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Improving Productivity and Fruit Quality of Florida Prince Peach Trees by Using Some Agriculture Treatments

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THIS investigation was carried out during 2009 and 2010 seasons on eight years old peach trees grown in a commercial orchard located at Sedy Salem District, Kafr El-Sheikh governorate. The effects of thinning out and heading back pruning, fruit thinning and their interaction on improving yield and fruit quality of Florida Prince peach cultivar specially fruit size and colour were studied. Thinning out and heading back pruning treatments and hand fruit thinning levels revealed significant variation in yield and fruit quality of Florida Prince peach trees. Therefore, the interaction (TO x HB x FT) which was significant in most cases exhibited the most important data in the present work. Thus, thinning out 50% of the number of one year old shoot and heading back 25% from the length of one year old shoot with fruit thinning at 15 cm apart, considered the best combination treatment. This treatment produced maximum yield as kg/tree, the highest number and percentage of large sized fruit with high quality specially fruit weight, size, colour and its content of TSS, vitamin C and anthocyanin.

Keywords: Florida Prince, Pruning, Yield, Fruit characteristics.

Peach is one of the most important deciduous fruit trees grown in Egypt. The total planted area increased rapidly through the last three decades due to introduced several peach cultivars of low and moderate chilling requirements by the Agricultural Development system (Stino *et al*., 1982 and Mansour & Stino, 1986a, 1986b). It reached about 80609 feddans with a production of about 273156 tons according to the last statistics of Ministry of Agriculture and Land Reclamation (2013). Fruit size and colour are the major criterion of peach fruit quality since pruning and fruit thinning are considered the two agricultural practices that affected fruit size and colour (Zayan, 1991 and Eliwa, 2003). Pruning is an essential cultural practice in the production of peaches. As trees aged, pruning stimulate new growth and provides essential light distribution through the tree for the formation of large fruit with acceptable fruit quality. Appropriate fruit colour, soluble solids and ripeness. Pruning can be used to judiciously remove a significant portion of the unwanted potential crop at a lower cost than hand thinning (Li *et al*., 2003 and Fumey *et al*., 2008). Fruit thinning is usually performed in peach orchards in order to improve fruit size (Corelli-Grappadelli and Costen, 1991). The principal aim of thinning is to optimize the leaf to fruit ratio (Sansavini *et al*., 1985). Furthermore, hand

thinning is certainly the most accurate method, which allowed space fruit regularly along a branch at about specific space. However, it is considered more profitable to select large and well formed fruits and eliminate smaller and deformed ones. These later seldom achieve good quality at harvest (Southwick *et al*., 1995 and Eliwa, 2003). The objective of this experiment was to study the possible effects of thinning out, heading back, fruit thinning and their interaction on yield and fruit quality of "Florida Prince" peach trees.

Materials and Methods

The present study was carried out during two successive season of 2009 and 2010 on eight years old Florida Prince peach cv. trees (*Prunus persica* L. Batsch) and grown in private orchard located at Sedy Salem district, Kafrelsheikh Governorate. Trees were subjected to horticulture practices usually done in this region.

At winter pruning (15 November), three degrees of thinning out pruning were carried out by removing 25, 50 and 75% of one year old shoots (To1, To_2, To_3).

Also, three degrees of heading back pruning were applied by removing 25% and 50% of length of each one year-old shoot corresponding to HB1 (unpruned), HB2 (light heading back)and HB3 (severe heading back), respectively.

Hand fruit thinning was carried out after fruit set by leaving one fruit for 10 and 15 cm apart on fruiting shootsThe tree level of thinning out pruning (To1 , To_2, To_3) and the three degrees of heading back pruning (HB1, HB2, and HB3) as well as the two levels of fruit thinning (FT1 and FT2) were arranged in 18 combination treatments (3 thinning out x 3 heading back x 2 fruit thinning). All combination treatments used in this experiment are listed in Table 1.

TABLE 1. Treatment .

Thinning out (TO)	Heading back (HB)	Fruit thinning (FT)
Thinning out 25% (To1)	Heading Back 0% (HB1)	Fruit thinning at 10 cm (FT1)*
		Fruit thinning at 15 cm (FT2)
	Heading Back 25% (HB2)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)
	Heading Back 50% (HB3)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)
Thinning out 50% (To2)	Heading Back 0% (HB1)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)
	Heading Back 25% (HB2)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)
	Heading Back 50% (HB3)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)
Thinning out 75% (To3)	Heading Back 0% (HB1)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)
	Heading Back 25% (HB2)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)
	Heading Back 50% (HB3)	Fruit thinning at 10 cm (FT1)
		Fruit thinning at 15 cm (FT2)

*This treatment served as control

A randomized complete block design as a factorial experiment was used. The obtained data were subjected to statistical analysis according to Snedecor and Cochran (1990). The LSD test at 0.5 and 0.1 level was used to compare between the means.

Measurements and Determinations

Yield and its components

Tree fruit yield was divided into 3 classes according to fruit size i.e. (->5.5 cm), (5.5-6.0 cm) and (6.0>- cm). Number and percent of fruit of each class were also recorded. Yield per tree was recorded as number and weight kg/tree. Yield efficiency (YE) as fruit weight kg per cm^2 of trunk cross section area (TCSA) was estimated.

Fruit quality

At harvest time (April 5^{th} and April 6^{th}) in 2009 and 2010 season, ten fruit were selected at random from each tree and prepared for the determination of physical and chemical fruit characteristics.

