EFFECT OF SUMMER PRUNING DATE AND SEVERITY ON VEGETATIVE GROWTH, YIELD AND FRUIT QUALITY OF 'CANINO' APRICOT TREES.

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ABSTRACT

Summer pruning was applied on different dates with several severities at 2003 & 2004 years on 6 years old 'Canino' apricot (Prunus persica L. Batch) trees grown in Elbostan region, where the soil is sandy and drip irrigated.

All heading-back treatments increased shoots number, leaf area, while thinning treatments increased shoot length, leaf dry weight. In both techniques, pruning effects were increased as severity increased. The earliest light thinning treatment recorded the highest significant specific leaf weight. Thinning treatments increased leaf content of chlorophyll a, chlorophyll b and total chlorophyll while heading-back treatments increased chlorophyll a only. The most later severe thinning treatment increased significantly leaf P% while, the most earlier severe one increased leaf content of K and Fe. At the same time, the late light heading-back treatment induced leaf content of Zn.

All summer pruning treatments increased the number of flowers on spurs, while heading-back treatments increased number of flowers on shoots and total number of flowers per tree. At the same time, treatment of heading-back 50% of shoot length for 50% of shoots number / tree at end of June increased spurs number of 'Canino' apricots. All summer treatments of both techniques (heading-back or thinning) increased essential fruit set percentage in a significant manner in most cases.

At harvest date, most of summer pruning treatments (all of heading-back treatments and some of thinning) improved both fruit weight and number per tree, while the most severe thinning treatment increased average fruit weight and volume. As severity of thinning increased and performance was later as fruit firmness and total soluble solids increased so, thinning 50% of shoots number per tree produced the most highly TSS and firm fruits. At the same time, some of heading-back treatments increased fruit firmness.

Key words: Apricot - Prunus persica - Summer pruning - Heading-back – Thinning - Leaf nutritional status.

INTRODUCTION

Optimum fruit production involves maximizing the photosynthates distribution to fruit for optimum yield and quality while controlling vegetative and root growth at minimum level of plant requirements (Chalmers *et al.*, 1981). Therefore, the efficiency of pruning systems could be evaluated in terms of the capacity to maximize assimilates distribution into fruit (Said *et al.*, 2003).

Summer pruning is commonly said to have many advantages over dormant pruning including control of tree size and shape, improved light distribution in the tree canopy (Miller, 1987 and Flore *et al.*, 1992), advanced fruit maturity, compressed harvest period, improved fruit size and color, improved flower bud cold hardiness, reduced pruning expenses and suppressed tree vigor (Marini and Barden 1987).

Summer pruning of apricot reduce shading within the canopy and stimulate new shoot growth (Jay *et al.*, 1995) which in turn increases the concentrations of growth substances and carbohydrates in shoots of deciduous fruit trees (Satoh *et al.*, 1977 and Gabr and Fatma Ibrahim, 2005). So, one of the benefits of summer pruning is an increase in photosynthetic photon flux density (PPFD) within the tree canopy. The vital importance of adequate PPFD is well documented for flower bud formation, fruit set, fruit color, fruit size and soluble solids (Marini and Barden, 1982b).

Also, summer pruning was used as a tool for breaking apical dominance and thus increasing twigs and spurs formation of apricots (Svoboda, 1996), pears (Nasr, 1996), apples (Fathi and Mokhtar, 1998; Abdel-Wahab *et al.*, 2002 and George *et al.*, 2002); increasing flower bud density per node of peaches (Rome and Ferree,1985); fruit set (Fathi and Mokhtar, 1998) and early flowering of apricots (Kuden, 1997). By the way, summer pruning increased percentage of retained fruits to perfect flowers (Ebied, 2005); increased total fruit yield for plum (Morgas *et al.*, 1998); increased yield in the subsequent year by increasing fruiting wood in the center of the tree (Miller, 1987; De jong and Day, 1991) and yields were more regular (Kuden and Kaska, 1995).

Moreover, summer pruning increased fruit size of apricots (Kuden and Kaska, 1995 and Kuden *et al.*, 1997); fruit weight and volume of apples (Fathi and Mokhtar, 1998) total soluble solids and acidity (Fathi and Mokhtar, 1998) enhanced firmness of deciduous fruits (Marini, 1985 and Ebied, 2005).

As regards of summer pruning date, influences are greater when treatments were carried out early in the season (Flore *et al.*, 1992).

The aims of the present investigation are, therefore, to maintain vegetative growth, keep tree healthy, increase yield and improve fruit quality of 'Canino' apricot.

