SHORT COMMUNICATION

Optimization of number of offshoots in date palm (*Phoenix dactylifera* L.)

Kapil Mohan Sharma*, D. A. Baidiyavadra, M. D. Dharva and B. B. Golakiya
Date Palm Research Station, Sardarkrushinagar Dantiwada Agricultural University, Mundra-Kachchh, Gujarat, India
**Email:k.m.sharma456@sdau.edu.in Orcid: https://orcid.org/0000-0003-4714-7854*
Receipt: 25.02.25 Revised: 15.03.25 Acceptance: 18.03.25

DOI: 10.53552/ijmfmap.11.1.2025.284-287

ABSTRACT

Date palm (Phoenix dactylifera L.) is a one of the important fruit crop in arid and semi-arid regions of the world. The major method of the propagating date palm vegetatively is through offshoots and tissue culture. However, the retention of excessive offshoots on a mother plant can impact growth, fruit yield, and economic returns due to resource competition. The objective of the current study was determining the optimal number of offshoots per plant for maximizing productivity while maintaining sufficient offshoot for propagation. The study was conducted during 2019-2023 using the high offshoot-bearing genotype MDP-29 and examined the impact of offshoot retention (0, 2, 4, 6, and 8 per plant) on growth and yield. Results showed that increasing the number of offshoots reduced plant growth, canopy spread, and yield, with fruit production declining by almost forty percent. The optimum number of offshoots for optimized fruit yield is four per palm.

***Keywords**:Date palm, offshoot retention, fruit yield, resource allocation, propagation*

Date palm (*Phoenix dactylifera* L.) is one of the important fruit crop in arid and semi-arid regions of the world. Worldwide, the date palm cultivation is ongoing since last 5000 years (Gros-Balthazard and Flowers, 2021) but in India the crop is estimated to be of around 450 years in the coastal belt of Kachchh district of Gujarat (Sharma *et al*., 2019a). Majority of the old plantation are of seedling origin, thus bears huge variability among themselves. Vegetatively, the date palm is propagated either through offshoot or tissue culture plants. Although tissue culture plants are a method for mass propagation, the usage of offshoot is still demanding as the number of genotypes having tissue culture protocol is limited. Generally, the number of offshoots borne by any plant varies from four to ten in its life time, but for few of the genotypes may go higher (Sharma *et al.*, 2019b, 2022a). In the past three decades the farmers are now focusing to produce and plant offshoots to improve with elite genotypes to improve farm yield which are early maturing and can avoid peak rainfall (Sharma *et al.*, 2022b). Among these the offshoots of the elite genotypes are very high and thus farmers often try to keep and produce as much as offshoots possible, however, at the end of the offshoot bearing period, they also wish to keep the fruit harvest. The number of offshoots retained on a mother plant influences nutrient allocation, thereby affecting growth and fruit yield and may also increase in parthenocarpic fruits (Chao and Krueger, 2007; Qaddoury and Amssa, 2003). Higher number of offshoot may reduce fruit size or yield (Alikhani-Koupaei and Aghdam, 2022). Thus, there is a need to optimize the number of offshoots to maximize plant growth and yield and ascertain sufficient offshoot for propagation.

This study aimed to determine the optimal number of offshoots that should be retained per plant to achieve a balance between growth, yield, and economic returns.

The experiment was conducted at the Date Palm Research Station, Sardarkrushinagar Dantiwada Agricultural University, Mundra-Kachchh, Gujarat from 2019 to 2023 under North West Gujarat Agro-Climatic Zone-V conditions. The plant was planted in the year 2016 and the numbers of offshoots were maintained since the year 2019 onwards. The yield was calculated from year 2021 to year 2023 (three years). The date palm variety used was MDP-29, an indigenous genotype which is a high offshoot bearing and the number of offshoots may go as high as thirty-two per plant. The experiment followed a Randomized Block Design (RBD) with five treatments (0, 2, 4, 6, and 8 offshoots per plant) and five replications, with one palm per replication. A common agronomic practice was followed in all the treatments. Drip irrigation was applied at approximately 200 L/day per plant. The fertilization regime included 50 kg FYM along with 1:1:1 kg $N:P_2O_5:K_2O$ per palm. Pollination was done during February within two days of spathe cracking using male strands. All the pollination in the treated plants was done using the same male plant. The fruits were harvested betweenthird week of June to first week of July. Regular observation for pests and diseases were conducted to avoid any damage to the plant. Data on various growth parameters, yield, and economic returns were recorded and analysed statistically.