1. Physical fruit quality:

Fruit weight (g), length and diameter (cm) were measured and their fruit shapes (L/D) ratio were calculated. Fruit volume in ml was determined by water displacement. A Magness-Taylor type pressure tester with plunger of 5/16 $inch^2$ was used for determining flesh fruit firmness (lb/in^2). Fruit colour was visually determined for each fruit sample according to colour degree expressed on number as follows:

0 = green colour and 10 = deep red.

Chemical fruit quality

Soluble solids contents (TSS), total acidity, TSS/acidity ratio ascorbic acid (VC) as mg/100 g fresh weight was determined according to A.O.A.C. (1990).Total anthocyanin: measured according to Hsia *et al*. (1965).

Results and Discussion

Yield

Number of fruit per tree

Data in Tables 2 and 3 revealed that number of fruits/tree was significantly reduced by increasing the severity of thinning out and heading back pruning treatments. This effect may be due to the effect of dormant thinning out and heading back in reducing the number of flowers per bearing shoot (Mikhael, 2001).

These results herein are in line with those obtained by Zayan (1991) and Mikhael *et al*. (2012) working on "Dessert Red" peach trees mentioned that, severe pruned trees (thinning out 50%) produced the least number of fruit per tree. As for the effect of hand thinning, it is clear that, fruit thinning at 15 cm apart of bearing shoot significantly reduced the total number of fruits per tree compared to fruit thinning at 10 cm apart, in both seasons. Similar results were obtained by said *et al*. (2003), Nijorog and Reighard (2008) and Mohsen (2010).

However, the interaction was significant in both seasons and the highest number of fruits belonged to the control treatment (To1 x HB1 x FT1) with (510 and 440) in 2009 and 2010 seasons, respectively whereas (To3x HB3 x FT2) combination treatment gave the least fruit number per tree (236 and 216) in both seasons, respectively.

Yield (kg/tree)

Data in Tables 2 and 3 exhibited that moderate thinning out treatment (50%) recorded the highest yield compared to light and severe ones (25 and 75%). However, severe treatments produced the least yield (kg/tree) in both seasons. Concerning the impact of heading back treatments, the data disclosed that, light headed trees (25%) produced maximum yield in both seasons. Meanwhile, severe headed trees (50%) gave minimum yield (kg/tree) when compared to un-headed ones (control). Similar effect was obtained by Rathi *et al*. (2003) on "Tessia Samisto" peach, Siham *et al*. (2005) on "Alexandra" peach and Mikhael *et al*. (2012) on Dessert Red peach cvs . The data also clarify no significantly differences were found in tree yield (kg) between the two tested fruit thinning treatments at 10 and 15 cm, in both seasons. These findings are in accordance with those obtained by Egea *et al*. (1989) and Myer *et al*. (1993), Nijorog and Reighard (2008) and Mohsen (2010) on peach cvs., they indicated that hand fruit thinning treatments reduced the yield as weight of fruits (kg/tree).However, the most important effect was obtained by the interaction which was significant in both seasons and the highest yield (kg/tree) came from (To2 x HB2 x FT2) and (To2 x HB2 x FT1) combination treatments without significant differences between them. While the least yield (kg/tree) was always belonged to (To3 x HB3 x FT2) treatment in both seasons.

Yield efficiency (YE) (kg/cm^2) TCSA

As shown in Tables 2 and 3, data of both seasons disclosed that yield efficiency (YE) determined as kg/cm^2 of trunk cross section area take the same trend of yield (kg/tree) as influenced by thinning out , heading back, fruit thinning and their interaction.

These results are in agreement with those reported by Mikhael *et al*. (2012), Davarynefad *et al*. (2008) and Reginoto *et al*. (1995) which they mentioned that yield efficiency was decreased by thinning ten year old "fairland" nectarine trees at 15 days before pit hardening to normal density 2.5 fruit/cm^2 TCSA. However, the interaction (To x HB x FT) was significant in both season and the highest values always belonged to (To2 x HB2 x FT1) and (TO2 x HB2 x FT2) combination treatments without significant differences between them in both seasons.

TABLE 2. Effect of thinning out, heading back, fruit thinning and their interaction on yield of "Florida Prince" peach trees in 2009 season.

Treatment		Yield				Yield efficiency (kg/cm^2)	
		No. of fruits/tree		kg/tree			
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	510	424	39.84	38.77	0.375	0.357
	HB2	469	398	41.16	41.09	0.356	0.378
	HB3	394	327	36.19	35.01	0.326	0.321
To2	HB1	490	422	41.72	39.89	0.397	0.374
	HB2	478	387	44.86	45.60	0.412	0.426
	HB3	356	284	34.87	33.77	0.309	0.310
To3	HB1	384	308	33.68	32.95	0.330	0.297
	HB2	374	297	35.84	34.59	0.335	0.307
	HB3	278	236	28.17	27.91	0.251	0.247
L.S.D. interaction 0.05		15.7		2.520		0.0309	
0.01		21.1		3.383		0.0416	
Mean effect of thinning out	Thinning out 25%	420		38.71		0.352	
	Thinning out 50%	403		40.12		0.372	
	Thinning out 75%	312		32.19		0.295	
L.S.D. 0.05		6.4		1.029		0.0126	
L.S.D. 0.01		8.6		1.381		0.0170	
Mean effect of heading back	Heading back 0%	423		37.81		0.355	
	Heading back 25%	401		40.56		0.369	
	Heading back 50%	313		32.65		0.294	
L.S.D. 0.05		6.4		1.029		0.0126	
L.S.D. 0.01		8.6		1.381		0.0170	
Mean effect of fruit thinning	Fruit thinning 10 cm	415		37.37		0.344	
	Fruit thinning 15 cm	343		36.64		0.335	
L.S.D. 0.05		5.2		NS		NS	
L.S.D. 0.01		7.0		NS		NS	

TABLE 3. Effect of thinning out, heading back, fruit thinning and their interaction on yield of "Florida Prince" peach trees in 2010 season.