MATERIALS AND METHODS

This investigation was carried out on six years old 'Canino' apricot (*Prunus armeniaca* L. Batch) trees budded on apricot seedling rootstock on 2002 -

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2003 & 2003 - 2004 seasons. Trees were grown at Elbostan region of Elbehira governorate where the soil is sandy under drip irrigation. Trees were blocked on the basis of trunk circumference at the beginning of the experiment to minimize within-treatments variation due to differences in tree size. Treatments were arranged as a random complete blocks design with a single tree plot replicated 3 times for each treatment while, obtained data were statistically analyzed using the Irristat (1999) computer soft ware package.

Two summer pruning techniques (Thinning and Heading-back) were applied on trees at two dates (after fruit harvest): end of June (A) & mid of July (B). Summer thinning treatments were applied by thinning 33% (T1) and 50% (T2) of shoots number / tree. At the same time, summer heading-back treatments were applied by heading-back 33% of shoot length for 33% of shoots number / tree (H1) and 50% of shoot length for 50% shoots number / tree (H2). Control trees (C) received regular horticultural practices without any summer pruning. So, investigated trees were subjected to the following treatments in table (A):

symbols	Pruning dates	Pruning treatments
C	Without	Control: Regular horticultural practices, without summer pruning.
AT1	End of June	Thinning 33% of shoots number / tree.
AH1	"	Heading-back 33% of shoot length for 33% of shoots number / tree.
AT2	"	Thinning 50% of shoots number / tree.
AH2	"	Heading-back 50% of shoot length for 50% of shoots number / tree.
BT1	Mid of July	Thinning 33% of shoots number / tree.
BH1	"	Heading-back 33% of shoot length for 33% of shoots number / tree.
BT2	"	Thinning 50% of shoots number / tree.
BH2	"	Heading-back 50% of shoot length for 50% of shoots number / tree.

Three branches, five years old, in different directions on each tree were selected and labeled for measuring all growth parameters. All current shoots which developed on these branches were counted to get shoots number and measured to get shoot length (cm). All leaves on fifteen shoots (five shoots per branch) were measured by using Li-Core-3100 Areameter to get leaf area (cm^2). Leaf sample was dried at 70° C and weighed to get leaf dry weight (g.) and then specific leaf weight (SLW) was calculated as ($mg.cm^{-2}$).

At mid August, thirty fully expanded mature leaves per branch on each tree based on mid of current year growth were sampled (Reisenauer, 1978) to determine leaf constituents. Nitrogen was determined by micro-Kjeldahl gunning method (A.O.A.C., 1990). Phosphorus was determined with a colorimetric method as described by Foster and Cornelia (1967). Potassium was determined by a flame photometer model E.E.L. (Jackson, 1967). Iron, Zinc and Manganese were determined by Perking – Elmer atomic absorption spectrophotometer model 2380 AL, according to Jackson and Ulrich (1959) and Yoshida *et al.* (1972).

Chlorophyll a and chlorophyll b were extracted from fresh leaves with DMF and were determined using a spectrophotometer as reported by Rami and Porath (1980). The concentration of chlorophyll a and chlorophyll b and its total value were calculated by Rami' s formulas as (µg / ml) (Rami 1982), while presented in this study as ($mg.cm^{-2}$).

At harvest, yield as fruit number, fruit weight per tree and average fruit weight were estimated. Thus, fruit firmness was recorded by Magness – Taylor type pressure tester with a standard 7/16 $inch^2$ plunger, to determinate fruit firmness and recorded in $Lb/inch^2$. Total soluble solids (TSS) was determined by using a hand refractometer and total acidity percentage was estimated according to (A.O.A.C., 1990).

RESULTS AND DISCUSSION

Data of table (1) show that all heading-back treatments increased shoots number significantly compared with control or the other thinning treatments. Response of shoots number to stimulation of summer pruning was increased as heading-back severity increase and earlier date of pruning was performed without significant differences. So, trees which received heading- back 50% of shoot length for 50% of shoots number / tree at the end of June (AH2) recorded the highest number (60.67) and then BH2 (57.33 & 57.67) in both seasons , respectively.

All thinning treatments increased shoot length compared with control or heading-back treatments. Stimulating effect of summer thinning for shoot length was increased as thinning severity increased and pruning date advanced without significant differences. Trees which received thinning 50% of shoot length for 50% of shoots number / tree at mid of July (BT2) recorded the highest length (116.7 & 117.3) and then BT1 (98.67 & 98.00) in both seasons, respectively.

