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Thinning Time and Fruit Spacing Influence on Maturity, Yield and Fruit Quality of Peaches

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Abstract: The present investigation was carried out during 2007 and 2008 seasons on mature uniform Flordaprince and Desert Red peaches cultivars. Trees were thinned at the full bloom (FB) stage, 10, 20,30 or 40 days after full bloom(DAFB) at spacing fruits 10, 15 or 20 cm. Results show that, the fruit maturity of Flordaprince cultivar was advanced by 10-11 days when the thinning was done at full bloom. Also, the fruit maturity of Desert Red cultivar was advanced by 8-9 days when the thinning was done at 20 days after full bloom in both seasons of the study. Thinning treatments decreased the yield as weight and number, advanced the maturity stage and enhanced the fruit quality in terms of weight, diameter, increased total sugars, TSS, TSS/acid ratio while, reduced firmness and acidity. The best results were dedicated to thinning Flordaprince cultivar at full bloom (FB) stage and Desert Red cultivar at 20 DAFB with 20 cm apart.

Key word: Peach · Hand thinning · Fruit spacing · Yield-Fruit quality

INTRODUCTION

In peach, flowering and fruit setting are generally much more than required for getting a commercial crop which adversely affects fruit size and flower initiation for the subsequent crop. Heavy bearing produces small sized and poor quality fruit, resulting in poor returns to the growers. Thinning of either flowers or fruits is, therefore, necessary to produce marketable sized fruits of good color and quality, to prevent limb breakage of overloaded branches, to promote early ripening and to stimulate flower initiation for the next year's crop [1]. All the hand thinning treatments advanced fruit maturity to the varying degrees, increased fruit weight and brought about significant improvement in fruit quality as measured in terms of high TSS, low acidity and high TSS/acid ratio. The advancement in fruit maturity under most of the thinning treatments might be due to faster accumulation of minerals and metabolites, availability of more light and reduced competition among the developing fruits [2,3].

However, when early peach thinning was done at 0, 10, 20, 30 and 40 days after full bloom (DAFB), trees were hand thinned to achieve different crop loads by spacing flowers or fruit 10, 15 or 20 cm along the shoot on whole tree canopies, fruit weight and diameter decreased with increasing time to hand thinning and increased linearly with increasing spacing. Number of fruits harvested and yield per tree decreased linearly with increased spacing, while fruit spacing did not affect soluble solids [4].In this respect peach thinning is connected with profitable peach growing. It improves fruit quality as indexed by fresh weight, fruit diameter, total soluble solids, acidity and TSS/acid ratio [5]. However, thinning too early, i.e. blossom thinning, reduce both fruit set and yield [6-9].

The objective of this investigation was to study the effect of thinning time and fruit spacing on maturity, yield and fruit quality of Flordaprince and Desert Red Peaches.

MATERIALS AND METHODS

The present investigation was carried out for two successive seasons 2007 and 2008 in a private orchard at El-Bostan region in Beheira governorate. Forty eight trees of Flordaprince cultivar and another forty eight trees of Desert Red cultivar were considered in each season. Trees were seven years old, grafted on Nemagaurd rootstock and planted in sandy soil. They were spaced at 4X4 m, vase trained, irrigated and fertilized with a drip irrigation system and subjected to recommended cultural practices. The experiment was arranged in a randomized complete blocks design. Each three trees of each cultivar were subjected to one of

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the following thinning treatments with each tree acting as a replicate: manual thinning of blossoms at 10, 15 or 20 cm at full bloom (when 80% of the blossoms were opened), manual thinning of fruit set at 10, 15 or 20 cm at 10, 20, 30 or 40 days after full bloom (DAFB) and control (unthinned). At maturity stage for Flordaprince and Desert Red cultivars as previously determined by Shaltout [10, 11], number of fruits born on each considered tree was counted and the yield (kg) was estimated by multiplying the average fruit weight x number of fruit born on each tree and a sample of 10 fruits was harvested from each tree and transferred to the lab for the following determinations:

Physical Characteristics: Fruit weight (g) with a digital scale, fruit diameter (cm) with vernial caliper and flesh firmness (Ib/inch^2) with a pressure tester

Chemical Characteristics: Total sugars (%) according to Smith [12], juice total soluble solids% (TSS) with a hand rafractometer, total acidity (%) as malic acid according to A.O.A.C. [13] and TSS/acid ratio. The data were tabulated and statistically analyzed according to Snedecor and Cochran [14]. The mean values were compared by using the least significant differences (L.S.D) test at 5 % level [15].