Treatment		Yield				Yield efficiency (kg/cm^2)	
		No. of fruits/tree		kg/tree			
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	440	381	36.24	36.35	0.327	0.322
	HB2	429	351	37.93	37.65	0.336	0.340
	HB3	331	282	31.32	30.86	0.288	0.283
To2	HB1	427	379	37.70	37.09	0.340	0.334
	HB2	422	339	40.89	40.93	0.378	0.383
	HB3	324	262	32.65	31.68	0.295	0.272
To3	HB1	346	284	31.58	30.83	0.280	0.283
	HB2	342	275	33.71	32.62	0.298	0.293
	HB3	253	216	26.59	26.04	0.228	0.235
L.S.D. interaction 0.05		16.0		2.576		0.0204	
0.01		21.5		3.459		0.0275	
Mean effect of thinning out	Thinning out 25%	369		35.06		0.316	
	Thinning out 50%	359		36.82		0.334	
	Thinning out 75%	286		30.23		0.270	
L.S.D. 0.05		6.5		1.052		0.0083	
L.S.D. 0.01		8.8		1.412		0.0112	
Mean effect of heading back	Heading back 0%	376		34.97		0.314	
	Heading back 25%	360		37.29		0.338	
	Heading back 50%	278		29.86		0.267	
L.S.D. 0.05		6.5		1.052		0.0083	
L.S.D. 0.01		8.8		1.412		0.0112	
Mean effect of fruit thinning	Fruit thinning 10 cm	368		34.29		0.308	
	Fruit thinning 15 cm	308		33.78		0.305	
L.S.D. 0.05		5.3		NS		NS	
L.S.D. 0.01		7.1		NS		NS	

Fruit size and percentage of large fruits

Data presented in Tables 4 and 5 exhibited that, the interaction was significant in both seasons and (To2 x HB2 x FT2) combination treatment produced the highest number and percentage of large fruits (6.0> cm diameter) in both seasons,. Concerning the effect of fruit thinning, the data revealed that increasing the space between fruits from 10 to 15 cm apart significantly increased the number and percentage of large fruits but reduced the number and percent of medium and small fruit in both seasons. The obtained results are in line with those obtained by Abdel-Hamid (1998) and Eliwa (2003) who found that hand thinning increased yield % in the first picking and large fruit (>90 g) of "Mit Ghamr" peach when compared to the control.

TABLE 4. Effect of thinning out, heading back, fruit thinning and their interaction on number and percentage of fruit size of "Florida Prince" peach trees in 2009 season.

Treatment / Fruit size		>5.5 cm				5.5-6 cm				6> cm			
		No. of fruits		%		No. of fruits		%		No. of fruits		%	
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	172	97	33.73	22.88	142	82	27.84	19.34	196	245	38.43	57.78
	HB2	129	57	27.51	14.32	110	61	23.45	15.33	230	280	49.04	70.35
	HB3	98	37	24.87	11.31	81	42	20.56	12.84	215	248	54.52	72.84
To2	HB1	105	38	21.43	9.00	92	54	18.78	12.80	293	330	59.80	78.20
	HB2	69	16	14.41	4.13	79	24	16.49	6.20	331	347	69.10	89.66
	HB3	34	11	9.55	3.87	51	16	14.23	5.63	271	257	76.12	90.49
To3	HB1	66	21	17.19	6.82	72	41	18.75	13.31	246	246	64.06	79.87
	HB2	27	12	7.22	4.04	51	18	13.64	6.06	296	267	79.14	89.90
	HB3	19	9	6.83	3.81	27	13	9.71	5.51	232	214	83.45	90.67
L.S.D. interaction 0.05		3.2		3.01		4.3		3.96		11.2		7.18	
0.01		4.4		4.05		5.8		5.33		15.1		9.66	
Mean effect of thinning out	Thinning out 25%	98		22.44		86		19.89		236		57.67	
	Thinning out 50%	46		10.40		53		12.37		305		77.23	
	Thinning out 75%	26		7.65		37		11.16		250		81.18	
L.S.D. 0.05		1.3		1.23		1.8		1.62		4.6		2.93	
L.S.D. 0.01		1.8		1.65		2.4		2.18		6.1		3.94	
Mean effect of heading back	Heading back 0%	83		18.51		81		18.47		259		63.02	
	Heading back 25%	52		11.94		57		13.53		292		74.53	
	Heading back 50%	35		10.04		38		11.43		240		78.62	
L.S.D. 0.05		1.3		1.23		1.8		1.62		4.6		2.93	
L.S.D. 0.01		1.8		1.65		2.4		2.18		6.1		3.94	
Mean effect of fruit thinning	Fruit thinning 10 cm	80		18.08		78		18.17		257		63.75	
	Fruit thinning 15 cm	33		8.91		39		10.78		270		80.31	
L.S.D. 0.05		1.1		1.00		1.4		1.32		3.73		2.39	
L.S.D. 0.01		1.5		1.35		1.9		1.78		5.02		3.22	

TABLE 5. Effect of thinning out, heading back, fruit thinning and their interaction on number and percentage of fruit size classes of "Florida Prince" peach trees in 2010 season.