Concerning leaf area, heading-back treatments significantly increased leaf area, regardless of pruning date, in a comparison of control or thinning treatments, at second season. Contra wise, at the first season thinning treatments increased leaf area with significant differences when compared with control, while heading-back treatments did not show any significant effect.

Data of table (1) cleared that all thinning treatments increased leaf dry weight compared with the control or heading-back treatments. Increment of leaf dry weight was increased as thinning severity decreased and performance earlier. So, trees which received thinning 33% of shoots number / tree at end of June (AT1) recorded the highest significant values (0.327 & 0.335) while, BH2 treatment (heading-back 50% of shoot length for 50% of shoots number / tree at mid of July) recorded the lowest significant records (0.186 & 0.191) in both seasons, respectively. Other treatments occupied intermediate position with some overlapping of significance.

AT1 treatment recorded the highest significant specific leaf weight (SLW) records (10.28 & 13.44) in the studied seasons while, other pruning treatments did not affect SLW in a significant manner, compared with control. This increase of SLW for AT1 may be due to the leaf dry weight increment which were proportionate to the leaf area values.

Findings of Jay *et al.* (1995) that summer pruning of apricot reduced shading within the canopy and stimulated new shoot growth confirm the results of present study and those presented by Marini (1985) which reported that summer pruning stimulated shoot growth of peach trees; number of shoot of apple trees (Marini and Barden, 1982a and Zayan *et al.*, 2002) and apple leaf SLW (Marini and Sowers, 1991).

Table (1): Effect of summer pruning on vegetative growth of 'Canino' apricot trees (2003-2004).*

Treatments **	Shoots number		Shoot length (Cm.)		Leaf area (Cm.^{2})		Leaf dry wt. (g.)		SLW (mg. Cm.$^{-2}$)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
C	31.00	32.67	53.67	54.00	26.89	26.31	0.228	0.222	8.49	8.45
AT1	19.33	20.67	86.33	87.33	31.87	24.98	0.327	0.335	10.28	13.44
AH1	52.00	55.67	43.33	44.00	26.86	29.70	0.211	0.221	7.88	7.47
AT2	18.00	18.67	89.00	86.00	31.32	24.75	0.248	0.253	7.93	10.22
AH2	60.67	60.67	41.67	47.67	26.13	30.44	0.197	0.198	7.53	6.48
BT1	18.33	19.33	98.67	98.00	30.09	25.49	0.266	0.259	8.85	10.16
BH1	52.67	53.67	71.00	72.00	25.96	30.36	0.187	0.199	7.19	6.54
BT2	15.67	17.33	116.7	117.3	30.80	24.28	0.243	0.249	7.89	10.25
BH2	57.33	57.67	59.67	61.67	25.76	29.23	0.186	0.191	7.22	6.58
L.S.D	8.4	7.7	11.2	13.1	3.3	2.9	0.34	0.42	0.57	0.63

*: 5 years old branch.

**:- C: Control - AT1: Thinning 33% of shoots number / tree at end of June - AH1: Heading-back 33% of shoot length for 33% of shoots number / tree at end of June – AT2: Thinning 50% of shoots number / tree at end of June – AH2: Heading-back 50% of shoot length for 50% of shoots number / tree at end of June - BT1: Thinning 33% of shoots number / tree at mid of July - BH1: Heading-back 33% of shoot length for 33% of shoots number / tree at mid of July – BT2: Thinning 50% of shoots number / tree at mid of July – BH2: Heading-back 50% of shoot length for 50% of shoots number / tree at mid of July.

Concerning leaf chlorophyll content, data of table (2) indicate that summer pruning treatments increased chlorophyll a significantly compare with the control, except AH2 treatment which presented a lower insignificant differences. Statistically, only thinning treatments increased significantly chlorophyll a, chlorophyll b and total chlorophyll, in both seasons.

In this respect, the obtained results are in harmony with those of Mika (1986) who discussed that the higher rate of photosynthesis of pruned shoots was associated with greater chlorophyll content, mesophyll cell enlargement, lower starch and alteration of cytokinin like substrates. So, the increment of determined chlorophyll values in leaves of summer pruned trees is expected.

Table (2): Effect of summer pruning on chlorophyll content of 'Canino' apricot leaves (2003-2004).