The study revealed significant differences among treatments presented in Table 1. The results indicated that as the number of offshoots increases, there is a gradual decline in various growth and yield parameters. The palmswith zero offshoots exhibited the highest stem girth (150.00 cm), plant height (530.26 cm), and canopy spread (E-W: 599.80 cm, N-S: 630.86 cm), whereas the palms with those with eight offshoots showed the lowest values for these parameters (137.86 , 482.80 , 497.33 , and 500.13 cm, respectively).

The decline in plant vigour with increasing number of offshoots is in line with the concept of source-sink competition, where excessive offshoot retention creates strong competing sinks that divert assimilates away from main plant growth and reproductive structures (Alikhani-Koupaei and Aghdam, 2022). Alikhani-Koupaei and Aghdam (2022) also found that date palms with a higher number of suckers had reduced stem girth, lower plant height, and weaker canopy development. Similarly, the presence of multiple offshoots might have led to competition for nutrients, water, and photosynthates, which limits overall vegetative growth. In date palms, the reduction in canopy spread with increasing number of offshoots might have increased competition for light and nutrients, which may have affected overall vegetative growth and efficiency in carbon assimilation. Additionally, under a secondary observation it was noted that the plants with higher number of offshoots, the main trunk was not easily visible and induction of the spathe was also lower.

The number of bunches per palm followed a declining trend, where the palmswith zero-offshoot producing the highest number of bunches (6.13), while those with eight offshoots produced the least (3.93). Leaf production also declined with increasing offshoot numbers, confirming that excess offshoots may act as strong sinks that reduce resource allocation to other parts.

Among the various observation, yield performance is an important trait, where the palms with zero-offshoot recorded the highest yield (37.73 kg/palm), followed by two offshoots (33.86 kg), four offshoots (32.80 kg), which were at-par with the zero-offshoot plant and the lowest yield in eight-offshoot palms (21.26 kg/palm) on averaging the yield of three years. This confirms the

trend on the negative impact of excessive offshoot retention on fruit development. It might be due to the source-sink relationship which was explored in other similar studies. Dorel *et al.* (2016) demonstrated that in banana, removing all suckers until the mother plant was harvested led to increased fruit diameter, higher bunch weight, and improved overall yield, while retaining higher number of suckers impacts negatively. Similar mechanism might be applicable to date palms, where limiting offshoot retention allows for better fruit set and gives higher yield. It was confirmed by Alikhani-Koupaei and Aghdam (2022), who noted that when too many offshoots are present, they act as competing sinks, diverting carbohydrates and nutrients away from developing fruits.

Additionally, as a secondary observation of the plants, when all the matured offshoots were removed, the trunk of the plants bearing eight offshoots or higher, the plant becomes weak and narrow at the base and was very prone to damage by high wind velocity during cyclone. After the completion of the experiment, after the harvest, the plants were impacted by high wind velocity due to the cyclone *Biporjoy* in the year 2023 and cyclone *Asan* in the year 2024. The damage causes the plant to bend and to support the plants, earthing up was needed, which was not necessary for the other plants or genotypes were the number of offshoots were lower. Moreover, the plants were higher number of offshoots are removed at later stages are more prone to attack of red palm weevil as the base of the trunk (from where the offshoots are removed) are more exposed for the weevil to attack.

This study demonstrates that reducing the number of offshoots to a maximum of four per palm significantly improves date palm growth and yield. Retaining upto four offshoots per plant is sufficient for optimizing fruit production while maintaining sufficient offshoot availability for propagation.

ACKNOWLEDGEMENT

The authors acknowledge Sardarkrushinagar Dantiwada Agricultural University for supporting the experiment.

CONFLICT OF INTEREST STATEMENT

The author declare that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 1: Effect of number of offshoots on various date palm characters (pooled for three years 2021-2023)

Treatment	Plant Height	Plant Spread (E-W)	Plant Spread (N-S)	Number of bunches*	Number of leaves*	Yield (kg/ palm)
0 Offshoot	530.26	599.80	630.86	2.44 (6.13)	6.88 (47.53)	37.73
2 Offshoot	511.13	565.93	591.86	2.36 (5.80)	6.81[ab] (46.80)	33.86
4 Offshoot	498.73	529.73	827.33	2.29 (5.46)	6.33 (44.20)	32.80
6 Offshoot	498.20	519.80	516.66	2.21 (5.13)	6.57 (43.33)	29.46
8 Offshoot	482.80	497.33	500.13	1.95 (3.93)	6.40 (41.26)	21.26
Mean	504.22	542.52	553.37	2.25 (5.29)	6.66 (44.62)	31.02
SeM±	7.38	8.12	10.52	0.07	0.11	1.82
C.D. @5%	21.23	23.47	30.09	0.20	0.32	5.21
C.V. %	5.73	5.89	7.41	12.45	6.46	22.90

*Values are sq. root transformed. Value in parenthesis are original value