Journal
J. Biol. Chem. Environ. Sci., 2009, Vol. 4(4): 383-398
www.acepsag.org

RESPONSE OF "CANINO" APRICOT (*PRUNUS ARMENICA* L.) TREES TO GIRDLING AND FRUIT THINNING

Abo-El-Ez, A. T.* and R.A.A. Mostafa**

**Hort. Dept., Fac. of Agric., Sohag Univ., Sohag, Egypt.*
*** Hort. Dept., Fac. of Agric., Assiut Univ., Assiut, Egypt*

ABSTRACT

A study was conducted during three successive seasons 2006, 2007 and 2008 on the effect of girdling and hand thinning of fruit either individually or in combination on growth, nutritional status, yield and fruit quality of "Canino" apricots grown in El-Kawther region Sohag Governorate, Egypt. The results indicated that girdling and fruit thinning increased significantly leaf area, leaf dry weight, specific leaf weight, leaf total chlorophyll, shoot total carbohydrates and C/N ratio, fruit yield and maturity and fruit quality as compared with the control. Girdling individually or combined with fruit thinning were the superior in its effect on these parameters in the three seasons of the study. Time of ripening was enhanced by about 3-4 days with girdling individually or combined with fruit thinning compared to the control and fruit thinning alone. The highest yield percent was obtained from girdling alone. Also, girdling individually or combined with fruit thinning were the superior in its effect on this parameter. Also, girdling individually or combined with fruit thinning improved fruit quality (fruit weight, firmness, total soluble solids and total sugars. Girdling combined with fruit thinning was the superior in there effect on these properties. On the other hand, the largest leaf area were obtained from girdling individually or combined with fruit thinning. Girdling alone was the superior in its their effect on this parameter. Girdling alone or combined with fruit thinning improved leaf dry weight and specific leaf weight. Girdling combined with fruit thinning at 10 cm apart was the superior in its effect on these parameters. Girdling individually or combined with fruit thinning improved leaf total chlorophyll content with no significant differences between them.

From the obtained results, it is evident that secondary branch girdling alone was the recommended treatment, for improving yield and fruit quality of "Canino" apricot.

Keyword: Apricot, "Canino" cultivar, girdling, Fruit thinning, Vegetative growth, Yield and Fruit quality.

INTRODUCTION

Apricot (*Prunus armeniaca*) is a deciduous fruit tree which has low chilling requirements. "Canino" apricot is newly introduced cultivar gives high yield in new reclaimed lands.

Fruit trees often set more fruits than they can support or develop adequately, especially if the trees were not properly pruned during the previous season. Excessive fruit number compete with each other for carbohydrates (stored energy) and remain small. This carbohydrate drain or "Sink" can also weaken the tree and make it more susceptible to pest infections and sunburn damage. Leaving too much fruit on a tree can also lead to alternate bearing (a cycle in which the tree bears excessively in one year and little in the next year) or limb breakage. Many cultural operations, including proper pruning, fruit thinning and limb girdling at pit hardening, are practiced to prevent these problems from developing. All stone fruit (peaches, apricots, nectarines, cherries, plums, etc.) require thinning. Fruit should be thinning when they are fairly small-typically from early Apr. (for early-ripening fruit) to mid-May (for late ripening fruit). Fruit thinning too early can result in split pits in stone fruits, especially peaches, on the other hand thinning too late reduces the chances that fruit size will increase. Time is critical for thinning to be beneficial (Westwood, 1993). The amount of fruits to be thin depends on the species and the overall fruit load on the tree. For example, stone fruits such as apricots and plums are fairly small, so they should be thinnined to 2 to 4 inches (5 to 10 cm) apart on the branch. Thinning immature fruits at the appropriate time allows the remaining fruits to develop to its maximum size, with reduction of tree vigor. Less-crowded fruits receive more sunlight, so fruit color and flavor may be improved. Fruit thinning also reduces alternate bearing (Eliwa, 2003 and Said *et al.,* 2003).