Treatments *	Chlorophyll a ($mg.cm^{-2}$)		Chlorophyll b ($mg.cm^{-2}$)		Total chlorophyll ($mg.cm^{-2}$)	
	2003	2004	2003	2004	2003	2004
C	3.36	3.30	2.38	2.31	6.13	5.61
AT1	4.29	4.21	2.82	2.74	6.81	6.95
AH1	3.67	3.59	2.36	2.28	6.36	5.87
AT2	4.34	4.26	2.75	2.67	6.87	6.92
AH2	3.58	3.51	2.50	2.42	6.18	5.93
BT1	4.11	4.69	2.76	2.68	6.78	7.36
BH1	3.84	3.76	2.46	2.36	6.42	6.12
BT2	4.25	4.17	2.70	2.59	6.71	6.76
BH2	3.76	3.68	2.25	2.20	6.01	5.88
L.S.D	0.31	0.33	0.18	0.22	0.36	0.43

*:- C: Control - AT1: Thinning 33% of shoots number / tree at end of June - AH1: Heading-back 33% of shoot length for 33% of shoots number / tree at end of June – AT2: Thinning 50% of shoots number / tree at end of June – AH2: Heading-back 50% of shoot length for 50% of shoots number / tree at end of June - BT1: Thinning 33% of shoots number / tree at mid of July - BH1: Heading-back 33% of shoot length for 33% of shoots number / tree at mid of July – BT2: Thinning 50% of shoots number / tree at mid of July – BH2: Heading-back 50% of shoot length for 50% of shoots number / tree at mid of July.

Concerning leaf macro elements, it was clear from data of table (3) that leaf N content was not affected by summer pruning. Only, the most severe pruning treatments (BT2 + AT2) increased leaf N% significantly, each one in each season, when compared with control leaves. At the same time, all applied treatments did not have clear trend on P values on 'Canino' apricot leaves, except the most severe thinning treatment (BT2) increased significantly leaf P% in both studied seasons, when compared with control leaves. On the other hand, most applied treatments showed inconsistent trend of leaf K content, while differences of the most earlier severe thinning treatment (AT2) were significant, and recorded the highest values (4.47 & 2.50) in both seasons.

These results coincide with those reported that summer pruning treatments increased leaves content of N (Taylor and Ferree, 1986) and K (Gabr and Fatma Ibrahim, 2005) while, it had no effect on leaf P content of apple (Taylor and Ferree, 1986 and Gabr and Fatma Ibrahim, 2005).

Data of table (3) demonstrated that the latest and severe summer thinning treatment (BT2) increased significantly leaf content of Fe in both seasons, where most of other treatments increased the records at the first season only. BH1 & BT2 treatments developed the highest significant values of Mn, each treatment at each season. At the same time, the late light heading-back (BH1) treatment showed the highest significant values of Zn, during studied season on 'Canino' apricot leaves. Other treatments occupied intermediate position with some overlapping of significance.

These results confirm those reported by Taylor and Ferree (1986) that summer pruning increased spur leaf content of Mn while did not show clear trend in its influence on Fe and Zn concentration. Also, it could be concluded that the lighter and later summer thinning treatments increased micro elements concentration of 'Canino' apricot leaves. The obtained results found support of those reported by Awasthi and Kaith (199١) that pruning removed major amount of mineral nutrients from pruned trees. On the other hand, the most severe and earlier heading-back treatments arose more reduction of micro nutrients. So, it was obvious that there was a clear trend for severity of summer heading-back on affecting micro nutrients values of 'Canino' apricot leaves. This may be due to its effect on increasing the active growing tips, which in turn act as pools that attract nutrients to build new organs. This explanation found support in the findings of Mika (1986) and Zayan *et al.* (2002)

Data of table (4) show that all heading-back treatments increased spur number significantly compared with control or other thinning treatments. Trees which received heading-back 50% of shoot length for 50% of shoots number / tree at end of June (AH2) recorded the highest spur number (211.33 & 228.33) in both seasons , respectively. At the same time, all summer pruning treatments increased number of flowers on spurs compared with control, significantly. Trees of heading-back 33% of shoots number / tree at end of June treatment recorded the highest number (1015.00 & 1026.67) in both seasons , respectively.

Table (3): Effect of summer pruning on leaf content of nutritional elements of 'Canino' apricot trees (2003-2004).