Fruit size / Treatment		>5.5 cm				5.5-6 cm				6> cm			
		No. of fruits		%		No. of fruits		%		No. of fruits		%	
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	145	71	32.95	18.64	121	86	27.50	22.57	174	224	39.55	58.79
	HB2	117	42	27.27	11.97	99	56	23.08	15.92	213	253	49.65	72.08
	HB3	82	25	24.77	8.87	63	39	19.03	13.83	186	218	56.19	77.30
To2	HB1	91	31	21.31	8.18	78	49	18.27	12.95	258	299	60.42	78.89
	HB2	57	15	13.51	4.42	71	19	16.82	5.61	294	305	69.67	8.97
	HB3	34	11	10.49	4.20	39	14	12.04	5.34	251	237	77.47	90.45
To3	HB1	51	24	14.74	8.45	68	31	19.65	10.92	227	229	65.61	80.63
	HB2	31	12	9.06	4.36	38	15	11.1	5.45	273	248	79.82	90.18
	HB3	18	9	7.11	4.17	22	12	8.7	5.56	213	195	84.19	90.28
L.S.D. interaction 0.05		4.9		2.87		5.6		3.28		12.6		6.14	
0.01		6.6		3.86		7.6		4.41		16.9		8.26	
Mean effect of thinning out	Thinning out 25%	80		20.75		77		20.33		211		59.93	
	Thinning out 50%	40		10.35		45		11.84		274		77.81	
	Thinning out 75%	24		7.98		31		10.23		231		81.79	
L.S.D. 0.05		2.0		1.17		2.3		1.34		5.2		2.51	
L.S.D. 0.01		2.7		1.58		3.1		1.80		6.9		3.37	
Mean effect of heading back	Heading back 0%	69		17.38		72		18.64		235		63.98	
	Heading back 25%	46		11.77		50		13.00		264		75.23	
	Heading back 50%	30		9.94		32		10.75		217		79.31	
L.S.D. 0.05		2.0		1.17		2.3		1.34		5.2		2.51	
L.S.D. 0.01		2.7		1.58		3.1		1.80		6.9		3.37	
Mean effect of fruit thinning	Fruit thinning 10 cm	70		17.91		67		17.36		232		64.73	
	Fruit thinning 15 cm	27		8.14		36		10.91		245		80.95	
L.S.D. 0.05		1.6		0.96		1.7		1.09		4.2		2.05	
L.S.D. 0.01		2.2		1.29		2.3		1.47		5.7		2.75	

Data also exhibited that, the highest number of large sized fruit was obtained by moderate thinning out degree (50%) (To2) and light heading back level 25% (HB2) compared to other levels, while the percentage of large sized fruits was linearly increased by increasing the severity of thinning out and heading back pruning. While, the number and percentage of medium and small sized fruit were decreased by increasing the severity of thinning out and heading back. The differences were significant in both seasons. These results are in complete agreement with those obtained by Zayan (1991) and Sharma *et al*. (2001) who revealed that severe pruned trees (75%) produced the highest percentage of large size fruits of "July Alberta" peach.

Fruit quality

physical fruit

Fruit dimensions proerties and shape

Data presented in Tables 6 and 7 revealed that, raising fruit thinning space and increasing the severity of thinning out and heading back pruning significantly increased both fruit length and diameter.

The interaction was significant in both seasons and the highest values belonged to (To2 x HB2 x FT2), (To2 x HB3 x FT2), (To3 x HB2 x FT2) and (To3 x HB3 x FT2) treatments without significant differences among them and the difference between each of them and the control was significant in both seasons. These results agree with those of Mohsen (2010) on "Florida Prince" and Bussi *et al*. (2009) on peach and Said *et al*. (2003) on apricot. Furthermore, Zayan (1991), Siham *et al*. (2005), and Mikhael (2001) on persimmon.

Fruit shape

The date of Table 6 and 7 also indicated that fruit shape (L/D ration) was in effected with thinning out and heading back pruning as well as fruit thinning and their interaction in both season. Similar results wear also obtained by Mikhael (2001) .

Average fruit weight and volume (cm^3)

Data in Tables 8 and 9 show that raising fruit spacing at 15 cm increased fruit weight and volume than those spaced at 10 cm apart in both seasons. The data also clarify significant increase in average fruit weight by increasing the severity of thinning and heading back treatments and the heaviest fruits were always belonged to severity degree (To3 or HB3). Similar results were obtained by Njorog and Reighard (2008), Zayan (1991) on "Mit Ghamr" peach cv. and Mahajan and Dhillon (2002) on "Sham I Punjab" and Bussi *et al*. (2009) on "Big Top" and "Alexandra" and Mikhael *et al*. (2012) on Desert Red peach cv, they found that with increasing the severity of pruning, average fruit weight and volume were significantly increased. However, the hehaviest fruit produced by (To2 x HB2 x FT2), (To2 x HB3 x FT2), (To3 x HB2 x FT2) and (To3 x HB3 x FT2) combination treatments, while the lightest fruit obtained by the control (To1 x HB1 x FT1) in both seasons. The difference between wide and narrow fruit spacing was significant in both seasons and the larger fruits were produced by wider fruit spacing at 15 cm. These results herein are in line with those obtained by Mahajan and Dhillon (2002) and Mikhael *et al*. (2012) mentioned that, fruit volume of "Desert Red" peach significantly increased by increasing the severity of thinning out pruning at dormancy.

