
- Zohary, D., & Hopf, M. (2000). *Domestication of plants in the Old World: The origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley*. Oxford University Press.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2025): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://pr.sdiarticle5.com/review-history/141010>