Girdling has been, and is still, worldwide used for centuries in citrus, grape, peach and other fruit tree crop, mainly to increase flowering , fruit set and fruit size. Girdling the trunk or branches of

stone fruit is a well known practice to increase accumulation of carbohydrates in parts above wounds. Ringing branches at pit hardening resulted in larger fruit and enhanced fruit colouring of peaches and nectarines. Because both together determine the time of harvest. Fruits from ringed trees were picked earlier, further, ringing resulted in advanced fruit ripening compare with controls. Cytokinin and gibberellin content of shoots is also modified by girdling (Saton *et al.,* 1977 and Cutting and Lyne, 1993). On the upper part of girdling leaf N content, C/N ratio and carbohydrate were improved. Therefore, flowering and fruit set were increased (Eliwa, 2003, Said *et al.,* 203 and Gabr and Fatma Ibrahim 2005). However, girdling and thinning in combination to different deciduous fruit crops had a positive effect on growth, nutritional status, yield and fruit quality of apricot trees (Ilha *et al.,* 1999; El-Beacy, 2001, Eliwa, 2003 and Said *et al.,* 2003).

This investigation was conducted to study the effect of girdling and hand fruit thinning either alone or in combination on vegetative growth, nutritional status, yield and fruit quality of "Canino" apricot cv. grown under El-Kawther region conditions, Sohag Governorate, Egypt.

MATERIALS AND METHODS

The present study was conducted during three successive seasons of 2006, 2007 and 2008 on7-year old "Canino" apricot (*Prunus armeniaca* L.) trees budded on apricot seedlings rootstock. Trees were spaced at 6x6 meters apart and trained to vase shape system, grown in sandy calcareous soil ($CaCo_3$ 18.8%) in the orchard of Faculty of Agriculture at El-Kawther region, Sohag Governorate, Egypt. The selected trees were chosen uniform in vigour size and normal growth as posible.

"Canino" apricot trees that selected for carrying out the experiment received basal recommended of NPK nutrition (by Ministry of Agriculture, Egypt) which including the addition of 2.5 kg ammonium sulphate (20.6%), 2.0 kg monocalcium superphosphate (15.5% P_2O_2) and 1.0 kg potassium sulphate (48% K_2O) per tree. Farmyard manure (0.25% N, 1.2% K_2O and 0.8% P_2O_5) was added to all the trees at 10 kg/tree. It was added once at the last week of December in the three seasons in two trenches with depth 25 cm at both tree sides , phosphate fertilizer was divided into two equal batches, the first was added with farmyard manure and the second was

applied just after fruit setting (at the first week of April). Potassium fertilizer was splitted into three equal batches, the first with farmyard manure, the second before blooming (at the first week of Mar. and the third just after fruit setting. Ammonium sulphate fertilizer was splitted into four equal batches at growth start (at the first week of Mar., just after fruit setting, at one month later and just after fruit harvesting (at the last week of May). Other horticultural practices namely pruning, hoeing, pest control management and irrigation were carried out as usual.

Experimental work: Winter pruning was made by removing the entire branches in the second week of Jan. in the three seasons, leaving about 250branches/tree. This study aimed mainly to study the effect of girdling by removing a narrow ring of the bark (4mm entirely round secondary branches by a double blade knife at full bloom (50-70% anthesis) in the second week of Mar. of 2006, 2007 and 2008 seasons, hand fruit thinning by leaving one fruit every 5 or 10 cm along the bearing shoots when the fruit were in the size of a hazelnut (i.e., about the end of cell division stage) on the first week of Apr. and their interaction beside the control (did not receive any treatment) in six treatments on vegetative growth in terms of leaf area, leaf dry weight and specific leaf weight, as well as yield and fruit quality. In addition, nutritional status of the tree, in terms of seasonal changes in total carbohydrates and C/N ratio. Leaf total chlorophyll content were also considered during the consecutive seasons of 2006, 2007 and 2008.

Vegetative growth: Twenty leaves from the current growth shoots of the three seasons at the end of growing season (30^{th}, Aug.) were used for measuring leaf area (cm^2). Leaf sample was taken and dried at 70^{o}c and weighted to get leaf dry weight (g) and specific leaf weight ($mg.cm^2$) as described by Ferree and Forshey (1988).

Shoot total carbohydrates content: Four shoots, one from each direction per tree were sampled each season, at the time of flower bud induction of the following crop (30^{th} June) they were washed three times with tap water , then washed again by distilled water. Samples were oven dried at 70^{0}c to a constant weight. Total carbohydrates were determined as percent on dry weight basis according to Dubies *et al.,* (1956)and total nitrogen percentage by the semi-micro

Kjeldahl/technique (Peach and Tracey, 1968). then C/N ratio was calculated.