Treatments *	Macro-elements % on dry weight			Micro-elements ppm on dry weight		
	N	P	K	Fe	Mn	Zn
	2003					
C	1.88	0.18	3.66	427.7	65.3	223.9
AT1	1.67	0.10	3.78	444.3	62.6	219.6
AH1	1.66	0.19	4.23	400.7	67.9	237.3
AT2	1.70	0.25	4.47	544.6	66.0	220.1
AH2	2.37	0.42	4.65	412.8	64.4	228.3
BT1	2.00	0.11	3.90	535.7	75.0	229.7
BH1	2.05	0.10	3.95	493.4	77.2	282.8
BT2	3.40	0.37	3.45	526.5	71.0	239.1
BH2	1.46	0.12	3.45	429.4	74.0	155.7
L.S.D	0.58	0.08	0.37	47.6	11.8	32.7
	2004					
C	1.93	0.19	2.06	384.3	76.4	193.7
AT1	1.72	0.18	2.19	343.9	79.5	219.6
AH1	1.79	0.19	2.30	249.5	66.6	240.3
AT2	2.39	0.18	2.50	311.1	68.7	220.5
AH2	1.62	0.15	1.86	311.1	66.7	228.3
BT1	1.62	0.15	1.95	280.8	83.8	203.0
BH1	1.68	0.14	1.83	291.3	70.8	282.8
BT2	1.54	0.30	2.48	500.8	98.7	188.0
BH2	1.61	0.15	2.21	348.9	77.7	173.5
L.S.D	0.44	0.07	0.29	53.7	13.9	44.6

*:- C: Control - AT1: Thinning 33% of shoots number / tree at end of June - AH1: Heading-back 33% of shoot length for 33% of shoots number / tree at end of June – AT2: Thinning 50% of shoots number / tree at end of June – AH2: Heading-back 50% of shoot length for 50% of shoots number / tree at end of June - BT1: Thinning 33% of shoots number / tree at mid of July - BH1: Heading-back 33% of shoot length for 33% of shoots number / tree at mid of July – BT2: Thinning 50% of shoots number / tree at mid of July – BH2: Heading-back 50% of shoot length for 50% of shoots number / tree at mid of July.

Mainly, heading-back treatments increased number of flowers on shoots in a significance manner while, thinning treatments recorded the lowest significant number of flowers on shoots, comparing with control during studied seasons. It was obvious that the effect of summer pruning was proportionate with its severities. So, AH2 treatment recorded the highest significant number of flowers on shoots (1674.33 & 1727.0), while BT2 thinning treatment recorded the lowest significant records (638.0 & 588.67). Other treatments occupied intermediate position with some overlapping of significance.

Concerning total number of flowers of 'Canino' apricot trees, heading-back treatments increased total number of flowers significantly while, thinning treatments recorded the lowest significant ones, when compared with control in both seasons. The influence of summer pruning techniques was increased as pruning severity increased. So, AH2 treatment recorded the highest significant total number of flowers (2627.33 & 2725.0), while BT2 thinning treatment recorded the lowest significant records (1611.67 & 1602.67).

These results are confirmed with those reported that summer pruning improved flower bud formation (Marini and Barden, 1982a; Abdel-Wahab *et al.*, 2002; Zayan *et al.*, 2002 and Ebied, 2005) and induced spurs formation (Nasr, 1996; Svoboda, 1996; Fathi and Mokhtar, 1998; and George *et al.*, 2002). Therefore, It could be explained in light of Lord *et al.* (1979) findings that treated trees produced terminal flower buds on some long axillary shoots from the first and second axillary buds,

Data of table (4) cleared that all thinning treatments increased fruit set compared with control or corresponding heading-back treatments of each date, in the two seasons. Only one exception of heading-back treatments, the most light and earlier one which performed as heading-back 33% of shoots number / tree at end of June (AH1) increased essential fruit set percentage, in a significant manner when compared with the control. Trees subjected to thinning 50% of shoot length at end of June (AT2) recorded the highest significant percentage of essential fruit set (10.3 & 11.1) in seasons of 2003 and 2004, respectively.

These results are in harmony with those reported that summer pruning improved fruit set (Fathi and Mokhtar, 1998 and Zayan *et al.*, 2002). Also, the present results are in agreement with the conclusions of *Marini* and Barden (1982a) and Marini and Sowers (1991) who reported that summer pruning treatments suppressed drop and increased fruit set.

Table (4): Effect of summer pruning on flowering and fruit set of 'Canino' apricot trees (2003-2004).*

