

Effect of Fruit Thinning on Date Yield and Quality of Mishrig Wad Khateeb and Barakawi in Northern Sudan

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Abstract

The experiments were conducted in the Horticulture nursery and a farmer orchard at Elgurerir for two and three seasons on Mishrig wad Khateeb (MWK) and Barakawi palms, respectively, to determine the effect of fruit thinning on fruit quality and yield of both cultivars. The results showed that the best method of thinning for MWK was the removal of the central strands and for Barakawi was the removal of tip and central strands. Fruits resulting from thinned bunches were significantly superior in size, weight, pulp/seed ratio, total soluble solid (TSS) and yield compared to those collected from unthinned bunches.

Introduction

Date palm (*Phoenix dactylifera*) is the dominant fruit in the northern Sudan. The long, hot and dry summers with low relative humidity make northern Sudan an ideal region for date culture (Appendix 1). The Sudan like most other date palm growing countries has its own indigenous cultivars. Barakawi is the most important commercial dry cultivar and Mishrig Wad Khateeb (MWK) is the most important semi-dry cultivar in Merowe area. Levels of yields in northern Sudan are still below the world averages. This is mainly due to many cultural problems, including lack of proper fruit thinning programs. However, many efforts are enforced to increase yield per palm through improving the cultural practices and through the promotion of extension services for the production of the crop.

Fruit thinning as stated by Nixon (1935, 1936, 1951), Khairi et al. (1983), Osman (1979) is generally practiced to increase fruit size, improve quality and prevent delayed ripening of dates. In addition, fruit thinning is assumed to ensure sufficient flowering in the following year. Fruit thinning at a commercial level is practiced either by reducing the number of fruits per bunch (bunch thinning) or by reducing the number of bunches per palm (bunch removal) (Nixon, 1951; Osman, 1989; Ibrahim and Hamadi, 1995).

The natural phenomenon of thinning is known as natural fruit drop. Reuveni (1969) reported that the rate of natural fruit drop varies with variety and gardens and it was more or less fixed for each variety in a specific garden and showing the same pattern throughout the season..

The objective of this study was to determine the effect of fruit thinning on the characteristics of female bunch, fruits and seeds physical characteristics, yield, sugar content and total soluble solid (TSS) of MWK and Barakawi cultivars.

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Materials and Methods

The experiments were carried out in the Horticulture nursery and a farmer orchard at Elgureir for two seasons (2004 and 2005) and three seasons (2003 to 2005) on MWK and Brakawi, respectively.

The selected palms were of uniform growth pattern, size and planted at 8x8 m distance. No fertilization programs were adopted. MWK palms were about 30 years old and Barakawi palms 15 years old. MWK were irrigated at monthly interval, while Barkawi at 15 days interval.

The experimental design used was a randomized complete block design repeated 3 and 4 times for MWK and Barakawi cultivars, respectively.

One male date palm tree grown at Elgurair adjacent to the experimental area of about 15 years old was selected as source of pollen. The main objective of selecting a single male tree was to avoid xenia and meta xenia effect of pollen.

Each thinning treatment was carried out on one bunch of the specified tree. The treatments were carried out 4 and 2 weeks after pollination for MWK and one month after pollination for Barakawi. The treatments include:

1. cutting back of $\frac{1}{3}$ of strands tips
2. Removal of $\frac{1}{3}$ central strands (from the center of the bunch).
3. Removal and cutting of $\frac{1}{3}$ (tip + central) strands.
4. control (untreated bunches).

Data collection

Morphological data and yield:

Yield and morphological data after the fruits were fully mature include total yield/bunch, number of strands/bunch, number of fruits/strand, average length of strands at the upper, middle and lower part of the bunch).

Physical characteristics of fruit and seed:

Ten fruits were randomly selected for each treatment to measure the whole fruit, pulp and seed weights using a sensitive balance. Avernier was used to determine, length, width, and diameter of fruits and length, and width of seeds. Seed percentage was determined based on weight of whole fruit.

Chemical characteristics of fruit:

Total soluble solid and sucrose percent of various treatments were determined at the "Khalal" stage by hand refractometer (at $<40\text{ C}^{\circ}$).

Results and Discussion

Tables 1, 2, 3 and 4 summarize the effects of different methods of thinning on length of strands, number of strands, number of date per strands and yield per bunch for two successive fruiting seasons, 2004 and 2005.