Leaf total chlorophyll content: Fresh leaf samples were taken in August of each season from each replicate for extracting chlorophyll. Spectrophotometerically determination was carried out as reported by Rami and Porath (1980). The concentration of total chlorophyll were calculated by Rami's formula as μ/ml (Rami, 1982). The results were presented as ($mg.cm^2$) of leaf blade.

Yield and fruit quality: At harvest time, at the last week of May yield as fruit number and fruit weight/tree (kg) were estimated. Ten fruits were selected at random for each tree for quality measurements, viz , average fruit weight (g), flesh thickness (cm), fruit firmness ($Ib/inch^2$) was determined as recorded by (Magness and Taylor, 1925) using pressure. Tester at 5/16 plunger. Total soluble solids (TSS) was determined by using a hand refractometer. Total acidity percentage was estimated as malic acid as outlined in A.O.A.C. (1975) and total sugars were determined according to the method of Lane and Eynon outlined in A.O.A.C. (1975).

Statistical design and analysis: Treatments were arranged as a random complete block design with a single tree plot replicated four times for each treatment where the obtained data were statistically analyzed using the MSTAT-C statistical analysis package (Freed *et al.,* 1989), then LSD test was used to recognize the significance between the means according to the procedure of Snedecor and Cochran (1972).

RESULTS AND DISCUSSION

1- Vegetative growth parameters:-

All vegetative characters measured were significantly affected by girdling and fruit thinning treatments in all the three seasons Tables (1&2).

Girdling and fruit thinning treatments significantly affected leaf area in the three seasons. Secondary branch girdling (SBG) was significantly the largest followed by SBG with fruit thinning at 10 cm apart. SBG with fruit thinning at 5 cm apart and the control treatment were significantly the smallest, while other treatments resulted an intermediate leaves size Table (1).

Girdling and fruit thinning treatments were in the following descending order of significant effect in leaf dry weight: SBG with fruit thinning at 10 cm apart > SBG with fruit thinning at 5 cm apart > SBG > fruit thinning at 10cm apart > fruit thinning at 5cm apart > control in all the three seasons Table (1).

Table (1): Effect of some girdling and fruit thinning treatments on leaf area (cm^2) and leaf dry weight (g) of "Canino" apricot trees during 2006, 2007 and 2008 seasons.

Treatments	Leaf area (cm^2)			Leaf dry weight (g)		
	2006	2007	2008	2006	2007	2008
Control	31.85	33.67	33.78	0.199	0.211	0.211
Fruit thinning (5cm apart)	32.39	34.93	34.73	0.200	0.220	0.217
Fruit thinning (10cm apart)	33.52	35.78	35.76	0.226	0.244	0.243
Secondary branch girdling (SBG)	40.55	40.28	41.86	0.260	0.270	0.274
SBG+thinning (5cm apart)	38.57	38.11	39.63	0.288	0.282	0.296
SBG+thinning (10cm apart)	38.83	39.42	40.56	0.352	0.365	0.371
LSD at 5% level	0.57	0.24	0.12	0.007	0.006	0.003

Girdling and fruit thinning treatments significantly affected specific leaf weight in the three seasons. SBG with fruit thinning at 10 cm apart was significantly the highest followed by SBG with fruit thinning at 5 cm apart , while the control treatment was significantly the lowest but was not significantly different from fruit thinning at 5cm apart treatment. Other treatments occupied an intermediate position Table (2).

Leaf total chlorophyll content followed a trend nearly similar to that of the specific leaf weight in the three seasons. SBG with fruit thinning at 10cm apart was significantly the highest but was not significantly different from SBG with fruit thinning at 5 cm apart, while the control treatment was significantly the lowest but was not significantly different from fruit thinning at 5cm apart treatment. Other treatments occupied an intermediate position with no significant difference between them except in the first season with some overlapping significance Table (2).

In previous studies, girdling and fruit thinning in combination had a positive effect on growth of apricot trees (Ilha *et al.,* 1999; El-Beacy, 2001; Eliwa, 2003 and Said *et al.,* 2003).

Table (2): Effect of some girdling and fruit thinning treatments on specific leaf weight (mg. cm^2) and leaf total chlorophyll content (mg.cm^2) of "Canino" apricot trees during 2006, 2007 and 2008 seasons.