TABLE 6. Effect of thinning out, heading back, fruit thinning and their interaction on dimension and shape index of "Florida Prince" peach fruits in 2009 season.

Treatments		Fruit length, "L" (cm)		Fruit diameter, "D" (cm)		Fruit shape L/D ratio	
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	5.20	5.59	5.42	5.82	0.96	0.96
	HB2	5.31	5.79	5.53	6.03	0.96	0.96
	HB3	5.33	5.81	5.61	6.12	0.95	0.95
To2	HB1	5.45	5.78	5.74	6.15	0.95	0.94
	HB2	5.81	6.05	6.12	6.51	0.95	0.93
	HB3	5.86	6.06	6.23	6.52	0.94	0.94
To3	HB1	5.74	5.95	6.04	6.26	0.95	0.95
	HB2	5.87	6.07	6.24	6.53	0.94	0.93
	HB3	5.91	6.09	6.35	6.55	0.94	0.93
L.S.D. interaction 0.05		0.174		0.287		NS	
0.01		0.234		0.386		NS	
Mean effect of thinning out	Thinning out 25%	5.51		5.76		0.96	
	Thinning out 50%	5.84		6.21		0.94	
	Thinning out 75%	5.94		6.33		0.94	
L.S.D. 0.05		0.071		0.117		NS	
L.S.D. 0.01		0.095		0.158		NS	
Mean effect of heading back	Heading back 0%	5.62		5.91		0.95	
	Heading back 25%	5.82		6.16		0.95	
	Heading back 50%	5.84		6.23		0.94	
L.S.D. 0.05		0.071		0.117		NS	
L.S.D. 0.01		0.095		0.158		NS	
Mean effect of fruit thinning	Fruit thinning 10 cm	5.61		5.92		0.95	
	Fruit thinning 15 cm	5.91		6.28		0.94	
L.S.D. 0.05		0.058		0.096		NS	
L.S.D. 0.01		0.078		0.129		NS	

TABLE 7. Effect of thinning out, heading back, fruit thinning and their interaction on dimension and shape index of "Florida Prince" peach fruits in 2010 season.

Treatments		Fruit length, "L" (cm)		Fruit diameter, "D" (cm)		Fruit shape L/D ratio	
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	5.30	5.65	5.46	5.89	0.97	0.96
	HB2	5.36	5.86	5.58	6.10	0.96	0.96
	HB3	5.41	5.85	5.64	6.16	0.96	0.95
To2	HB1	5.53	5.96	5.76	6.21	0.96	0.96
	HB2	5.87	6.17	6.18	6.56	0.95	0.94
	HB3	6.07	6.12	6.39	6.58	0.95	0.93
To3	HB1	5.79	5.95	6.09	6.31	0.95	0.95
	HB2	5.94	6.18	6.36	6.57	0.4	0.94
	HB3	6.04	6.12	6.49	6.58	0.93	0.93
L.S.D. interaction 0.05		0.174		0.189		NS	
0.01		0.234		0.254		NS	
Mean effect of thinning out	Thinning out 25%	5.57		5.81		0.96	
	Thinning out 50%	5.95		6.28		0.95	
	Thinning out 75%	6.01		6.40		0.94	
L.S.D. 0.05		0.071		0.077		NS	
L.S.D. 0.01		0.095		0.104		NS	
Mean effect of heading back	Heading back 0%	5.70		5.95		0.96	
	Heading back 25%	5.91		6.23		0.95	
	Heading back 50%	9.94		6.31		0.94	
L.S.D. 0.05		0.071		0.077		NS	
L.S.D. 0.01		0.095		0.104		NS	
Mean effect of fruit thinning	Fruit thinning 10 cm	5.71		5.99		0.95	
	Fruit thinning 15 cm	5.98		6.33		0.95	
L.S.D. 0.05		0.058		0.063		NS	
L.S.D. 0.01		0.078		0.085		NS	

TABLE 8 Effect of thinning out, heading back, fruit thinning and their interaction on some physical properties of "Florida Prince" peach fruits in 2009 season.

Treatments		Av. fruit weight (g)		Av. fruit volume (cm^2)		Firmness ($Lb/inch^2$)	
Thinning out (To)	**Heading back (HB)**	**Fruit thinning 10 cm (FT1)**	**Fruit thinning 15 cm (FT2)**	**Fruit thinning 10 cm (FT1)**	**Fruit thinning 15 cm (FT2)**	**Fruit thinning 10 cm (FT1)**	**Fruit thinning 15 cm (FT2)**
To1	HB1	78.12	91.45	76.17	89.15	11.84	11.12
	HB2	87.76	103.74	86.38	101.04	11.28	10.10
	HB3	91.88	107.06	88.94	105.03	10.85	9.26
To2	HB1	85.14	94.53	82.42	91.88	11.56	9.77
	HB2	93.71	117.82	90.61	115.37	11.49	8.89
	HB3	97.96	118.91	95.52	115.86	10.36	8.64
To3	HB1	87.71	106.98	85.43	104.63	10.61	9.35
	HB2	95.83	116.45	93.24	113.89	9.72	8.69
	HB3	101.34	118.28	98.09	115.85	9.58	8.42
L.S.D. interaction 0.05		6.996		7.051		0.222	
0.01		9.355		9.482		0.299	
Mean effect of thinning out	Thinning out 25%	93.34		91.12		10.74	
	Thinning out 50%	101.35		98.61		10.12	
	Thinning out 75%	104.43		101.86		9.40	
L.S.D. 0.05		2.840		2.878		0.091	
L.S.D. 0.01		3.819		3.871		0.122	
Mean effect of heading back	Heading back 0%	90.66		88.28		10.71	
	Heading back 25%	102.55		100.09		10.03	
	Heading back 50%	105.91		103.22		9.52	
L.S.D. 0.05		2.840		2.878		0.091	
L.S.D. 0.01		3.819		3.871		0.122	
Mean effect of fruit thinning	Fruit thinning 10 cm	91.05		88.53		10.81	
	Fruit thinning 15 cm	108.36		105.86		9.36	
L.S.D. 0.05		2.318		2.350		0.074	
L.S.D. 0.01		3.118		3.160		0.100	