It was evident that the fruit weight per bunch for MWK (Tables 1 and 2) and for Barakawi (Tables 3 and 4) was significantly increased by all thinning treatments compared to the control .

The length of strand per bunch showed non-significant differences between control and thinned bunch for Brakawi, while it varied significantly different between removal of strands tips and other treatments for Mishrig Wad Khateeb. The number of strands per bunch showed highly significant differences between the removal of central strands and other treatments on both cultivars.

The data presented in Tables 5 and 6 for MWK and Tables 7, 8 and 9 for Barakawi revealed that all thinning treatments showed a significantly higher values of fruit length, width, flesh thickness, fruit weight, and pulp weight over the control, while there were no significant differences in seed length, width and weight on both cultivars. Tables 5 and 6 showed that in MWK fruit thinning after one month gave the best results than after 15 days on fruit physical characteristics.

In MWK removal of $\frac{1}{3}$ of the strands from the center of the bunch was the best, followed by the removal of $\frac{1}{3}$ (tip + central) of the strands and cutting back of $\frac{1}{3}$ tip of strands.

In Brakawi the removal of $\frac{1}{3}$ (tip + central) of the strands was the best, followed by removal of $\frac{1}{3}$ of the strands from the center of the bunch and lastly cutting $\frac{1}{3}$ tip of the strands. According to the available data, the increase in whole fruit weight was mainly due to the increase in pulp weight.

The effect of different bunch thinning treatments on sucrose percent and total TSS of date fruits at the end of “Khalal” stage was shown in Table 10 for MWK and Tables 11 and 12 for Barakawi. Generally, bunch thinning resulted in a significant increase in total soluble solids and sucrose% compared to the control. For MWK the removal of $\frac{1}{3}$ central strands was found to be superior to the removal and cutting back $\frac{1}{3}$ (central + tip) strands and cutting back $\frac{1}{3}$ the tip of the strands, while in Barakawi the removal and cutting $\frac{1}{3}$ (central + tip) the strands gave the highest yields, followed by the removal of $\frac{1}{3}$ central strands and cutting back $\frac{1}{3}$ the tip of the strands.

Conclusions

From the present study, the best results were obtained from thinning treatment in which about $\frac{1}{3}$ of the fruits was thinned by removal of central strands and removal and cutting (central + tips) of the strands for Mishrig Wad Khateeb and Brakawi cultivars, respectively.

Such method of fruit thinning would result in higher grade fruits and accelerated time of ripening by more than 7 days compared with the control.

Recommendations

Based on the above mentioned results we request the Crop Husbandry Committee to pass the following recommendations:

1. For Mishrig Wad Khateeb, the best method of thinning is the removal of $\frac{1}{3}$ central of the strands.
2. For Barakawi. the best method of thinning is the removal of $\frac{1}{3}$ (tip + central) of strands.
3. The best time of fruit thinning is a month after pollination for the two cultivars.

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Appendix 1. The metrological Data for Merowi area (2004-2005).

Month	2004				2005			
	Mean Temperature		Relative Humidity	Total Rainfall	Mean Temperature		Relative Humidity	Total Rainfall
	C°		%	(mm)	C°		%	(mm)
	Max.	Min.			Max.	Min.		
January	28.9	13.0	24	0	27.2	11.3	26	0
February	30.5	13.6	21	0	34.9	17.3	19	0
March	36.1	18.2	14	0	36.1	17.6	13	0
April	40.1	21.2	12	0	40.6	22.9	14	0
May	45.2	26.5	11	0	41.8	25.7	14	0.7
June	43.6	26.5	14	TR	44.4	28.1	13	0
July	43.9	21.8	16	1.0	43.1	28.8	27	0.2
August	43.4	28.8	21	TR	43.2	29.2	26	0.4
September	43.4	27.7	17	0	43.1	27.8	18	0
October	40.7	25.2	21	0	40.1	24.9	21	0
November	34.7	19.3	25	0	-	-	-	-
December	29.5	13.7	29	0	-	-	-	-

Table 1. Effect of fruit thinning on morphological characteristics and bunch yield of MWK at Elgureir (Merowe Province) in season 2004.