Treatments	Specific leaf weight (mg. cm^2)			Leaf total chlorophyll (mg.cm^2)		
	2006	2007	2008	2006	2007	2008
Control	7.69	7.25	7.73	5.71	5.66	5.70
Fruit thinning (5cm apart)	7.71	7.26	7.73	5.65	5.92	5.96
Fruit thinning (10cm apart)	8.44	8.26	8.63	6.25	6.18	6.23
Secondary branch girdling (SBG)	8.45	11.11	10.07	6.81	6.79	6.77
SBG+thinning (5cm apart)	9.57	11.06	10.67	6.99	6.96	6.98
SBG+thinning (10cm apart)	11.07	14.64	13.25	7.07	7.30	7.13
LSD at 5% level	0.18	0.29	0.14	0.82	0.70	0.62

2-Shoot total carbohydrates content:

Shoot carbohydrates content was significantly the highest in SBG treatment expect in the first season followed by the control treatment except in first season.

Trend in shoot C/N ratio was consistent in the three seasons. SBG with fruit thinning at 10 cm apart treatment was significantly the highest in shoot C/N ratio followed by SBG with fruit thinning at 5 apart treatment except in the third season. While the fruit thinning at 5 cm apart and control treatments were significantly the lowest with significant differences between them (Table 3).

In previous studies, carbohydrate and C/N ratio were improved in the upper part of girdling (Eliwa, 2003, Said et al., 2003 and Gabr and Fatma Ibrahim 2005). On the other hand, girdling and thinning in combination had a positive effect on nutritional status of apricot trees (Ilha *et al.,* 1999; El-Beacy, 2001; Eliwa, 2003 and Said *et al.,* 2003).

Table (3): Effect of some girdling and fruit thinning treatments on shoot total carbohydrate %, nitrogen % and carbohydrate/nitrogen (C/N) ratio of "Canino" apricot trees during 2006, 2007 and 2008 seasons.

Treatments	Total carbohydrate %			N%			(C/N) ratio		
	2006	2007	2008	2006	2007	2008	2006	2007	2008
Control	30.41	29.70	30.00	2.13	2.28	2.17	14.24	13.05	13.77
Fruit thinning (5cm apart)	28.13	28.39	28.26	1.72	1.67	1.68	16.29	16.93	16.74
Fruit thinning (10cm apart)	28.83	28.38	28.57	1.39	1.37	1.38	20.21	20.62	20.61
Secondary branch girdling (SBG)	29.93	31.28	30.72	1.42	1.57	1.49	20.98	19.84	20.61
SBG+thinning (5cm apart)	28.03	28.89	28.53	1.12	1.27	1.18	24.88	22.63	24.06
SBG+thinning (10cm apart)	29.17	29.84	29.56	1.12	1.27	1.18	25.90	23.38	24.95
LSD at 5% level	0.24	0.24	0.13	0.10	0.08	0.06	0.26	0.71	1.00

3- Productivity:

Girdling and fruit thinning treatments significantly affected tree productivity characters viz, total number of fruits /tree and fruit yield/tree (Table 4).

In the three seasons, the least significant effect on the total number of fruits/tree was observed in the thinning at 10 cm, apart treatment followed by treatments: fruit thinning at 5 cm , SBG with fruit thinning at 10cm and SBG with thinning at 5 cm, the control while SBG was significantly the highest in total number of fruit /tree.

SBG treatment produced the highest significant fruit yield in the three seasons, followed by SBG with fruit thinning at 10 cm apart treatment then, SBG with fruit thinning at 5 cm apart treatment while fruit thinning at 10 and 5 cm apart treatments were the lowest, although it did not differ significantly from the control.

In previous studies, girdling and fruit thinning in combination had a positive effect on yield of apricot trees (Ilha *et al.,* 1999; El-Beacy, 2001 Elwa, 2003 and Said *et al.,* 2003).

4- Fruit quality:

Girdling and fruit thinning treatments considerably affected all physical Tables (5&6) and chemical Tables (6&7) fruit quality characters.

SBG treatment alone or in combination with fruit thinning 10 and 5 cm apart treatments resulted in a significantly heaviest fruits in

the three seasons, with no significant difference between them. Although fruit thinning at 10 and 5 cm apart treatments came mostly next to the mentioned treatments with no significant difference between them except in the first seasons. The control treatment was the smallest in fruit weight (Table 5).