TABLE 9. Effect of thinning out, heading back, fruit thinning and their interaction on some physical properties of "Florida Prince" peach fruits in 2010 season.

Treatments		Av. fruit weight (g)		Av. fruit volume (cm^2)		Firmness ($Lb/inch^2$)	
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	82.36	95.40	80.95	93.69	11.65	10.92
	HB2	88.43	107.26	85.72	104.83	11.16	9.96
	HB3	94.62	109.42	92.07	106.78	10.65	8.92
To2	HB1	88.29	97.85	86.61	96.19	11.34	9.59
	HB2	96.82	120.74	95.46	118.81	10.28	8.72
	HB3	100.77	120.92	97.95	118.98	10.19	8.54
To3	HB1	91.28	108.55	88.54	105.51	10.42	9.18
	HB2	98.57	118.62	95.71	116.25	9.61	8.71
	HB3	105.11	120.57	103.75	117.64	9.36	8.18
L.S.D. interaction 0.05		5.953		6.320		0.203	
0.01		8.006		8.486		0.273	
Mean effect of thinning out	Thinning out 25%	96.25		94.01		10.54	
	Thinning out 50%	104.23		102.33		9.78	
	Thinning out 75%	107.12		104.57		9.24	
L.S.D. 0.05		2.430		2.580		0.083	
L.S.D. 0.01		3.268		3.464		0.114	
Mean effect of heading back	Heading back 0%	93.96		91.92		10.52	
	Heading back 25%	105.07		102.80		9.74	
	Heading back 50%	107.57		106.20		9.31	
L.S.D. 0.05		2.430		2.580		0.083	
L.S.D. 0.01		3.268		3.464		0.114	
Mean effect of fruit thinning	Fruit thinning 10 cm	94.03		91.86		10.52	
	Fruit thinning 15 cm	111.04		108.74		9.19	
L.S.D. 0.05		1.984		2.186		0.068	
L.S.D. 0.01		2.669		2.940		0.091	

Fruit firmness (Lb/inch^2)

Data presented in Tables 8 and 9, clear that raising thinning out and heading back as well as fruit thinning levels led to decrease fruit firmness in both seasons. These reduction in fruit firmness might be due to the increase of fruit size and the reduction in its Ca concentration. These findings confirmed with those obtained by Stino (1995)and Demitras *et al*. (2010), Samara *et al*. (2003) and Mohsen (2010) indicated that hand fruit thinning significantly reduced fruit firmness. On the other hand, Attala (1997) and Njorog and Reighard (2008) showed that fruit thinning did not influence fruit firmness. However, the interaction (To x HB x FT) was significant and the firm fruits came from light thinning out and un-headed trees with narrow fruit spacing in (To1 x Hb1 x FT1) treatment.

Chemical fruit properties

Data in Tables 10-11 show that TSS value and TSS/acid ratio were significantly increased by increasing the severity of thinning out and heading back pruning. The interaction was significant in both seasons and the highest values achieved by (TO2 x HB2 x FT2) compared to the least values obtained by TO1 x HB1 x FT1. On the other hand, the same treatment and the interaction reduced the acidity in both seasons. These results are supported by conclusion of Zayan (1991), Mikhael *et al*. (2012) on peach cvs.

Concerning vit. C content in the same tables data clear that all the tested thinned out and heading back pruning treatments significantly increased vit. C. Fruit spaced at 15 cm with higher vit. C. These results are in agreement with the findings of Attala (1997) and Abo Ogiela (2006).

Fruit colour

Data presented in Table 12 show that, the degree of red colour and the values of Ancocyanin content in each fruit skin were increased by increasing the degree of both thinning out up to 50 or 75% and heading back up to 25 or 50% and increasing the spacing between fruit from 10 to 15 cm apart. The increment was significant in both seasons. the abovementioned results are in accordance with those reported by Zayan *et al*. (2002), Mika (1986) and Samara *et al*. (2003) which they mentioned that hand thinning increased ancocyanin content in "Anna" apple fruit compared to un thinned trees.

Finally, it can be recommended Thinning out 50% and heading back 25% of one year old shoots with fruit Thinning at 15 cm a part obtain the highest yield with highly physical and chemical fruit characters.

TABLE 10. Effect of thinning out, heading back, fruit thinning and their interaction on some chemical properties of "Florida Prince" peach fruits in 2009 season.

