Original article

Bunch and different types of strand thinning effects on yield and fruit characteristics of Barhee date palm cultivar under River Nile State condition, Sudan

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Abstract

Different thinning treatments were conducted on Barhee date palm cultivar to study their effect on yield and fruit characteristics. Five thinning treatments were applied (removing some of total bunches, removing 40 % of strands from the middle of the bunch, removing 50 % of the whole strand per bunch by taking one leaving the other, removing 10cm of strands length per bunch and control (no thinning), Experimentation was conducted at Mukabrab area in River Nile State during 2017 and 2018 seasons. Fruit thinning significantly increased fruit weight, fruit length, fruit diameter, Pulp thickness in both seasons, while increased TSS and fruit volume in one season. Total palm yield was not significantly affected by thinning treatment in both seasons.

Keywords: Date palm, Barhee, thinning, Sudan.

Introduction

Date palm (*Phoenix dactylifera* L.) is one of the most important tree crops in desert areas of Northern Africa, Southern Asia and the Middle East, been domesticated since 3000 BC [1]. It is a perennial plant with dioecious nature (meaning with separate male and female individual plants) and diploid chromosomes (2n = 36) [2,3].

There have been many date palm cultivars grown in northern Sudan and the number of date palm trees in this part is estimated to be 8 million [4]. Inadequate cultural practices coupled with an infestation of pests and diseases were the major problems of date cultivation [5]. However, only little and very limited work has been devoted to improve cultural practices of date palm [6], indicating that there was a decline in yield of date palm attributed to insufficient cultural practices coupled with an infestation of pests and diseases as noticed in the last decade.

Despite the importance of the crop to the farmers of the Northern and River Nile States, it is marketing usually faces two major problems; domination of lesser preference dry date cultivars over soft dates in term of areas under cultivation and inferior fruit quality as a result of poor cultural practices.

Thinning practices were conventionally used to improve fruit quality [7]. Fruit thinning is used to decrease alternate bearing, increase fruit size, improve fruit quality, haste fruit ripening, and facilitate bunch management [3]. Fruit thinning can be carried out three ways: removal of entire bunches, reduction in the number of strands per bunch and reduction in the number of

fruit per strand. The cultivar, climate and cultural practices influence the appropriate levels of fruit thinning. The choice of the proper method for thinning was often related to date cultivars, removal of strands or individual fruits rather than whole bunches was much better in small-fruit date palm cultivars [1]. To maximize crop value and marketable yield, growers must evaluate their optimal tree load, the maximum number of fruits to be retained per bunch. To achieve this objective they must know the genetic potential of a cultivar for fruit size and yield, and the effects of different cultural practices on these attributes.

The present study was conducted to determine the effect of removing some of bunches or some of strand or part of them on the yield and fruit quality of 'Barhee' date palm cultivar.

Materials and methods

The experiment was conducted during two sequential seasons of 2017, 2018 on 20 female date palm (*Phoenix dactylifera* L.) of "Barhee" cultivar in the orchard of Acashia at Mukabrab area, 17^{o} 32' N, 33^{o} 59' E, River Nile State. Trees were of 20-year-old, uniform in size, and growth vigor, spaced at 9*9m and kept under recommended condition of cultural practices. Hand pollination was carried out during mid-February to mid-March in the two seasons using the same pollen source (a male seedling growing at the same orchard). Thinning practices were applied 4 weeks after pollination. Each treatment was replicated four times by keeping one palm tree for each treatment. Four strand thinning treatments + control were carried as in table (1).

Table 1. Experiment treatments

Treatments	Thinning practice
T1	Removal of some of total bunches
T2	Removal of 40 % of strands in the middle of the bunch
T3	Removal of 50 % of total strands (removing strand keeping the other)
T4	Removing 10 cm of strands length per bunch
T5	Control (no thinning of strands)

Removal of some of total bunches tried to keep leaf/ bunch ratio at 8:1. The experiment was laid out in randomized complete block design (RCBD). Parameter taken were; yield per palm, fruit length, fruit diameter, fruit volume, fruit weight, pulp thickness and total soluble solids (Brix %). All bunches of the palms under investigation were covered to lessen bird and insect damage and harvested at full color stage (Khalal). Ten fruits from each bunch of a palm were randomly picked to identify characteristics. Vernier Caliper was used to measure the length and diameter of fruits, and electronic

balance for fruit weight. TSS (Brix %) was determined by hand refractometer. Data was analyzed using Analysis of Variance, followed by a comparison of treatment means using LSD test at a 5% level of significance. SAS computer software package was used [8].

Results and discussion

Table (2) showed that the fruit yield of Barhee cultivar was not significantly affected by all types of bunch and strand thinning in both seasons. Despite bunches size reduction the result obtained may be attributed to the increase of fruit retention per bunch and the increase in individual fruit weight as a result of increased supply of photosensitized materials to each fruit.

