JUST AGRICULTURE
multidisciplinary e-Newsletter

Just Agriculture Multidisciplinary *e- newsletter*

e-ISSN: 2582-8223

Volume - 5
Issue - 12
August, 2025

www.justagriculture.in

AUTHORS' DETAILS:

Panchal Bhakti B.
Sharma K. M.
Tank R.V.
Bhanderi D. R.

Scientist-Horticulture, Krishi Vigyan Kendra, NAU, Surat-395007

ARTICLE ID: 23

POLLEN MANAGEMENT IN DATE PALM

Introduction:

The date palm (*Phoenix dactylifera*) has a long and fascinating history, dating back thousands of years. Archaeological evidence suggests that the cultivation of date palms dates back to at least 4000 BCE and possibly earlier. The date palm is originated from Persian Gulf (modern-day Iraq, Iran) and Mesopotamia. Presence in India more than 450 years. In India, major plantation area is Gujarat, Rajasthan and Punjab. The importance of pollination for the successful production of date palm fruits can be understood from a stone sculpture extracted from the Assyrian Empire, near Mesopotamia, where a human-faced genie and an eagle-faced genie are shown pollinating the sacred tree, which is believed to be a date palm. Similar concepts have also been supported by Paszke (2019), suggesting date cultivation and knowledge of artificial pollination in 3300 BC. Pollen management in date palm is a critical aspect of the plant's reproductive success, especially in commercial cultivation where maximizing fruit yield and quality is essential. Date palm pollen (DPP) has a major influence on fruit quality, development and yield, which are widely influenced by pollen structure, viability and germination capability. Over the years, methods of pollination have improved and with the usage of mechanized tools the laborious pollination process has been made easier (Sharma *et al.*, 2023).

(a, c) Male inflorescence of date palm. (b, d) Female inflorescence of date palm. (e) Male strand of date palm. (f) Female strand of date palm. (g) Male date palm flowers; frontal (top) and profile (bottom) views. (h) Female date palm flowers; frontal (top) and profile (bottom) views. S, sepal; P, petal; St, stamen; C, carpel. Scale bar = 1600 µm.

Historical and cultural significance:

- ✓ The importance of pollen and its management has been understood since the date palm's early domestication, which is estimated to have occurred around 4000 BCE.
- ✓ The importance of pollination for the successful production of date palm fruits can be understood from a stone sculpture extracted from the Assyrian Empire, near Mesopotamia, where a human-faced genie and an eagle-faced genie are shown pollinating the Sacred Tree, which is believed to be a date palm.
- ✓ Similar concepts have also been supported by Paszke (2019), suggesting date cultivation and knowledge of artificial pollination in 3300 BC.

Taxonomic classification of date palm:

- ❑ **Kingdom**: Plantae (Plants)
- ❑ **Division**: Angiosperms (Flowering plants)
- ❑ **Class**: Monocots (Monocotyledons)
- ❑ **Order**: Arecales
- ❑ **Family**: Arecaceae (Palm family)
- ❑ **Sub-family**: Coryphyoideae
- ❑ **Tribe**: Phoeniceae
- ❑ **Genus**: *Phoenix*
- ❑ **Species**: *dactylifera*

Key features of date palm tree:

Habitat: Thriving in hot, dry climates with access to water.

Structure: Date palms are tall, single-stemmed trees that can grow up to 30 meters (100 feet) tall, with long feather-like leaves (fronds).

Fruit: The date palm produces clusters of oval, edible fruits (dates), which can be consumed in various stages of ripeness: soft, semi-dry, or dry.

Pollination: Date palms are dioecious; Pollination typically occurs via wind or human intervention in cultivated varieties. Needs daily climbing, it is expensive.

Male and female flowers characters:

Male flowers	Female flowers
✓ Creamy/waxy-white color	✓ Yellowish-white color
✓ Spathes are short and wide	✓ Spathes are narrow and long
✓ Inflorescences are densely packed with strands and have a greater number of strands (broom like)	✓ Inflorescences are comparatively less densely packed with strands
✓ Flowers resemble rice panicles	✓ Flowers are globose and resemble sorghum seeds
✓ Flowers are composed of three sepals, three petals, six stamens	✓ Flowers are composed of three sepals and three petals (fused together) and three carpels
✓ Flowers have a distinct sweet-scented aroma that attracts insects	✓ Flowers have a mild aroma but it does not widely attract insects

Why pollen management?

- Pollen management in date palm (*Phoenix dactylifera*) is a critical aspect of the plant's reproductive success, especially in commercial cultivation where maximizing fruit yield and quality is essential.
- Date palm pollen (DPP) has a major influence on fruit quality, development and yield, which are widely influenced by pollen structure, viability and germination capability.
- Under commercial cultivation, growers need to manage pollen by storing it at a cool temperature and mixing it with various adjuvants to dilute the quantity of the pollen used for pollination.
- The success of the pollination is further influenced by the female flowers and their receptivity, and thus proper vigilance is required to note the time of anthesis of the female inflorescence.
- Over the years, methods of pollination have improved and with the usage of mechanized tools the laborious pollination process has been made easier.

Pollen structure, characteristics and diversity:

- Pollen is the fine dust-like grain material produced by the male flowers and is the source of male gametes.
- Pollen grains are ellipsoidal, bisymmetric,

sometimes asymmetric or rhomboid or spherical in shape, with length ranging from 17.20 to 21.40 µm and width from 6.97 to 10.30 µm.