Treatment		TSS %		Acidity %		TSS/acidity ratio		Vit C. mg/100 g/fruit	
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	9.27	10.47	1.04	0.95	9.46	9.56	8.91	11.02
	HB2	9.53	10.87	0.98	0.92	10.33	11.42	9.72	11.82
	HB3	9.67	11.13	0.95	0.91	11.86	12.03	10.18	12.23
To2	HB1	10.40	10.80	0.97	0.86	9.69	9.66	10.72	12.56
	HB2	10.80	11.87	0.91	0.82	11.46	12.83	11.87	14.48
	HB3	11.13	11.80	0.88	0.82	12.06	12.53	12.65	14.39
To3	HB1	10.73	11.40	0.93	0.85	9.43	9.67	11.54	13.41
	HB2	11.20	11.93	0.86	0.82	11.56	12.13	13.02	14.55
	HB3	11.30	12.00	0.84	0.80	11.66	12.20	13.81	15.00
L.S.D. interaction 0.05		0.356		0.052		0.501		0.778	
0.01		0.478		0.071		0.672		1.045	
Mean effect of thinning out	Thinning out 25%	10.16		0.96		10.78		10.65	
	Thinning out 50%	11.13		0.88		11.37		12.78	
	Thinning out 75%	11.48		0.85		11.11		13.56	
L.S.D. 0.05		0.145		0.021		0.204		0.318	
L.S.D. 0.01		0.195		0.029		0.274		0.427	
Mean effect of heading back	Heading back 0%	10.51		0.93		9.58		11.36	
	Heading back 25%	11.03		0.89		11.62		12.58	
	Heading back 50%	11.22		0.87		12.06		13.04	
L.S.D. 0.05		0.145		0.021		0.204		0.318	
L.S.D. 0.01		0.195		0.029		0.274		0.427	
Mean effect of fruit thinning	Fruit thinning 10 cm	10.48		0.93		10.83		11.38	
	Fruit thinning 15 cm	11.36		0.86		11.34		13.27	
L.S.D. 0.05		0.119		0.017		0.167		0.259	
L.S.D. 0.01		0.160		0.024		0.024		0.349	

TABLE 11. Effect of thinning out, heading back, fruit thinning and their interaction on some chemical properties of "Florida Prince" peach fruits in 2010 season.

Treatment		TSS %		Acidity %		TSS/acidity ratio		Vit C. mg/100 g/fruit	
Thinning out (To)	**Heading back (HB)**	**Fruit thinning 10 cm (FT1)**	**Fruit thinning 15 cm (FT2)**	**Fruit thinning 10 cm (FT1)**	**Fruit thinning 15 cm (FT2)**	**Fruit thinning 10 cm (FT1)**	**Fruit thinning 15 cm (FT2)**	**Fruit thinning 10 cm (FT1)**	**Fruit thinning 15 cm (FT2)**
To1	HB1	9.20	10.40	1.01	0.94	9.40	9.46	9.11	11.06
	HB2	9.33	10.47	0.96	0.91	11.16	12.06	9.72	11.51
	HB3	9.53	11.07	0.93	0.90	11.23	12.20	10.25	12.30
To2	HB1	10.27	10.67	0.95	0.85	9.66	9.70	10.81	12.55
	HB2	10.73	11.73	0.87	0.81	11.90	13.20	12.33	14.48
	HB3	11.07	11.67	0.86	0.80	11.50	13.00	12.87	14.59
To3	HB1	10.60	11.33	0.92	0.84	9.56	9.83	11.52	13.49
	HB2	11.27	11.80	0.85	0.81	11.23	12.50	13.26	14.57
	HB3	11.53	11.87	0.83	0.78	11.86	12.23	13.89	15.22
L.S.D. interaction 0.05		0.340		0.054		0.469		0.813	
0.01		0.457		0.073		0.630		1.091	
Mean effect of thinning out	Thinning out 25%	10.00		0.94		10.92		10.66	
	Thinning out 50%	11.02		0.86		11.49		12.94	
	Thinning out 75%	11.40		0.84		11.20		13.66	
L.S.D. 0.05		0.139		0.022		0.192		0.332	
L.S.D. 0.01		0.186		0.030		0.257		0.446	
Mean effect of heading back	Heading back 0%	10.41		0.92		9.60		11.42	
	Heading back 25%	10.89		0.87		12.01		12.65	
	Heading back 50%	11.12		0.85		12.00		13.19	
L.S.D. 0.05		0.139		0.022		0.192		0.332	
L.S.D. 0.01		0.186		0.030		0.257		0.446	
Mean effect of fruit thinning	Fruit thinning 10 cm	10.28		0.91		10.83		11.53	
	Fruit thinning 15 cm	11.22		0.85		11.58		13.31	
L.S.D. 0.05		0.113		0.018		0.156		0.271	
L.S.D. 0.01		0.152		0.024		0.210		0.364	

TABLE 12. Effect of thinning out, heading back, fruit thinning and their interaction on colour degree and anthocyanin content of "Florida Prince" peach fruits in 2009 and 2010 seasons (1=green, 10 = full red).