Concerning fruit firmness, the control treatment produced the lowest firmness fruits in the three seasons, but without significant differences from those of the fruit thinning at 5 and 10 cm apart treatments. Meanwhile, fruit firmness was significantly the highest in SGB with fruit thinning at 10 cm apart, SBG with fruit thinning 5 cm apart and SBG treatments in the three seasons without significant differences between them. This trend was due to the earlier fruit ripening that was induced by other treatments Table (5).

When samples of harvested mature fruits were left at room temperature until ripening before quality determination, it was noticed that, fruits of SBG treatment, alone or in combination with fruit thinning 10 and 5 cm apart treatments ripened 3-4 days earlier than fruits of other treatments. These two criteria, i.e. firm fruit and early mature ripe, were, therefore, interrelated.

Table (4): Effect of some girdling and fruit thinning treatments on fruit number and yield/tree (kg) of "Canino" apricot trees during 2006, 2007 and 2008 seasons.

Treatments	Fruit number/tree			Yield/tree (kg)		
	2006	2007	2008	2006	2007	2008
Control	1014.0	1074.3	1117.0	26.86	31.40	33.76
Fruit thinning (5cm apart)	874.7	945.7	996.0	24.35	33.07	34.16
Fruit thinning (10cm apart)	836.7	905.0	953.7	25.80	31.74	34.27
Secondary branch girdling (SBG)	1101.7	1155.0	1193.0	53.59	54.45	57.29
SBG+thinning (5cm apart)	962.7	1040.7	1096.0	47.36	49.54	53.39
SBG+thinning (10cm apart)	945.0	996.7	1033.7	49.69	50.57	53.56
LSD at 5% level	4.40	2.34	4.41	1.18	1.87	1.92

Table (5): Effect of some girdling and fruit thinning treatments on fruit weight (g) and fruit firmness (Ib/inch^2) of "Canino" apricot trees during 2006, 2007 and 2008 seasons.

Treatments	Fruit weight (g)			Fruit firmness (Ib/inch^2)		
	2006	2007	2008	2006	2007	2008
Control	26.49	29.23	30.23	12.47	12.47	12.51
Fruit thinning (5cm apart)	27.84	34.97	34.30	12.77	12.84	12.81
Fruit thinning (10cm apart)	30.84	35.08	35.94	12.84	12.88	12.86
Secondary branch girdling (SBG)	48.65	47.15	48.03	13.53	13.68	13.62
SBG+thinning (5cm apart)	49.25	47.61	48.72	13.87	13.94	13.91
SBG+thinning (10cm apart)	52.59	50.74	51.82	14.44	14.44	14.44
LSD at 5% level	2.61	6.00	4.84	1.55	1.55	1.55

In the three seasons, SBG treatment alone or in combination with fruit thinning 5 and 10 cm apart treatments produced the thickness flesh with some over lapping significance. While the control treatment was significantly the thinnest in fruit flesh and not significantly different from other treatments. However, fruit thinning at 5 and 10 cm apart treatments were not significantly different than the control (Table 6).

The results are in harmony with most of the previous studies concerning the effect of girdling and fruit thinning on fruit weight, firmness and ripening (Andrews *et al.,* 1978, Agusti *et al.,* 1998; El-Shaikh *et al.,* 1999; Eliwa, 2003; Said *et al.,* 2003; Gabr and Fatma Ibrahim 2005, Harima *et al.,* 2006 and Matsumota *et al.,* 20047). They indicated that girdling and fruit thinning resulted in larger fruits, reducing fruit firmness and advanced fruit ripening.

Fruit TSS content was significantly the highest in the SBG with fruit thinning at 10 cm apart treatment in the three seasons, followed by SBG with fruit thinning at 5 cm apart treatment and SBG alone treatment while fruits of the control treatment was significantly the lowest and not significantly different from other treatments in fruit TSS content. Fruit thinning at 5 and 10 cm apart treatments were

intermediate and not significantly different from the control in fruit TSS content (Table 6).

Fruit titratable acidity% was almost in a reverse trend to that of fruit TSS content in the three seasons (Table 7) where the control treatment resulted in the highest percentage followed by fruit thinning at 5 cm apart treatment while fruits of other treatments especially SBG with fruit thinning at 10 cm apart treatment were the least in fruit acidity due to earlier ripening without significant differences between them (Table 7).