Treatments **	No. of spurs	Flowers on spurs	Flowers on shoots	Total No. of flowers	Essential fruit set	Essential fruit set%
	2003					
C	172.67	746.67	1369.33	2116.00	162.9	7.7
AT1	175.33	922.67	1181.00	2103.67	203.9	9.7
AH1	205.00	1015.00	1592.33	2607.33	239.8	9.2
AT2	178.00	915.33	899.00	1814.33	186.8	10.3
AH2	211.33	953.00	1674.33	2627.33	241.6	9.2
BT1	171.00	940.67	1053.67	1994.33	171.4	8.6
BH1	198.33	915.00	1467.33	2382.33	192.9	8.1
BT2	173.67	973.67	638.00	1611.67	148.2	9.2
BH2	207.00	946.67	1550.33	2497.00	209.7	8.4
L.S.D	19.6	76.4	83.7	102.6	38.2	0.88
	2004					
C	180.67	777.00	1231.33	2008.33	164.3	7.9
AT1	187.33	967.67	1054.00	2021.67	200.0	9.9
AH1	220.67	1026.67	1642.00	2668.67	253.4	9.5
AT2	193.33	960.33	772.67	1733.00	192.3	11.1
AH2	228.33	998.00	1727.00	2725.00	261.6	9.6
BT1	183.00	985.33	929.33	1914.67	174.1	9.1
BH1	215.33	1000.33	1520.33	2520.67	219.2	8.7
BT2	186.00	1014.00	588.67	1602.67	152.1	9.5
BH2	223.67	1004.33	1603.33	2607.67	229.4	8.8
L.S.D	22.3	68.5	72.8	94.4	33.7	0.83

*: 5 years old branch.

**:- C: Control - AT1: Thinning 33% of shoots number / tree at end of June - AH1: Heading-back 33% of shoot length for 33% of shoots number / tree at end of June – AT2: Thinning 50% of shoots number / tree at end of June – AH2: Heading-back 50% of shoot length for 50% of shoots number / tree at end of June - BT1: Thinning 33% of shoots number / tree at mid of July - BH1: Heading-back 33% of shoot length for 33% of shoots number / tree at mid of July – BT2: Thinning 50% of shoots number / tree at mid of July – BH2: Heading-back 50% of shoot length for 50% of shoots number / tree at mid of July.

It was obvious from data of table (5) that most of summer pruning treatments significantly increased fruit number per tree, in season of 2003. In 2004 season, regardless of pruning severity degree or performance date, only heading-back treatments recorded the highest significant fruit number when compared with control. The same trend was obtained for fruit weight per tree in both studied seasons. So, it could argued that increment in 'Canino' apricot yield (fruit weight per tree) might be due to the influence of summer heading-back treatments on increasing fruit number per tree as a result of inducing flowering and fruit set (table 4).

The obtained results are in harmony with those reported by Dejong and Day (1991) and Miller (1987) that summer pruning increased fruit yields in peach in the subsequent year by increasing the number of fruits / tree. Also, Marini and Barden (1987); Kuden *et al.* (1995) and Zayan *et al.* (2002) reported that summer pruning increased the yield of peaches; apples and apricots. Moreover, Lichou and Jay (1996) cleared that fruiting of Priana and Beliana apricot cultivars trees were enhanced on older parts of the tree and yields were more regular with summer pruning.

Concerning total average fruit weight of 'Canino' apricot fruits, summer pruning treatments varied in their effects and significance in both seasons (table 5). Only, the most severe thinning treatment (BT2) recorded the highest significant average fruit weight (69.2 & 70.8) when compared with the control in both seasons.

These results are in agreement with reports of Kuden *et al.*, 1997; Sharma *et al.*, 1997) that summer pruning treatments increased fruit weight of apricots. On apple, Fathi and Mokhtar, 1998 and Zayan *et al.*, 2002 reported the same influence and added that the influence of summer pruning was found to be linearly related to its severity. On the other hand, Autio and Greene (1990) reported that summer pruning had no effect on fruit weight of apples.

Table (5): Effect of summer pruning on yield of 'Canino' apricot trees (2003-2004).

Treatments *	Fruit No. / tree		Fruit weight / tree (Kg.)		Av. Fruit weight (gm.)	
	2003	2004	2003	2004	2003	2004
C	646.3	656.6	41.12	40.67	63.4	60.9
AT1	802.3	703.6	48.15	41.80	59.8	58.3
AH1	916.0	912.0	57.22	60.80	62.2	65.7
AT2	744.6	668.0	4982.	43.76	66.9	64.3
AH2	904.0	944.3	56.78	61.03	61.8	64.6
BT1	664.0	596.6	40.13	39.72	60.2	65.4
BH1	768.3	776.0	4922.	48.32	63.8	61.8
BT2	592.3	508.3	41.4	36.99	69.2	70.8
BH2	836.6	996.0	51.61	54.32	61.2	54.2
L.S.D	86.9	91.7	3.22	3.86	3.2	3.6

*:- C: Control - AT1: Thinning 33% of shoots number / tree at end of June - AH1: Heading-back 33% of shoot length for 33% of shoots number / tree at end of June – AT2: Thinning 50% of shoots number / tree at end of June – AH2: Heading-back 50% of shoot length for 50% of shoots number / tree at end of June - BT1: Thinning 33% of shoots number / tree at mid of July - BH1: Heading-back 33% of shoot length for 33% of shoots number / tree at mid of July – BT2: Thinning 50% of shoots number / tree at mid of July – BH2: Heading-back 50% of shoot length for 50% of shoots number / tree at mid of July.