RESULTS AND DISCUSSION

Date of Maturity: Control Flordaprince fruits were the last to reach the stage of maturity (18/4 and 23/4) in the first and second seasons, respectively (Table 1). In general, all the conducted treatments advanced this date with various degrees. Earliest maturity dates were dedicated to thinning at 20cm space in the full bloom stage (8/4 and12/4) about 10-11 days earlier than control in the first and second seasons, respectively. In general, the earlier the thinning and the wider the spacing was practiced the more advanced the maturity stage. As for Desert Red cultivar, control fruits reached the maturity stage on (30/5 and 6/6) in the first and second seasons, respectively (Table 2). The stage of maturity was advanced in general by all of the conducted treatments. Thinning at 20 cm and 20 DAFB advanced the occurrence of this phonological stage (22/5 and 28/5 in the first and second, respectively), about 8-9 days earlier than any of the conducted treatments. In general, thinning at the same space prior to this timing is more effective than that carried past to this timing in this respect. These results are in agreement with Chanana *et al.* [1]; Allan *et al.* [2] and Chanana *et al.* [3] as they indicated that, the advancement in fruit maturity under most of the thinning treatments might be due to faster accumulation of minerals and metabolites, availability of more light and reduced competition among the developing fruits.

Yield, Number of Fruits per Tree and Fruit Weight: On the average, yield of Flordaprince cultivar was significantly reduced when thinning was carried out on all of the considered timings compared with the control (Table 3). Least reduction was attributed when thinning was carried out at the FB stage (44.7 and 47.67 Kg/tree in the first and second season, respectively). As for the spacing effect, it was evident that yield was significantly decreased with increasing the space. Interaction results show evidentially that, control trees bore significantly the highest yield (50.5 and 54.6 Kg/tree in the first and second seasons, respectively). Trees that were thinned at the FB stage at 10cm followed but with significant difference.

Highest significant yield of Desert Red cultivar trees was dedicated to the control and the trees thinned at 20 DAFB was followed (Table 4). The spacing effects show that, increasing the space reduced the yield significantly. The interaction results show that, highest yield was born on control trees (68.8 and 70.3 Kg/tree in the first and second seasons, respectively). Statistically equal results were dedicated to trees thinned 20 DAFB at 10cm in both seasons.

Control Flordaprince trees carried significantly the highest number of fruits (Table 3). This number was reduced by thinning at any of the considered dates. Least reducing effect was due to thinning at the FB stage. Fruits number per tree was reduced significantly with increasing the space. Interaction data reveal that, the control (unthinned) significantly the highest number of fruits in both seasons (782.6 and 837.4 fruits/tree). Trees thinned at 10 cm at the FB stage followed but with significant difference.

Similarly with Desert Red cultivar the conducted treatments significantly reduced the number of fruits born on each tree (Table 4). Least reduction was due to thinning at 20 and30 days AFB in the first season and to thinning at 20 days AFB in the second. This number was significantly decreased with increasing the thinning spacing. Interaction reveals that control trees carried significantly the highest number of fruits in both seasons (937.3 and 895.5 fruits/tree).

Table 1: Effect of thinning time and fruit spacing on date of maturity of Flordaprince peach during 2007 and 2008 seasons

	2007 season															
	Hand thinning at F.B*			Hand thinning at 10 days A.F.B**			Hand thinning at 20 days A.F.B			Hand thinning at 30 days A.F.B			Hand thinning at 40 days A.F.B			
	Fruit spacing (cm)			Fruit spacing (cm)			Fruit spacing (cm)			Fruit spacing (cm)			Fruit spacing (cm)			
Thinning time	10	15	20	10	15	20	10	15	20	10	15	20	10	15	20	Control (without thinning).
Date of thinning	1/2	1/2	1/2	10/2	10/2	10/2	20/2	20/2	20/2	1/3	1/3	1/3	10/3	10/3	10/3	-
Date of maturity	10/4	9/4	8/4	14/4	12/4	11/4	12/4	10/4	10/4	16/4	15/4	15/4	18/4	17/4	17/4	18/4
	2008 season															
Date of thinning	4/2	4/2	4/2	14/2	14/2	14/2	24/2	24/2	24/2	4/3	4/3	4/3	14/3	14/3	14/3	-
Date of maturity	14/4	14/4	12/4	17/4	16/4	16/4	15/4	15/4	13/4	20/4	20/4	19/4	21/4	21/4	20/4	23/4

* Full bloom. ** After full bloom.

