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A comparative study of maturity indices (heat unit) for indigenous and exotic date palm germplasm at Kachchh-India

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ABSTRACT

Date palm (Phoenix dactylifera L.) is an important fruit crop in many gulf countries and in recent years it is gaining popularity for cultivation in India. To understand the maturity period for six date palm germplasm a study was conducted at Date palm Research Station, Mundra-Kachchh during 2016-2020. The data were pooled for five years and an average heat unit and number of days required for maturity was identified. The lowest duration and heat unit was required for ADP-1 while highest was found in Barhee.

***Keywords*:** Date palm, heat unit, *Khalal* stage, maturity indices

INTRODUCTION

Date fruits are known for their sweet, succulent and exotic flavor and regarded as a fruit with high calorific value and nutrients. It is a good source of antioxidants and polyphenolics (Sharma *et al*., 2021). Date palm (*Phoenix dactylifera* L.) is one of the oldest cultivated crops in the world having its estimated origin dating back to 4000 BC in Mesopotamia (Current Iraq) (Johnson *et al.*, 2013), while in India, it is estimated to be around 450 years old with its major share of presence in the states like Gujarat, Rajasthan and Punjab where Kachchh district of Gujarat accounts for the largest share (Baidiyavadra *et al.*, 2019). Although the crop has its presence for almost five centuries in Kachchh, the majority of the plantation are still of seedling origin resulting in a huge variability in shape, size, colour as well as their maturity period (Sharma *et al*., 2019). Unlike the most of the major date palm producing countries where the fruits are harvested at *Dang* (*Rutab*) or *Pindkhajoor* (*Tamar*) stage, in India, majority of the fruits are harvested in their *Doka* or *Khalal* stage due to the climatic compulsions. In India, generally the dates reach its *Khalal* stage during June-end to mid-July which is also the peak rainfall period in this area, making it mandatory for the growers to harvest the crop or may result up to cent per cent crop loss. Fruits harvested at *Khalal* stage are done based on its colour, sweetness and astringency level. An early rainfall may cause a major damage to the crop due to fruit cracking and spoilage. Thus, it is important to identify early maturating cultivars, or short duration cultivars. However, for effective planning of the labour, financial requirements and sales, computed method can be a better alternative. One of the most used computed methods of date palm is using "heat units", also called as "degree days". The idea behind the absorption of certain heat unit is the growth of plant or plant part (Chandra *et al.,* 1992). It helps to calculate the time required to reach that particular stage. A few of the earlier studies were made using exotic varieties in India; however, indigenous varieties were not examined (Kalra and Bajwa, 1976; Chandra *et al.*, 1990). The current experiment was conducted to understand the heat unit required for fruit maturity at *Khalal* stage.

MATERIALS AND METHODS

The experiment was conducted at Date palm Research Station, Sardarkrushinagar Dantiwada Agricultural University, Mundra-Kachchh during 2016 to 2020. Six germplasm were evaluated, where Barhee and Halawy are exotic varieties introduced in India propagated through offshoots and recommended for cultivation in Gujarat and Rajasthan under ICAR-All India Co-ordinated Research Project on Arid Zone Fruits in 2003 (Sharma *et al.*, 2019), while ADP-1, MDP 20, MDP 21 and MDP 22 were tissue culture raised plants of Indian origin seedling plants. The flowering and fruiting data were recorded from five plants as five

replications with two bunches from each plant. The date of pollination of each bunch was noted and their respective date of harvesting maturity was noted for all the five years of experimentation. Temperature parameters of the fruiting season was observed using automatic weather station present at the research station. The data of maximum temperature and minimum temperature was used to calculate the degree days where 10°C was used as base temperature as per the earlier experiments (Chandra *et al*., 1990). Statistical analysis and graphical representation of the data was done using R (ver 4.1.2) based on the methods described by Panse and Sukhatme (1978).

$$\text{Heat Unit} = \frac{\text{Minimum Temperature} + \text{Maximum Temperature}}{2} - \text{Base Temperature}$$

RESULTS AND DISCUSSION

Date palm cultivation in India, especially in the western border districts of Gujarat and Rajasthan are mainly dependent on the rainfall pattern. The data presented in Figure 1, Figure 2 and Table 1 represents the heat unit and number of days required for maturity of date palm upto *Khalal* stage. Based on the Figure 1 and 2, it can be understood that every year the maturity period does not remain same and variation on the maturity days