- Exine: The pollen's outer layer is thick and sculptured
- Intine: The inner layer is thinner and plays a key role in the germination process

Xenia and metaxenia effects:

- Metaxenia is the term for the direct influence of pollen on portions of the fruit, while xenia is the term for its influence on the seed.
- The pollen of the date palm and other *Phoenix* species has been found to have a direct effect on the size, shape and color of the seed, as well as on the size of the fruit, its rate of development, and the time of ripening of the fruit, which is made up of the ovarian tissue of the date palm's mother plant (Swingle, 1928).
- Denney (1992) suggested that different amounts of one or more of the three hormones most closely connected with fruit growth (auxins, cytokinin, and/ or GA) could explain the varied metaxenic size effects in date fruits and suggested smaller fruits (seed + pericarp) will have lower hormone levels, whereas larger fruits will have higher hormone levels.
- Effects of pollen on the tissue culture derived female cv. Barhee was investigated by assessing the changes in the levels of malic acid, citric acid, fructose, glucose, sucrose, L-proline and myo-inositol during the fruit development.

Factors affecting pollination:

Many factors affect pollination in date palms, including:

- Temperature, wind, water & light
- Soil quality
- Pollen viability
- Pollination time
- Pollination method
- Source of pollen
- The receptivity of female flowers
- Compatibility between male and female flowers

Practices for pollen management

- Pollen collection
- Pollen storage
- Pollen viability testing
- Pollination techniques
- Pollination timing
- Cultural practices to improve pollen transfer
- Challenges in pollen management

Date palm pollen germination under different temperature/storage time regimes:

Temperature (°C)	Length of storage (months)	Pollen germination (%)	Reference
24	Fresh	94.37	Anushma *et al.*, (2018)
4	2	61.64	
4	12	0.00	
–20	12	73.61	
–196	12	90.29	
28	Fresh	96.30	Kadri *et al.*, (2021)
28	12	14.70	
4	12	42.10	
–30	12	52.20	
4	12	24.39	Maryam *et al.*, (2015)
–20	12	27.40	
–80	12	24.64	

Pistillate receptivity of different cultivars of date palm:

Cultivar	Days after anthesis	Reference
Barhee	2–3	Muralidharan *et al*., (2020)
Gulistan	1	Iqbal *et al*., (2018)
Rothana	1	Ahmed *et al*., (2013)
Sewy	3	El-Salhy *et al*., (2011)
Najda	7–10	Zirari (2010)
Dhakki	4	Iqbal *et al*., (2004)
Khalas	2–4	Shabana *et al*., (2001)

Pollination process:

- Generally, the male inflorescence emerges earlier in most parts of the world, but due to climatic influences, the flowering period may vary.
- On average a single male date palm can produce 20 to 30 spathes per season. The production of pollen per male spathe may vary from 5 to 50 g and may total more than 1000 g per palm in a good-quality male.
- On many commercial farms, pollination is done using males that have been pre-identified for better production. Pollen germination takes place at 25–28°C on the stigma.
- Sharma *et al.,* (2019) reported 8 a.m. to 12 noon in India, Iqbal *et al.,* (2014) reported 10 a.m. to 2 p.m. in Pakistan and Hajian (2005) reported 10 a.m. to 3 p.m. in Iran as effective time periods for pollination for higher fruit set.

Advantages of pollen management:

- Improves fruit quality
- Efficient use of male trees
- Facilitates artificial pollination
- Reduced labour
- Increased pollination frequency
- Use of different pollen sources
- Reduces pollination costs
- Prevents pollen contamination
- Enhanced pollination in low-wind areas

Limitations:

- Male and female flowering synchronization
- Pollen viability and quality
- Pollination efficiency and labor-intensive manual pollination
- Climate and environmental factors
- Pollen contamination
- Male tree availability
- Pollen age and long-term storage
- Pollen handling

Future thrust:

1. Identification of superior male for quality pollen and have positive metaxenic effect
2. Economical pollen storage and availability including storage at room temperature
3. Pollen mixture to improve fruit set
4. Efficient pollination method to improve pollination efficiency
5. Usage of AI tools for timely and effective pollination
6. AI tools to detect pollen quality
7. Efficient pollen harvesting tool to reduce respiratory problem of manual harvesting
8. Secondary usage of pollen, e.g. pollen based medicine (to improve fertility)

References:

- Awad, M.A. (2011). *Met. Env. & Arid Land Agric. Sci.*, **22**(1): 91-101.
- Kadri, K. M.; Makhlouf, E. S. and Awad, M. A. (2022). *Saudi J. of Bio. Sci.*, **29**(2): 1085–1091.
- Kumawat, P. K.; Rathore, R. S.; Singh, R. P. and Kumar, S. (2022 b). *Sugar Tech*, https://doi.org/10.1007/s12355-022-01152-0.
- Muralidharan, C. M.; Panchal, C. N.; Baidiyavadra, D. A.; Sharma, K.M. and Verma, P. (2020). *Sugar Tech*, https://doi.org/10.1007/s12355-020-00859-2.
- Paszke, M.Z. (2019). *IRAQ* 81, 221–239. DOI: 10.1017/irq.2019.15.
- Sharma, K. M.; Kumar, M.; Murlidharan, C. M. and Torres, R. S. (2023). *CABI international*, DOI: 10.1079/9781800620209.0007, P.209-240.
- Sharma, K. M.; Muralidharan, C. M.; Baidiyavadra, D. A. and Panchal. C. N. (2019). *Enviro. and Eco.*, **37**(4B): 1568–1570.