Regarding data of table 6 concerned with fruit volume, it could be seen that treatment of (BT2) which performed as thinning 50% of shoots / tree at mid of July recorded the highest average fruit volume (69.2 & 70.8) when compared with control and differences were statistically significant in both seasons. Other pruning treatments varied in their effect and significance from one season to another.

These results coincide with findings of Fathi and Mokhtar (1998) that summer pruning treatments increased fruit volume of apple. Moreover, they cleared that the increasing influence was linearly related to pruning severity.

At harvest date, all treatments of the study did not affect seriously both seed weight or flesh thickness.

Statistically, most of summer pruning treatments enhanced significantly fruit firmness (table 6). Data of table (6) illustrated that as severity of thinning increased and performance was later as fruit firmness increased. So, it was found that treatment of (BT2) which was performed as thinning 50% of shoots / tree at mid of July produced the most firm fruits (14.5 & 14.3) when compared with control which recorded the lowest fruit firmness (12.4 & 12.6) in respect order, in both seasons.

The obtained herein results are in line with those of Marini (1985), Ebied (2005) and Gabr and Fatma Ibrahim (2005) that summer pruning improved fruit firmness in peach and apricot. Moreover, Fathi and Mokhtar (1998) reported that fruit firmness was increased by summer pruning and there was a linear relationship between severity of pruning and firmness of apple fruits. It could be regarded that the influence of summer pruning on fruit firmness might be due to its effect on leaf calcium content (Gabr and Fatma Ibrahim, 2005) which may be reflected on increment of fruit calcium and increased fruit firmness.

Also, it could be seen from table (6) that thinning treatments showed significant differences in total soluble solids of apricot fruit juice (TSS%). Moreover, it was observed from table (6) that as performance of thinning was later, the influence on TSS was increased. So, it was found that treatment of (BT2) which performed as the most severe and latest thinning treatment recorded the highest percentage of total soluble solids of fruit juice (13.5 & 13.6) when compared with control and differences were significant in both seasons. On the other hand, summer pruning treatments of this study did not show a clear trend in their effect on acidity percentage of 'Canino' apricot fruit juice, while there was any significant differences among treatments or between treatments and control.

Obtained herein results, confirm with findings of Fathi and Mokhtar (1998) that summer pruning increased TSS and values were higher as trees practiced later as possible. Likewise, Gabr and Fatma Ibrahim (2005) reported that the influence of summer pruning treatments on acidity percentage varied from one season to another.

Table (6): Effect of summer pruning on physical and chemical characteristics of 'Canino' apricot fruits (2003-2004).

Treatments **	Volume (cm^3)	Firmness ($Lb.inch^{-2}$)	Seed weight (g.)	Flesh thickness (cm.)	TSS %	Acidity%
	2003					
C	63.0	12.4	11.6	1.14	12.7	1.24
AT1	59.9	12.7	11.6	1.22	13.0	1.24
AH1	62.0	12.8	10.3	1.17	12.6	1.29
AT2	66.5	13.4	12.3	1.26	13.2	1.27
AH2	62.0	12.5	12.0	1.09	12.5	1.31
BT1	60.0	13.8	11.0	1.18	13.3	1.20
BH1	63.4	12.6	10.6	1.09	12.7	1.34
BT2	69.0	14.5	11.9	1.11	13.5	1.26
BH2	61.5	12.6	10.3	1.23	12.8	1.27
L.S.D	3.4	0.41	2.3	0.33	0.36	0.24
	2004					
C	61.0	12.6	11.3	1.18	12.4	1.27
AT1	58.5	12.9	11.6	1.08	12.9	1.21
AH1	65.6	12.9	10.6	1.09	12.5	1.26
AT2	64.0	13.8	12.3	1.20	13.4	1.34
AH2	64.0	12.1	11.9	1.24	12.2	1.24
BT1	65.5	13.6	11.3	1.23	13.4	1.19
BH1	62.0	12.4	10.6	1.21	12.4	1.29
BT2	70.5	14.3	12.0	1.19	13.6	1.25
BH2	54.7	12.8	10.3	1.16	12.5	1.31
L.S.D	3.7	0.44	2.2	0.37	0.34	0.29

*:- C: Control - AT1: Thinning 33% of shoots number / tree at end of June - AH1: Heading-back 33% of shoot length for 33% of shoots number / tree at end of June – AT2: Thinning 50% of shoots number / tree at end of June – AH2: Heading-back 50% of shoot length for 50% of shoots number / tree at end of June - BT1: Thinning 33% of shoots number / tree at mid of July - BH1: Heading-back 33% of shoot length for 33% of shoots number / tree at mid of July – BT2: Thinning 50% of shoots number / tree at mid of July – BH2: Heading-back 50% of shoot length for 50% of shoots number / tree at mid of July.