Table 2: Effect of thinning time and fruit spacing on date of maturity of Desert Red peach during 2007 and 2008 seasons

	2007 season															
	Hand thinning at F.B*			Hand thinning at 10 days A.F.B**			Hand thinning at 20 days A.F.B			Hand thinning at 30 days A.F.B			Hand thinning at 40 days A.F.B			
	Fruit spacing (cm)			Fruit spacing (cm)			Fruit spacing (cm)			Fruit spacing (cm)			Fruit spacing (cm)			
Thinning time	10	15	20	10	15	20	10	15	20	10	15	20	10	15	20	Control (without thinning).
Date of thinning	25/2	25/2	25/2	6/3	6/3	6/3	16/3	16/3	16/3	26/3	26/3	26/3	14/5	14/5	14/5	-
Date of maturity	28/5	27/5	27/5	26/5	26/5	24/5	23/5	23/5	22/5	29/5	28/5	28/5	30/5	29/5	29/5	30/5
	2008 season															
Date of thinning	1/3	1/3	1/3	10/3	10/3	10/3	20/3	20/3	20/3	30/3	30/3	30/3	10/5	10/5	10/5	-
Date of maturity	2/6	1/6	1/6	30/5	30/5	29/5	29/5	28/5	28/5	4/6	3/6	3/6	5/6	5/6	4/6	6/6

* Full bloom. ** After full bloom

Table 3: Effect of thinning time and fruit spacing on yield, number of fruits per tree and fruit weight (g) of Flordaprince peach during 2007 and 2008 seasons

	Yield (Kg per tree)				Number of fruits per tree				Fruit weight (g)			
	2007 season											
	Fruit spacing (cm)				Fruit spacing (cm)				Fruit spacing (cm)			
Thinning time	10	15	20	Mean (B)	10	15	20	Mean (B)	10	15	20	Mean (B)
Hand thinning at F.B*	47.4	44.2	42.5	44.70	597.7	523.7	479.6	533.67	79.3	84.4	88.6	84.10
Hand thinning at 10 days A.F.B**	43.6	40.8	39.4	41.27	569.2	506.8	461.9	512.63	76.6	80.5	85.3	80.80
Hand thinning at 20 days A.F.B	45.4	42.6	40.6	42.87	588.1	510.8	468.3	522.40	77.2	83.4	86.7	82.43
Hand thinning at 30 days A.F.B	41.6	38.4	35.6	38.53	589.2	503.3	430.9	507.80	70.6	76.3	82.6	76.50
Hand thinning at 40 days A.F.B	41.2	37.2	35.2	37.87	586.9	493.4	428.2	502.83	70.2	75.4	82.2	75.93
Control (without thinning).	50.5	50.5	50.5	50.50	782.6	782.6	782.6	782.60	64.4	64.4	64.4	64.40
Mean (A)	44.92	42.26	40.62	-	618.95	553.43	508.58	-	73.05	77.39	81.63	-
L.S.D at 5 %	A=0.4766 B=0.6740 AB=1.167				A=1.513 B=2.139 AB=3.705				A=0.3119 B=0.4411 AB=0.7640			
	2008 season											
Hand thinning at F.B*	51.2	47.3	44.5	47.67	614.6	542.4	490.6	549.20	83.3	87.2	90.7	87.07
Hand thinning at 10 days A.F.B**	46.4	43.6	41.8	43.93	582.9	517.8	473.9	524.87	79.6	84.2	88.2	84.00
Hand thinning at 20 days A.F.B	47.6	44.2	43.3	45.03	584.8	512.2	483.3	526.77	81.4	86.3	89.6	85.77
Hand thinning at 30 days A.F.B	42.2	40.7	38.7	40.42	568.7	512.6	448.9	510.07	74.5	79.4	86.2	80.03
Hand thinning at 40 days A.F.B	40.8	39.4	37.4	39.20	553.6	506.4	443.1	501.03	73.7	77.8	84.4	78.63
Control (without thinning).	54.6	54.6	54.6	54.60	837.4	837.4	837.4	837.40	65.2	65.2	65.2	65.20
Mean (A)	47.13	44.97	43.38	-	623.67	571.47	529.53	-	76.28	80.02	84.05	-
L.S.D at 5 %	A=0.5105 B=0.7220 AB=1.251				A=1.840 B=2.602 AB=4.507				A=0.7182 B=1.016 AB=1.759			

* Full bloom. ** After full bloom.

Table 4: Effect of thinning time and fruit spacing on yield, number of fruits per tree and fruit weight (g) of Desert Red peach during 2007 and 2008 seasons