Treatment	Length of strand (cm)	No. of strand/bunch	No. of date/strand	Yield/bunch (kg)
Cutting back$\frac{1}{3}$ the tip of strands	36.3 b	106.6 a	29.6 c	6.7 c
Removal of $\frac{1}{3}$ central strands	41.3 a	74.6 d	35.3 a	9.5 a
Removal and cutting $\frac{1}{3}$ (tip+ central)	36.3 b	94.3 c	32.0 bc	8.2 b
Control (untreated)	40.6 a	104.6 b	33.3 b	6.3 c
SE\pm	0.82	0.29	0.81	0.22
Significance level	**	***	*	***

Table 2. Effect of fruit thinning on morphological characteristics and bunch yield of MWK at Elgureir (Merowe Province) in season 2005.

Treatment	Length of strand (cm)	No. of strand/bunch	No. of date/strand	Yield/bunch (kg)
Cutting back$\frac{1}{3}$ the tip of strands	54.3 b	84.6 a	48.0 b	8.7 c
Removal of $\frac{1}{3}$ central strands	76.3 a	62.6 c	56.0 a	12.4 a
Removal and cutting $\frac{1}{3}$ (tip+ central)	60.0 b	74.0 b	52.0 ab	11.1 b
Control (untreated)	75.3 a	84.0 a	56.6 a	7.8 c
SE\pm	4.24	1.92	1.32	0.33
Significance level	*	***	*	***

Table 3. Effect of fruit thinning on morphological characteristics and bunch yield of Brakawi at Elgureir (Merowe Province) in season 2004.

Treatment	Length of strand (cm)	No. of strand/bunch	No. of date/strand	Yield/bunch (kg)
cutting back $\frac{1}{3}$ the tip of strands	32.0 b	54.3 a	23.3 c	8.5 b
Removal of $\frac{1}{3}$ central strands	40.0 a	32.0 c	32.6 a	9.8 ab
Removal and cutting $\frac{1}{3}$ (tip+ central)	34.0 b	38.3 b	28.6 b	11.0 a
Control (untreated)	38.6 a	42.6 a	30.6 ab	7.8 b
SE\pm	1.07	0.78	0.65	0.34
Sig. Level	**	***	***	**

Table 4. Effect of fruit thinning on morphological characteristics and yield of Brakawi bunch at Elgureir (Merowe Province) in season 2005.

Treatment	Length of strand (cm)	No. of strand/bunch	No. of date/strand	Yield/bunch (kg)
cutting back $\frac{1}{3}$ the tip of strands	31.05 b	46.33 a	22.25 b	8.64 c
Removal of $\frac{1}{3}$ central strands	37.57 a	29.00 c	31.25 a	10.00 b
Removal and cutting $\frac{1}{3}$ (tip+ central)	34.00 ab	34.33 bc	24.75 ab	11.16 a
Control (untreated)	35.25 ab	39.00 ab	26.50 b	7.79 d
SE\pm	1.4	2.27	1.85	0.22
Significance level	*	**	*	***

Table 5. Effect of fruit thinning on fruit and seed physical characteristics of Mishrig Wad Khateeb at Elgureir (Merowe Province) in season 2004.

Treatment	Fruit Length (mm)	Fruit width (mm)	Flesh thickness (mm)	Fruit weight (g)	Pulp weight (g)	Seed Weight (g)	Seed width (mm)	Seed length (mm)
cutting back $\frac{1}{3}$ the tip of strand	2.7e	1.91 bc	0.55 c	5.89 de	5.02 de	0.87 a	0.84 a	1.86 f
Removal of $\frac{1}{3}$ central strands	3.02 bc	2.08 b	0.68 b	7.18 bc	6.26 bc	0.92 a	0.88 a	1.91 d
Removal and cutting $\frac{1}{3}$ (tip +central) strands	2.84 de	1.99 b	0.58 c	6.39 cd	5.48 cd	0.90 a	0.86 a	1.90 c
Control (untreated)	2.61 f	1.73 c	0.37 d	5.18 e	4.31 e	0.84 a	0.82 a	1.80 g
cutting back $\frac{1}{3}$ the tip of strands	2.92 cd	2.04 b	0.57 c	7.18 bc	6.16 bc	1.03 a	0.86 a	1.94 c
Removal of $\frac{1}{3}$ central strands	3.43 a	2.44 a	0.88 a	9.64 a	8.64 a	1.00 a	0.85 a	2.04 a
Removal and cutting $\frac{1}{3}$ (tip +central) strands	3.07 b	2.10 b	0.68 b	7.71 b	6.76 b	0.95 a	0.87 a	1.99 b
Control (untreated)	2.61 f	1.73 c	0.37 d	5.18 e	4.31 e	0.84 a	0.83 a	1.80 g
S.E \pm	0.04	0.06	0.03	0.25	0.27	0.05	0.02	0.01
Significance level	**	*	**	**	**	n.s	n.s	***