Thinning treatments increased significantly TSS during 2017, the highest value (40.98), obtained by removal of 50 % of total strands (T3) followed by removing 10 cm of strands length per bunch (T4). While control treatment (T5) reflected minimum TSS (33.23). During 2018 result obtained showed no significant differences (Table 2). Previous findings indicated similar TSS increase as a result of fruit thinning [9,10].

As shown in table (2), a substantial increase in fruit weight was noticed as a result of bunch and different types of strand thinning over the control treatment in both seasons. The highest fruit weights were scored from (T1) the palms where some of the total bunches were removed (mean fruit weights were 10.23 and 11.90 grams in season 2017 and 2018 respectively). The least fruit weights were obtained by the control treatment (mean fruit weights were 7.70 and 6.23 grams in season 2017 and 2018 respectively). The increase in average fruit weight, owed to thinning practices, may be due to the reduction in fruit competition for a limited amount of assimilates. Results obtained support previous findings on Succary date palm [11] and Zaghloul and Haiany Date Palms cultivar [12].

Table 2. Yield, mean fruit weight and TSS as affected by bunch and various types of strand thinning

Treatments	Yield (kg/tree)		Mean fruit wt. (g)		TSS	
	2017	2018	2017	2018	2017	2018
T1	32.25 a	42.33 a	10.23a	11.90 a	37.58ab	40.50 a
T2	34.50 a	41.25 a	8.98 ab	11.20 a	37.78 ab	39.33 a
T3	22.50 a	40.25 a	9.48 ab	11.15 a	40.98 a	36.75 a
T4	25.24 a	38.75 a	9.88 ab	11.03 a	40.30a	35.00 a
T5	28.75 a	35.50 a	7.70 b	6.23 b	33.23 b	32.00 a
LSD	NS	NS	2.262	3.39	4.678	NS
CV%	22.28	14.89	15.87	18.70	8.00	16.12

Means with the same letters in same columns are not significantly different at 5% probability level.

Bunch and various types of strand thinning affected significantly fruit length (Table 3). The highest value during 2017 (3.32 cm) was obtained by T4, while during 2018 (4.23 cm) recorded by T1. The least values were recorded by the control (T5) in both seasons (2.75 and 2.95 cm during 2017 and 2018 respectively). Bunch and all types of strand thinning significantly increased fruit diameter as compared to control (Table 3). The highest value during 2017 (2.40 cm) was obtained by T2, while during 2018 (2.63 cm) recorded by T1. The least values were recorded by the control (T5) in both seasons (2.06 and 2.10 cm during 2017 and 2018 respectively). A Similar result was documented on fruit dimensions with regard to small fruit size date palm cultivar in Pakistan [13].

Pulp thickness was significantly increased by bunch and various types of strand thinning over control treatment (Table 3). Under thinning treatment it ranged between 6-7.75 and 7-8.25 mm in season 2017 and 2018 respectively, but such difference between different thinning treatments was not statistically significant. Minimum fruit pulp thickness was found in the palms under control treatment (4.00 and 5.75 mm during 2017 and 2018 respectively). Likewise, thinning treatments led to a significant increase in fruit flesh and seed weight [11,13].

Bunch and various types of strand thinning effect on fruit volume was not significant in season 2017. While in the season 2018, a significant effect was noticed (Table 3). T1 recorded the highest fruit volume (5.67 cm^3) and the control treatment recorded the least fruit volume (3.75 cm^3). A similar increase in fruit volume was indicated (14) by using late pollination as a thinning tool in 'Barhee' date palm cultivar.

Table 3. Yield, mean fruit length, fruit diameter, fruit volume and pulp thickness as affected by bunch and various types of strand thinning

Treatments	Fruit length (cm)		Fruit diameter (cm)		Fruit volume (cm^3)		Pulp thickness (mm)	
	2017	2018	2017	2018	2017	2018	2017	2018
T1	3.30 a	4.23 a	2.26 ab	2.63 a	5.25 a	5.67 a	7.00 a	8.25 a
T2	3.28 a	3.63 ab	2.40 a	2.60 a	4.50 a	5.50 a	7.75 a	8.25 a
T3	3.28 a	3.50 b	2.28 ab	2.55 a	4.75 a	5.50 a	6.00 ab	7.75 a
T4	3.32 a	3.47 b	2.27 ab	2.50 a	5.00 a	5.50 a	7.50a	7.00 ab
T5	2.75 b	2.95 b	2.06 b	2.10 b	4.00 a	3.75 b	4.00 b	5.75 b
LSD	0.4093	0.723	0.2439	0.41	NS	1.09	2.009	1.450
CV%	8.35	11.70	7.02	9.38	15.90	12.07	20.21	11.14

Means with the same letters in same columns are not significantly different at 5% probability level.

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