	Yield (Kg per tree)				Number of fruits per tree				Fruit weight (g)			
	2007 season											
	Fruit spacing (cm)				Fruit spacing (cm)				Fruit spacing (cm)			
Thinning time	10	15	20	Mean (B)	10	15	20	Mean (B)	10	15	20	Mean (B)
Hand thinning at F.B*	64.8	61.7	60.6	62.37	702.1	592.1	512.7	602.30	92.3	104.6	118.6	105.17
Hand thinning at 10 days A.F.B**	66.9	64.2	62.7	64.60	706.4	569.1	512.3	595.93	94.7	112.8	122.4	109.97
Hand thinning at 20 days A.F.B	67.9	66.5	64.4	66.27	695.7	571.8	518.5	595.33	97.6	116.3	124.2	112.70
Hand thinning at 30 days A.F.B	62.4	59.8	56.4	59.53	729.0	640.3	502.2	623.83	85.6	93.4	112.3	97.10
Hand thinning at 40 days A.F.B	61.2	58.2	53.8	57.73	742.7	645.2	485.6	624.5	82.4	90.2	110.8	94.47
Control (without thinning).	68.8	68.8	68.8	68.80	937.3	937.3	937.3	937.30	73.4	73.4	73.4	73.40
Mean (A)	65.33	63.20	61.12	-	752.2	659.3	578.1	-	87.67	98.45	110.3	-
L.S.D at 5 %	A=0.4941 B=0.6988 AB=1.210				A=1.776 B=2.512 AB=4.351				A=0.7299 B=1.032 AB=1.788			
	2008 season											
Hand thinning at F.B*	67.6	66.4	64.3	66.10	716.9	602.0	533.2	617.37	94.3	110.3	120.6	108.40
Hand thinning at 10 days A.F.B**	69.4	68.0	66.4	67.93	706.0	572.4	528.2	602.20	98.3	118.8	125.7	114.27
Hand thinning at 20 days A.F.B	70.0	68.4	67.3	68.57	668.6	567.2	528.3	587.90	104.7	120.6	127.4	117.57
Hand thinning at 30 days A.F.B	66.2	63.2	60.6	63.33	738.8	655.6	521.1	638.50	89.6	96.4	116.3	100.77
Hand thinning at 40 days A.F.B	63.5	60.7	57.3	60.50	726.5	648.5	496.5	623.83	87.4	93.6	115.4	98.80
Control (without thinning).	70.3	70.3	70.3	70.30	895.5	895.5	895.5	895.50	78.5	78.5	78.5	78.50
Mean (A)	67.83	66.17	64.37	-	742.05	656.87	583.70	-	92.13	103.0	114.0	-
L.S.D at 5 %	A=0.5586 B=0.7900 AB=1.368				A=1.974 B=2.791 AB=4.835				A=0.4549 B=0.6434 AB=1.114			

* Full bloom. ** After full bloom

Fruit weight of Flordaprince cultivar was significantly increased by all the conducted treatments compared with the control (Table 3). Highest significant increment was dedicated to thinning at the FB stage amounting to 84.1 and 87.07 gm in the first and second seasons of the investigation, respectively. Increasing the spacing resulted in a significant increase in the fruit weight. Interaction results clarify that, heaviest fruits were dedicated to thinning at 20 cm at the FB stage amounting to 88.6 and 90.7 gm in both seasons.

As for the Desert Red cultivar, its' fruit weight was increased statistically by the conducted treatments (Table 4). The most significant effect was due to the 20 days AFB thinning (112.7 and 117.57 gm for first and second seasons, respectively). The spacing effect was in parallel to that on Flordaprince cultivar. Interaction results verify that, thinning 20 days AFB at 20 cm resulted in significantly the heaviest fruits (124.2 and127.4 gm for first and second seasons, respectively). These results are in agreement with Samuel and Goregory [4] Who mentioned that, number of fruits per tree at harvest and yield per tree decreased linearly with increasing spacing between fruits .Moreover Khalil and Stino [16]; Nie and Yu [17] and Saini [18] reported that, hand thinning performed at full bloom gives considerable increase in fruit weight of peach. Also Chanana *et al.*[1]; Allan *et al.* [2] and Chanana *et al.* [3] indicated that, the hand thinning increased fruit weight of peach. Samuel and Goregory [4] and Abd El-Megeed, [5] found that, fruit weight decreased with increasing time to hand thinning and increased linearly with increasing spacing.

Fruit Diameter, Firmness and Total Sugars: Control Flordaprince fruits attained the narrowest diameter in both seasons of the investigation amounting to 3.62 and 3.84 cm, respectively (Table 5). Thinning at all of the considered treatments increased this parameter significantly than the control. In general, thinning at all of the considered periods resulted in statistically equal results. The effect of thinning spacing revealed that, thinning at 15 and 20 cm increased the fruit diameter significantly compared with thinning at 10 cm. The results of thinning at 15 and 20 cm were statistically equal. Interaction data clarify that, thinning at the FB stage at 20 cm resulted in fruits with the widest diameter. Comparable results were dedicated to thinning at 15 or 20 cm at all of the considered timings.

As for the Desert Red cultivar, it was also evident that control fruits were significantly the narrowest in diameter (5.84 and 5.87 cm in both seasons, respectively).