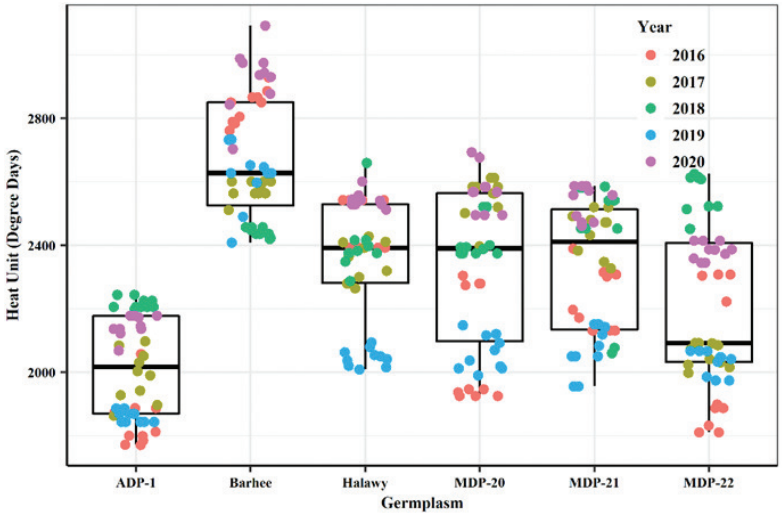

Figure 1: Heat unit needed for different date palm germplasm at *Khalal* stage

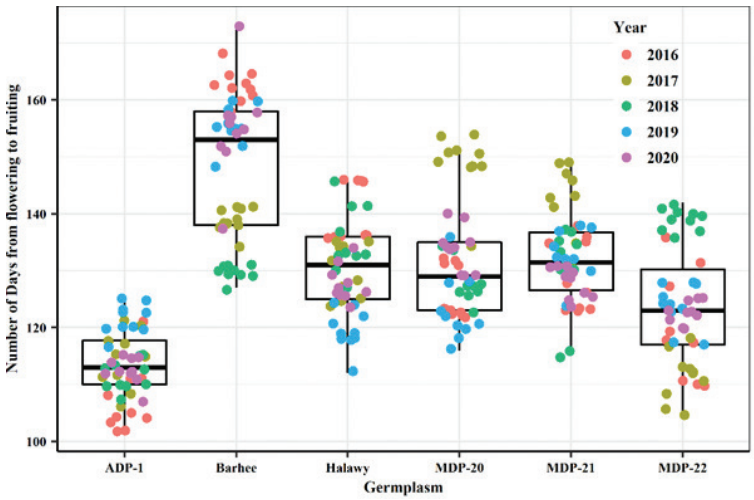

Figure 2: Number of days needed for maturity of different date palm germplasm at *Khalal* stage

Table 1: Heat units required for maturation of date palm cultivars (Pooled for 2016-2020)

S. No.	Germplasm	Maturity period	Heat units (base 10°C) for *Khalal* Stage*	Number of days from flowering to fruiting
1.	ADP-1	June Mid- June End	46.42(2011)	113.42
2.	Barhee	July End- August First	62.51(2679)	148.32
3.	Halawy	June End-July First	54.72(2360)	130.52
4.	MDP-20	June End-July First	54.95(2334)	131.94
5.	MDP-21	June End-July First	54.65(2341)	132.12
6.	MDP-22	June End-July First	50.40(2209)	123.70
		C. D. @ 5 %	6.74	16.58

* Data are sq. root transformed value. Value in the parenthesis are original value.

were observed. The pooled data showed that the lowest duration (113.42 days) and heat unit (2011 degree days) required for ADP-1 while the highest duration (148.32 days) and heat unit (2679 degree days) required for Barhee. It was observed that ADP-1 matures earliest among all the germplasm and often reaches *tamar stage* or *pind khajoor* stage before the Barhee reaches its *Khalal* stage. Next to the maturity, was MDP-22 which required 123.70 days and 2209 degree days for maturity. Chandra *et al.* (1990) reported that 1951 and 2323 heat units were required to reach colour turning stage for Halawy and Barhee respectively, while Kalra and Bajwa (1976) suggested the need of 1800°C to 2000°C HSU above 18°C to reach their ripening stage, which suggests similarity with our present study.

CONCLUSION

Date palm is now getting popularity in Tamil Nadu, Maharashtra, Andhra Pradesh *etc.* and for further expansion, early maturating cultivars will be needed. Evaluation of germplasm based on heat unit can be a better tool for identification of potential germplasm.

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