Treatment		2009 season				2010 season			
		Colour degree*		Anthocyanine content (µg/cm^2)		Colour degree		Anthocyanine content (µg/cm^2)	
Thinning out (To)	Heading back (HB)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)	Fruit thinning 10 cm (FT1)	Fruit thinning 15 cm (FT2)
To1	HB1	6.0	6.7	15.80	16.34	5.8	6.4	15.41	16.58
	HB2	7.1	8.0	15.89	17.25	6.9	7.8	16.07	17.01
	HB3	7.3	8.2	16.16	17.67	7.1	8.0	16.16	17.58
To2	HB1	6.6	7.1	15.98	16.52	6.3	6.9	15.94	16.75
	HB2	7.6	8.6	17.07	18.64	7.5	8.4	16.64	18.40
	HB3	7.8	8.5	16.81	18.46	7.6	8.3	16.46	18.00
To3	HB1	7.0	7.8	16.20	16.53	6.8	7.6	16.22	17.61
	HB2	7.9	8.5	17.18	18.34	7.6	8.3	17.13	18.24
	HB3	8.0	8.4	17.24	18.20	8.0	8.2	17.14	18.16
L.S.D. interaction 0.05		0.58		0.519		0.37		0.548	
0.01		0.79		0.695		0.77		0.737	
Mean effect of thinning out	Thinning out 25%	7.2		16.52		7.0		16.47	
	Thinning out 50%	7.7		17.25		7.5		17.3	
	Thinning out 75%	7.9		17.28		7.8		17.42	
L.S.D. 0.05		0.24		0.211		0.23		0.224	
L.S.D. 0.01		0.32		0.284		0.31		0.300	
Mean effect of heading back	Heading back 0%	6.9		16.23		6.6		16.42	
	Heading back 25%	8.0		17.40		7.8		17.25	
	Heading back 50%	8.1		17.42		7.9		17.25	
L.S.D. 0.05		0.24		0.211		0.23		0.224	
L.S.D. 0.01		0.32		0.284		0.31		0.300	
Mean effect of fruit thinning	Fruit thinning 10 cm	7.3		16.48		7.1		16.35	
	Fruit thinning 15 cm	8.0		17.55		7.8		17.59	
L.S.D. 0.05		0.19		0.172		0.19		0.183	
L.S.D. 0.01		0.26		0.232		0.26		0.246	

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تحسين إنتاجية محصول وجودة أشجار الخوخ صنف فلوريدا برنس بإستخدام بعض المعاملات الزراعية

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أجرى هذا البحث خلال موسمى ٢٠٠٩ ، ٢٠١٠ على أشجار خوخ صنف فلوريدا برنس عمر ٨ سنوات المنزرعة على مسافات ٤ × ٤ فى مزراعة خاصة بمنطقة سيدى سالم ، محافظة كفرالشيخ وذلك بهدف تحسين محصول وجودة ثمار أشجار الخوخ صنف فلوريدا برنس وذلك باستخدام ثلاث مستويات من تقليم الخف وذلك بازالة. (٢٥٪ ، ٥٠٪ ، ٧٥٪) وثلاث درجات من تقليم التقصير (صفر ، ٢٥٪ ، ٥٠٪) مستويين من خف الثمار يدويا عند ١٠ سم ، ١٥ سم وأمكن تلخيص النتائج المتحصل عليها فى النقاط الآتية:

١. أدت معاملات تقليم الأشجار بخف ٥٠ أو ٧٥٪ من النموات عمر سنة وتقصير ٢٥ أو ٥٠٪ للنموات عمر سنة مع خف الثمار على ١٥ سم فى المعاملات المركبة الآتية: (خف نموات ٥٠٪ + تقصير نموات ٢٥٪ + خف ثمار ١٥ سم) ، (خف نموات ٥٠٪ + تقصير نموات ٥٠٪ + خف ثمار ١٥ سم) ، (خف نموات ٧٥٪ + تقصير نموات ٢٥٪ + خف ثمار ١٥ سم) ، (خف نموات ٧٥٪ + تقصير نموات ٥٠٪ + خف ثمار ١٥ سم) لتحسين جودة الثمار مثل الطول والقطر ووزن وحجم ولون الثمار ومحتواها من المواد الصلبة الذائبة وفيتامين ج وصبغة الأنثوسيانين وكانت أفضل المعاملات .
٢. أعطت كلا من المعاملتين المركبتين (خف نموات ٥٠٪ + تقصير نموات ٢٥٪ + خف ثمار ١٠ سم) ، (خف نموات ٥٠٪ + تقصير نموات ٢٥٪ + خف ثمار ١٥ سم) أعلى محصول بـ كجم /شجرة وأعلى كفاءة محصول بـ كجم/سم٢ من مساحة مقطع الجذع بينما تعتبر فقط (خف نموات ٥٠٪ + تقصير نموات ٢٥٪ + خف ثمار ١٥ سم) أفضل معاملة مركبة فى إنتاج أعلى عدد ونسبة للثمار كبيرة الحجم.
٣. أوضحت النتائج أن أبعاد ووزن وحجم ودرجة تلوين الثمار علاوة على محتواها من المواد الصلبة الذائبة الكلية وفيتامين (ج) والأنثوسيانين قد زاد معنويا بزيادة شدة تقليم الخف والتقصير ودرجة خف الثمار .

لذلك يوصى هذا البحث مزارعى الخوخ صنف الفلوريدا برنس بتقليم أشجارهم بخف النموات ٥٠٪ + تقصير نموات ٢٥٪ + خف ثمار ١٥ سم للحصول على أعلى محصول وأعلى عدد ونسبة للثمار الكبيرة الحجم مع أفضل صفات جودة خاصة ووزن وحجم وتلوين الثمار ومحتواها من المواد الصلبة الذائبة الكلية (TSS) والأنثوسيانين.