Table 5: Effect of thinning time and fruit spacing on fruit diameter, firmnesses and total sugars of Flordaprince peach during 2007 and 2008 seasons

	Fruit diameter (cm)				Firmnesses (Ib/inch^2)				Total sugar (%)			
	2007 season											
	Fruit spacing (cm)				Fruit spacing (cm)				Fruit spacing (cm)			
Thinning time	10	15	20	Mean (B)	10	15	20	Mean (B)	10	15	20	Mean (B)
Hand thinning at F.B*	4.82	5.58	5.75	5.38	10.8	10.3	9.4	10.17	7.7	8.3	8.4	8.13
Hand thinning at 10 days A.F.B**	4.32	5.42	5.63	5.12	11.7	11.2	10.7	11.20	7.2	7.4	7.9	7.50
Hand thinning at 20 days A.F.B	4.74	5.53	5.72	5.33	11.2	10.6	9.8	10.53	7.5	8.0	8.2	7.90
Hand thinning at 30 days A.F.B	4.16	5.34	5.56	5.02	12.2	11.7	11.2	11.70	6.9	7.3	7.6	7.27
Hand thinning at 40 days A.F.B	4.02	5.17	5.54	4.79	12.6	12.2	11.7	12.17	6.7	7.1	7.3	7.03
Control (without thinning).	3.62	3.62	3.62	3.62	13.6	13.6	13.6	13.60	5.4	5.4	5.4	5.40
Mean (A)	4.28	5.11	5.30	-	12.02	11.60	11.07	-	6.90	7.25	7.47	-
L.S.D at 5 %	A=0.3089 B=0.4369 AB=0.7568				A=0.2976 B=0.4209 AB=0.7290				A=0.3401 B=0.4809 AB=0.8330			
	2008 season											
Hand thinning at F.B*	4.86	5.83	5.92	5.54	10.7	9.8	9.2	9.90	7.9	8.5	8.7	8.37
Hand thinning at 10 days A.F.B**	4.56	5.64	5.74	5.31	11.3	10.7	10.4	10.80	7.4	7.7	8.2	7.77
Hand thinning at 20 days A.F.B	4.82	5.74	5.78	5.45	10.8	10.2	9.3	10.10	7.8	8.3	8.6	8.23
Hand thinning at 30 days A.F.B	4.43	5.56	5.68	5.22	11.9	11.4	10.8	11.37	7.3	7.5	7.9	7.57
Hand thinning at 40 days A.F.B	4.37	5.40	5.64	5.14	12.3	11.8	11.2	11.77	7.0	7.4	7.7	7.37
Control (without thinning).	3.84	3.84	3.84	3.84	13.4	13.4	13.4	13.40	5.7	5.7	5.7	5.70
Mean (A)	4.48	5.34	5.45	-	11.73	11.22	10.72	-	7.18	7.52	7.80	-
L.S.D at 5 %	A=0.3921 B=0.5545 AB=0.9604				A=0.3414 B=0.4828 AB=0.8363				A=0.3119 B=0.4411 AB=0.7640			

* Full bloom. ** After full bloom

Table 6: Effect of thinning time and fruit spacing on fruit diameter, firmnesses and total sugars of Desert Red peach during 2007 and 2008 seasons

	Fruit diameter (cm)				Firmnesses (Ib/inch^2)				Total sugars (%)			
	2007 season											
	Fruit spacing (cm)				Fruit spacing (cm)				Fruit spacing (cm)			
Thinning time	10	15	20	Mean (B)	10	15	20	Mean (B)	10	15	20	Mean (B)
Hand thinning at F.B*	6.54	7.37	7.63	7.18	13.8	13.4	12.7	13.30	6.3	6.5	6.8	6.53
Hand thinning at 10 days A.F.B**	6.78	7.52	7.80	7.37	13.4	12.8	12.2	12.80	6.4	7.2	7.3	6.97
Hand thinning at 20 days A.F.B	6.83	7.54	7.84	7.40	13.0	12.6	11.7	12.43	6.7	7.3	7.9	7.30
Hand thinning at 30 days A.F.B	6.38	7.14	7.44	6.99	14.3	13.8	13.2	13.77	5.8	6.4	6.7	6.30
Hand thinning at 40 days A.F.B	6.17	6.58	7.26	6.67	14.6	14.4	13.8	14.27	5.6	6.3	6.2	6.03
Control (without thinning).	5.84	5.84	5.84	5.84	15.3	15.3	15.3	15.30	4.9	4.9	4.9	4.90
Mean (A)	6.42	7.00	7.30	-	14.07	13.72	13.15	-	5.95	6.43	6.63	-
L.S.D at 5 %	A=0.2131 B=0.3014 AB=0.5221				A=0.4861 B=0.6875 AB=1.191				A=0.2606 B=0.3686 AB=0.6384			
	2008 season											
Hand thinning at F.B*	6.53	7.60	7.62	7.25	13.4	12.6	12.5	12.83	6.4	6.7	7.4	6.83
Hand thinning at 10 days A.F.B**	6.84	7.73	7.84	7.47	12.7	12.4	11.4	12.17	6.7	7.2	7.5	7.13
Hand thinning at 20 days A.F.B	6.84	7.82	7.93	7.53	12.4	11.7	11.3	11.80	6.8	7.4	7.8	7.33
Hand thinning at 30 days A.F.B	6.42	7.14	7.37	6.98	13.8	13.5	12.6	13.30	6.3	6.6	6.9	6.60
Hand thinning at 40 days A.F.B	6.34	7.02	7.32	6.89	14.2	13.6	13.2	13.67	6.0	6.3	6.7	6.33
Control (without thinning).	5.87	5.87	5.87	5.87	15.0	15.0	15.0	15.00	5.2	5.2	5.2	5.20
Mean (A)	6.47	7.20	7.33	-	13.58	13.13	12.67	-	6.23	6.57	6.93	-
L.S.D at 5 %	A=0.2976 B=0.4209 AB=0.7290				A=0.4087 B=0.5780 AB=1.001				A=0.3565 B=0.5042 AB=0.8733			