Results of this investigation revealed that summer thinning treatments improved vegetative growth; enhanced physiological status and directed apricot trees to produce more yield and improved fruit quality. So, the most severe and latest thinning treatment (BT2) was a recommended treatment to apply on 'Canino' apricot trees.

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الملخص العربي

تأثير ميعاد إجراء التقليم الصيفي و شدة التقليم علي النمو الخضري و المحصول و جودة الثمار في صنف المشمش كانينو

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تم إجراء التقليم الصيفي علي أشجار مشمش صنف كانينو عمر 6 سنوات المطعومة على أصل المشمش البذري و المزروعة في التربة الرملية بمنطقة البستان و التي تروى بالتنقيط خلال موسمي 2002- 2003 و2003- 2004 .

و قد أدت كل معاملات التطويش إلي زيادة عدد الأفرع و مساحة الورقة ، وكان تأثير المعاملات يزداد كلما كانت المعاملة أبكر ، في حين أدت كل معاملات الخف إلي زيادة طول الفرخ و الوزن الجاف للورقة ، وكان تأثير المعاملات يزداد كلما كانت المعاملة أكثر تأخيرا ، وفي كلا أسلوبي التقليم كان التأثير يزداد بزيادة شدة التقليم.

أدت المعاملة بالخف لثلث عدد الأفرع الموجودة على الشجرة في منتصف يونيو إلى زيادة الوزن النوعي للورقة ، و قد أدت كـل معاملات الخف إلى زيادة كل تقديرات الكلوروفيل (كلوروفيل أ و كلوروفيل ب والمحتوى الكلي للكلوروفيل بالورقة) في حين زودت معاملات التطويش من محتوى الورقة من كلوروفيل ب فقط.

أكثر معاملات الخف تأخيرا و شدة و التي أجريت علي الأشجار بخف 50% من عدد الأفرع الموجودة على الشجرة في منتـصف يوليو أدت إلى زيادة محتوى الورقة من الفوسفور في حين أدت أكثر معاملات الخف تبكيرا و شدة و التي أجريت علي الأشجار بخـف 50% من عدد الأفرع الموجودة على الشجرة في نهاية يونيو إلى زيادة محتوى الورقة من البوتاسيوم و الحديد ، في حين أدت المعاملـة المتـأخرة بالتطويش الخفيف و التي أجريت علي الأشجار بتطويش 33% من طول الفرع لثلث عدد الأفرع الموجودة على الشجرة في منتصف يوليو إلى زيادة محتوى الورقة من الزنك.

أدت معظم معاملات التقليم الصيفي إلي زيادة النسبة المئوية للعقد المبدئي على الأشجار في حين أدت كل المعاملات إلي زيادة عدد الأزهار الموجودة على دوابر و أدت كل معاملات التطويش إلي زيادة عدد الأزهار الموجودة على أفرع و العدد الكلي للأزهار على الشجرة وفي نفس الوقت أدت المعاملة المبكرة بشدة بالتطويش و التي أجريت علي الأشجار بتطويش 50% من طول الفرع لنـصف عـدد الأفـرع الموجودة على الشجرة في نهاية يونيو إلى زيادة عدد الدوابر لأشجار المشمش كانينو.

تم جمع الثمار في مرحلة النضج الفسيولوجي ولوحظ أن معظم معاملات التقليم الصيفي (كل معاملات التطويش وبعض معـاملات الخف) أدت إلى زيادة محصول الأشجار (وزن وعدد الثمار للشجرة) ، إلا أن أكثر معاملات الخف تأخيرا و شدة و التي أجريت علي الأشجار بخف 50% من عدد الأفرع الموجودة على الشجرة في منتصف يوليو أدت إلى تحسين مواصفات الثمرة بزيادة الوزن والحجم ، كما لوحظ أنه كلما تأخر ميعاد الخف وازدادت شدته كلما ازدادت صلابة الثمار و ازدادت النسبة المئوية للمواد الصلبة الذائبة بعصير الثمار.