Table 6. Effects of Fruit thinning on Fruit and seed physical characteristics of Mishrig Wad Khateeb at Elgureir (Merowe Province) in season 2005.

Treatment	Fruit length (mm)	Fruit width (mm)	Flesh thickness (mm)	Fruit weight (g)	Pulp weight (g)	Seed Length (mm)	Seed width (mm)	Seed weight (g)
cutting back $\frac{1}{3}$ the tip of strand	3.26 a	2.40 a	0.57 cd	8.33 cd	7.37 a	2.06 a	0.84 a	0.95 bc
Removal of $\frac{1}{3}$ central strands	3.25 a	2.30 ab	0.62 bc	7.83 b	6.87ab	2.00 a	0.85a	0.96 b
Removal and cutting $\frac{1}{3}$ (tip +central) strands	3.22 a	2.32 ab	0.48 e	7.83c	6.97 ab	1.95 a	0.82 a	0.87 bc
Control (untreated)	3.34 a	2.25 ab	0.48 c	9.19 d	8.29 a	2.25 a	0.85 a	0.91 bc
cutting back $\frac{1}{3}$ the tip of strands	3.16 ab	2.24 ab	0.56 d	7.91 b	6.98 ab	1.92 a	0.83 a	0.94 bc
Removal of $\frac{1}{3}$ central strands	3.45 a	2.46 a	0.81 a	8.93 a	7.79 a	2.02 a	0.86 a	1.14 a
Removal and cutting $\frac{1}{3}$ (tip +central) strands	3.27 a	2.03 bc	0.64 b	8.20 b	7.39 a	1.98 a	0.83 a	0.81 bc
Control (untreated)	2.91 c	1.93 c	0.39 f	6.39 d	5.61 b	1.85 a	0.82 a	0.78 c
S.E \pm	0.09	0.09	0.02	0.54	0.52	0.09	0.01	0.05
Significance level	*	*	***	*	*	n.s	n.s	*

Table 7. Effect of fruit thinning on fruit and seed physical characteristics of Barakawi at Elgureir (Merowe Province) in season 2003.

Treatment	Fruit length (mm)	Fruit width (mm)	Flesh Thickness (mm)	Fruit weight (g)	Pulp weight (g)	Seed length(mm)	Seed width (mm)	Seed weight (g)
cutting back 1/3 the tip of strands	3.80 a	1.70 b	0.40 a	4.60 c	3.85 c	2.40 a	0.70 a	0.75 a
Removal of 1/3 central strands	3.70 ab	1.83 ab	0.40 a	5.38 b	4.63 b	2.43 a	0.70 a	0.75 a
Removal and cutting 1/3 (tip+ central)	3.53 b	1.85 a	0.40 a	5.50 a	4.83 a	2.58 a	0.70 a	0.68 a
Control (untreated)	3.45 b	1.43 c	0.30 b	3.83 d	3.18 d	2.10 b	0.68 a	0.65 a
SE±	0.08	0.04	0.02	0.03	0.03	0.06	0.01	0.63 a
Significance level	*	***	*	**	***	**	N.S	N.S

Table 8. Effect of fruit thinning on fruit and seed physical characteristics of Barakawi at Elgureir (Merowe Province) in season 2004