* Full bloom. ** After full bloom.

All thinning timings increased this parameter markedly (Table 6). Highest effects were due to thinning at 20 DAFB and FB with insignificant differences between them. With respect to thinning severity, data clarify that increasing the severity results in widening the attained diameter. Results of thinning at 15 and 20 cm in the second season were statistically equal. Interaction data demonstrate that, thinning at 20 DAFB at 20 cm resulted in fruits with the widest diameter.

Flesh firmness of Flordaprince fruits was significantly higher if thinning was carried out at 30 or 40 DAFB compared with control and other considered periods (Table 5). Thinning at the FB stage and at 20 DAFB resulted in fruits with statistically the least flesh firmness. Data on spacing effect clarify that, the wider thinning is practiced the less firm the fruit flesh. Interaction clarifies that, least firm flesh is attained by thinning at the FB stage at 20cm.

With Desert Red cultivar, control fruits attained significantly the highest flesh firmness compared with all of the conducted treatments (Table 6). Thinning at 10 or 20 DAFB resulted in fruits with significantly the least firmness. The wider the spacing is carried the less the flesh firm. Interaction studies show that thinning at 20 cm apart 20 DAFB resulted in the least firm fruits.

Control Flordaprince fruits attained significantly the least total sugars content (Table 5). Whereas, thinning at the FB stage or 20 DAFB resulted in fruits with the highest significant total sugars content. Spacing clarify that, narrowest spacing i.e. 10 cm led to fruits with significantly the least total sugars. The effects of both 15 and 20 cm were statistically equal. Interaction data show that, fruits from the treatment of thinning 20 cm apart at the FB stage were of the highest total sugars content.

Concerning the Desert Red cultivar, it was evident that all of the timings used in thinning resulted in significant increments in the considered parameters (Table 6). Highest effects were dedicated to thinning at 10 or 20 DAFB in both seasons and to thinning at the FB stage in the second season only. Widest spacing resulted in fruits with significantly the highest total sugars. Comparable results were due to spacing at 15 cm in the first season only. With respect to the interaction, the highest total sugars were due to thinning at 20 DAFB with 20 cm apart. The above mentioned results are in harmony with those obtained by Samuel and Goregory [4] and Abd El-Megeed [5] as they indicated that, fruit diameter decreased with increasing time to hand thinning and increased linearly with increasing spacing of peach.

Table 7: Effect of thinning time and fruit spacing on total soluble solids, acidity and total soluble solids/ acid ratio of Flordaprince peach during 2007 and 2008 seasons

	Total soluble solids (TSS%)				Acidity (%)				TSS / acid ratio			
	2007 season											
	Fruit spacing (cm)				Fruit spacing (cm)				Fruit spacing (cm)			
Thinning time	10	15	20	Mean (B)	10	15	20	Mean (B)	10	15	20	Mean (B)
Hand thinning at F.B*	10.72	11.86	12.70	11.76	0.70	0.62	0.56	0.63	15.30	19.13	22.69	19.04
Hand thinning at 10 days A.F.B**	10.54	11.65	11.84	11.34	0.74	0.67	0.58	0.66	14.24	17.39	20.41	17.35
Hand thinning at 20 days A.F.B	10.68	11.82	12.63	11.71	0.70	0.64	0.58	0.64	15.26	18.47	21.78	18.50
Hand thinning at 30 days A.F.B	10.32	11.47	11.72	11.17	0.74	0.68	0.62	0.68	13.95	16.76	18.90	16.54
Hand thinning at 40 days A.F.B	10.18	11.26	11.58	11.01	0.75	0.70	0.62	0.69	13.57	16.09	18.68	16.11
Control (without thinning).	9.35	9.35	9.35	9.35	0.88	0.88	0.88	0.88	10.63	10.63	10.63	10.63
Mean (A)	10.30	11.23	11.61	-	0.75	0.70	0.64	-	13.83	16.41	17.74	-
L.S.D at 5 %	A=0.4624 B=0.6540 AB=1.133				A=0.03710 B=0.05247 AB=0.09088				A=2.043 B=2.889 AB=5.004			
	2008 season											
Hand thinning at F.B*	11.36	12.48	12.94	12.26	0.62	0.57	0.50	0.56	18.32	21.89	25.88	22.03
Hand thinning at 10 days A.F.B**	10.73	11.87	12.01	11.54	0.66	0.62	0.57	0.62	16.26	19.15	21.07	18.83
Hand thinning at 20 days A.F.B	11.12	12.36	12.78	12.09	0.63	0.58	0.52	0.58	17.65	21.31	24.58	21.18
Hand thinning at 30 days A.F.B	10.56	11.53	11.86	11.32	0.69	0.64	0.58	0.64	15.30	18.02	20.45	17.92
Hand thinning at 40 days A.F.B	10.38	11.47	11.76	11.20	0.72	0.67	0.60	0.66	14.42	17.12	19.60	17.05
Control (without thinning).	9.76	9.76	9.76	9.76	0.84	0.84	0.84	0.84	11.62	11.62	11.62	11.62
Mean (A)	10.65	11.58	11.85	-	0.69	0.65	0.60	-	15.57	18.18	20.53	-
L.S.D at 5 %	A=0.4055 B=0.5740 AB=0.9942				A=0.02142 B=0.03029 AB=0.05247				A=0.4338 B=0.6134 AB=1.062			

* Full bloom. ** After full bloom.

Table 8: Effect of thinning time and fruit spacing on total soluble solids, acidity and total soluble solids/ acid ratio of Desert Red peach during 2007 and 2008 seasons

	Total soluble solids (TSS%)				Acidity (%)				TSS / acidity ratio			
	2007 season											
	Fruit spacing (cm)				Fruit spacing (cm)				Fruit spacing (cm)			
Thinning time	10	15	20	Mean (B)	10	15	20	Mean (B)	10	15	20	Mean (B)
Hand thinning at F.B*	9.43	10.54	10.73	10.23	0.85	0.78	0.69	0.77	11.09	13.51	15.55	13.38
Hand thinning at 10 days A.F.B**	9.57	10.71	11.52	10.60	0.81	0.75	0.69	0.75	11.81	14.28	16.69	14.26
Hand thinning at 20 days A.F.B	9.61	10.75	11.60	10.65	0.81	0.73	0.67	0.74	11.86	14.72	17.31	14.63
Hand thinning at 30 days A.F.B	9.21	10.36	10.61	10.06	0.85	0.79	0.73	0.79	10.83	13.11	14.53	12.82
Hand thinning at 40 days A.F.B	9.17	10.15	10.47	9.93	0.86	0.81	0.73	0.80	10.66	12.53	14.34	12.51
Control (without thinning).	8.24	8.24	8.24	8.24	0.97	0.97	0.97	0.97	8.49	8.49	8.49	8.49
Mean (A)	9.20	10.13	10.53	-	0.86	0.80	0.75	-	10.79	12.77	14.48	-
L.S.D at 5 %	A=0.3933 B=0.5561 AB=0.9633				A=0.04284 B=0.06059 AB=0.1049				A=0.3148 B=0.4452 AB=0.7712			
	2008 season											
Hand thinning at F.B*	9.62	10.76	11.12	10.50	0.76	0.73	0.68	0.72	12.65	14.73	16.35	14.58
Hand thinning at 10 days A.F.B**	10.30	11.25	11.67	11.07	0.74	0.69	0.63	0.69	13.91	16.30	18.52	16.24
Hand thinning at 20 days A.F.B	10.25	11.37	11.83	11.15	0.73	0.68	0.62	0.68	14.04	16.72	19.04	16.60
Hand thinning at 30 days A.F.B	9.45	10.42	10.75	10.21	0.78	0.75	0.72	0.75	12.11	13.35	14.93	13.46
Hand thinning at 40 days A.F.B	9.27	10.36	10.65	10.09	0.83	0.78	0.69	0.77	11.16	13.28	15.43	13.29
Control (without thinning).	8.65	8.65	8.65	8.65	0.95	0.95	0.95	0.95	9.10	9.10	9.10	9.10
Mean (A)	9.59	10.47	10.78	-	0.80	0.76	0.61	-	12.16	13.91	15.56	-
L.S.D at 5 %	A=0.3808 B=0.5874 AB=1.017				A=0.04790 B=0.06774 AB=0.1173				A=0.3284 B=0.4644 AB=0.8044			

* Full bloom. ** After full bloom.