Treatment	Fruit length (mm)	Fruit width (mm)	Flesh Thickness (mm)	Fruit weight (g)	Pulp weight (g)	Seed length(mm)	Seed width (mm)	Seed weight (g)
cutting back 1/3 the tip of strands	4.68 b	1.92 a	0.49 bc	8.42 b	7.44 b	2.81 b	0.74 a	0.98 a
Removal of 1/3 central strands	4.81 b	1.99 a	0.54 ab	9.00 b	8.00 b	2.83 ab	0.74 a	1.01 a
Removal and cutting 1/3 (tip+ central)	5.09 a	2.08 a	0.85 a	10.34 a	9.35 a	2.92 a	0.69 a	1.00 a
Control (untreated)	4.33 c	2.01a	0.47 c	6.61 c	5.72 c	2.71 c	0.67 a	0.89 a
SE±	0.07	0.09	0.02	0.38	0.37	0.03	0.02	0.03
Significance level	*	No. Sign	*	***	***	*	No. Sign	No sign

Table 9. Effects of fruit thinning on fruit and seed physical characteristics of Barakwi at Elgureir (Merowe Province) in season 2005.

Treatment	Fruit length (mm)	Fruit width (mm)	Flesh Thickness (mm)	Fruit weight (g)	Pulp weight (g)	Seed length(mm)	Seed width (mm)	Seed weight (g)
cutting back $\frac{1}{3}$ the tip of strands	5.11 ab	2.06 ab	0.63 ab	12.49 ab	11.35 ab	3.26 a	0.75 a	1.13 a
Removal of $\frac{1}{3}$ central strands	5.21 ab	2.14 ab	0.67 a	12.93 ab	11.73 a	3.09 a	0.76 a	1.20 a
Removal and cutting $\frac{1}{3}$ (tip+ central)	5.49 a	2.12 a	0.73a	13.58 a	12.42 a	3.23 a	0.73 a	1.16 a
Control (untreated)	4.60 b	1.96 b	0.53b	11.27 b	9.96 b	3.07 a	0.70a	1.31 a
SE \pm	0.14	0.03	0.02	0.48	0.46	0.08	0.03	0.06
Significance level	*	**	***	*	*	n.s	n.s.	n.s

Table 10. Effect of fruit thinning after 15 days on fruit chemical characteristics (sucrose and TSS) of Mishrig Wad Khateeb at Elgureir (Merowe Province) in seasons 2005 and 2004.

Treatment	2005		2004	
	Sucrose %	TSS	Sucrose	TSS
cutting back $\frac{1}{3}$ the tip of strands	22.33 bc	72.67 bc	22.13 c	71.87 c
Removal of $\frac{1}{3}$ central strands	23.53a	76.80 a	23.00 a	75.00 a
Removal and cutting $\frac{1}{3}$ (tip+ central)	22.73 b	73.93 b	22.53 b	73.13 b
Control (untreated)	22.00c	71.33 c	21.87 c	70.80 d
SE \pm	0.16	0.65	0.09	0.26
Significance level	**	**	***	***

Table 11. Effect of fruit thinning after month on fruit chemical characteristics (sucrose and T.S.S) of Mishrig Wad Khateeb at Elgureir (Merowe Province) in seasons 2005 and 2004.

Treatment	2005		2004	
	Sucrose %	TSS	Sucrose	TSS
cutting back $\frac{1}{3}$ the tip of strands	23.00 b	74.67 b	23.27 bc	75.73 bc
Removal of $\frac{1}{3}$ central strands	24.00 a	78.33 a	25.00 a	82.00 a
Removal and cutting $\frac{1}{3}$ (tip+ central)	23.13 b	75.20 b	23.60 b	77.08 b
Control (untreated)	22.34 c	72.33 c	22.60 c	73.40 c
SE \pm	0.17	0.47	0.20	0.75
Significance level	**	***	***	**

Table 12. Effect of fruit thinning on fruit chemical characteristics (sucrose and TSS) of Barakawi at Elgureir (Merowe Province) in seasons 2005 and 2004

Treatment	2005		2004	
	Sucrose %	TSS	Sucrose	TSS
cutting back $\frac{1}{3}$ the tip of strands	20.00 b	64.92 c	19.73 b	62.67 b
Removal of $\frac{1}{3}$ central strands	21.00 ab	68.40 b	21.20 ab	68.87 ab
Removal and cutting $\frac{1}{3}$ (tip+ central)	22.58 a	73.67 a	22.40a	72.67 a
Control (untreated)	19.83 b	64.43 c	20.00 b	64.67 b
SE \pm	0.33	1.01	0.44	1.69
Significance level	***	***	*	*