Southwick *et al.* [9]; Stephen *et al.* [19] and Hassanien [20] indicated that the hand thinning treatments produced soft fruits of peach. Durner *et al.* [21]; Muthoo and Chetan [22] and Ezz and El-Kobbia [23] stated that "hand thinning treatments increased total sugar of peach"

Total Soluble Solid (TSS), Acidity and Tss/acid Ratio: Juice TSS% of Flordaprince cultivar, was statistically increased to various extents (Table 7). Highest increment in both seasons was due to thinning at the FB stage. Comparable results were due to thinning at 10, 20 or cm in the first season and due to 20 cm in the second only. Least juice TSS% was attributed to 10 cm spacing in both seasons. Both the 15 and 20 cm spacing increased this parameter with insignificant differences between them. Interaction data clarify that, the highest juice TSS % was dedicated to thinning treatment 20 DAFB at 20 cm spacing. All of the timings used in thinning significantly increased the juice TSS% compared with control in Desert Red cultivar (Table 8). Highest increments in both considered seasons were attributed to thinning at 20 DAFB. Severity treatments ascertain significantly that, increasing spacing of thinning to 10 cm, increase this parameter statistically while, wider spacing did not have a statistically relevant effect to the 10 cm. Interaction effect show that, the highest magnitude of this percentage was due to thinning at 20 cm 20 DAFB. With respect to the juice total acidity percentage of Flordaprince cultivar, it was evident that all of the considered timings significantly reduced this parameter compared with the control with variable degrees (Table 7). The effect of the FB stage in both seasons and 20 DAFB in the second season was more pronounced. It was also evident that, the wider the spacing used in thinning the more significant the acidity falls down. Interaction data reveal that, least acidity was due to thinning at the FB stage 20 cm apart. In Desert Red cultivar, similar results were found concerning the reducing effect of all the thinning timings used (Table 8). Evidential effects were due to the 20 DAFB timing used. Spacing effect was similar to that on Flordaprince cultivar. Interaction data clarify that, fruits with the least juice acidity were those from tree thinned at 20 DAFB with 20 cm spacing. All of the considered timings in thinning significantl increased the TSS/acid ratio compared with control in Flordaprince cultivar (Table 7), with a most pronounced effect due to the FB stage. Widest spacing resulted in statistically the highest ratio. The 15 cm spacing resulted in comparable effects in

the first season only. Interaction data show that thinning at the FB 20 cm apart resulted in the highest TSS /acid ratio.

With Desert Red cultivar, similar results were attained concerning the significant increasing effect of all the concerned thinning but highest significant effects were attributed to the 10 and 20 DAFB stages (Table 8). Increasing spacing significantly increased this ratio. Highest TSS/acid ratio was related to thinning 20 cm apart 20 DAFB. These results are in line with those reported by Allan *et al.* [2]; Chanana *et al.* [3] and Abd El-Megeed [5] indicated that, all the hand thinning treatments brought about significant improvement in fruit quality as measured in terms of high TSS, low acidity and high TSS/acid ratio .Moreover Khalil and Stino [16] and Bajwa and Singh [24] reported that, hand thinning and fruits spaced at10-15cm apart improved fruit quality of peach. Also Khalil and Stino [16]; Hassanien [20]; Ezz and El-Kobbia [23]; Kabbel *et al.* [25] and Yuan and Greene [26] found that, hand thinning treatments increased total soluble solids and TSS/acid ratio of peach. Also Hassanien [20]; Muthoo and Chetan [22]; Ezz and El-Kobbia [23] and Selli and Sansavin [27] indicated that, hand thinning treatments reduced total fruit acidity of peach as compared with unthinned trees.

In general, all thinning treatments were found to decrease the crop, advance the fruit maturity and enhance the fruit quality of both considered cultivars in terms of increasing weight, diameter, total sugars, juice TSS and TSS/acid ratio whereas, the number of fruits born on each tree, flesh firmness, juice acidity were decreased.

As for the effect of the time at which thinning was practiced, both cultivars responded differently. Optimal effects were attributed to early thinning at the FB stage which detected in the case of Flordaprince cultivar except for the reduced crop due to the lower number of fruits born/tree. Whereas, in the case of Desert Red cultivar most of the optimal effects were dedicated to thinning at 20 DAFB.

In conclusion, the above mentioned findings suggest that, although the negative effects reflected on the crop which is compensated by the advancement in maturity and enhancement in fruit quality thinning of Flordaprince cultivar at the FB stage and Desert Red cultivar at 20 DAFB with wide spacing are essential for both local market and exportation. These effects in our opinion might be due to increasing the fruit leaf ratio and thus reducing the competition on nutrients and assimilates at early stages (cell division stage) as mentioned by Samuel and Goregory [4].

Varietal differences might be due to that Desert Red cultivar (mid-season cultivar) is subjected to accumulation of more thermal units leading to enhance the photosynthetic apparatus which permits retarding the thinning procedure to 20 DAFB.

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