Fruit total sugars % was almost in a same trend to that of fruit TSS content (Table 6) where fruit total sugars was significantly the highest in fruit thinning at 10 cm and SBG with fruit thinning at 10cm. While fruit of the control treatment was significantly the lowest. However SBG with fruit thinning at 5cm and fruit thinning at l0 and 5 cm apart treatments were not significantly different from the control (Table 7).

Table (6): Effect of some girdling and fruit thinning treatments on flesh thickness (cm) and total soluble solids content (TSS) % of "Canino" apricot trees during 2006, 2007 and 2008 seasons.

Treatments	Flesh thickness (cm)			(TSS) %		
	2006	2007	2008	2006	2007	2008
Control	1.067	1.137	1.097	13.67	13.87	13.80
Fruit thinning (5cm apart)	1.100	1.210	1.150	14.17	14.37	14.30
Fruit thinning (10cm apart)	1.200	1.310	1.250	14.87	14.97	14.97
Secondary branch girdling (SBG)	1.543	1.527	1.537	15.27	15.37	15.37
SBG+thinning (5cm apart)	1.583	1.567	1.547	15.47	15.57	15.57
SBG+thinning (10cm apart)	1.657	1.627	1.647	15.87	15.97	15.97
LSD at 5% level	0.27	0.39	0.31	1.59	1.59	1.62

Table (7): Effect of some girdling and fruit thinning treatments on titratable acidity % and total sugars % of "Canino" apricot trees during 2006, 2007 and 2008 seasons.

Treatments	Titratable acidity %			Total sugars %		
	2006	2007	2008	2006	2007	2008
Control	0.503	0.497	0.507	10.27	10.37	10.37
Fruit thinning (5cm apart)	0.453	0.447	0.457	10.67	10.77	10.77
Fruit thinning (10cm apart)	0.397	0.387	0.387	11.27	11.37	11.37
Secondary branch girdling (SBG)	0.347	0.343	0.343	11.57	11.67	11.67
SBG+thinning (5cm apart)	0.317	0.317	0.317	11.77	11.87	11.87
SBG+thinning (10cm apart)	0.297	0.293	0.293	12.07	12.17	12.17
LSD at 5% level	0.15	0.11	0.15	N.S.	1.55	1.45

These results are in line with previous studies which reported that girdling and fruit thinning in combination had a positive effect on fruit quality (Andrews *et al.,* 1978; Agusti *et al.,* 1998; El-Shaikh *et al.,* 1999; Eliwa, 2003; Said *et al.,* 2003; Gabr and Fatma Ibrahim 2005; Harima *et al.,* 2006 and Matsumoto *et al.,* 2007).

From the aforementioned results one can conclude that secondary branch girdling alone (SBG) significantly increased all of leaf area, shoot total carbohydrates content, fruit number/tree, fruit weight/tree, flesh thickness of fruit and their TSS% as well as reducing the titratible acidity %.

In addition, following SBG with fruit thinning at 10 cm apart considerably increased all of leaf dry weight, specific leaf weight, leaf chlorophyll content, C/N ratio in shoots, fruit firmness and juice total sugars content.

Accordingly , the use of SBG treatment alone or combined with fruit thinning at 10 cm apart are the recommended treatment for improving growth , yield and fruit quality of "Canino" apricot trees.

REFERENCES

Agusti, M.; I. Andreu; M. Juan; V. Almela and L. Zacarias (1998): Effect of ringing branches on fruit size and maturity of peach and nectarine cultivars. J. Hortic. Sci. and Biotech. 73, 537-540.

Andrews, C.P.; W.B. Sherman and R.H. Sharpe (1978): Response of peach and nectarine cultivars to girdling. Proc. Fla. State Hort. Soc. 91:175-177.

Association of Official Agricultural Chemists (1975): Official methods of analysis. A.O.A.C. 12th Ed. Published by A.O.A.C., Washington, D.C., U.S.A.

Beruter, J. and M.E.S. Feusi (1997): The effect of girdling on carbohydrate partitioning in the growing apple fruit J. of plant physiology, 151:277-285.

Chalmer, D.J.; P.O. Mitchell and L. Van Heck (1981): Control of peach tree growth and productivity by regulated water supply, tree density and summer pruning. J. Amer. Soc. Hort. Sci. (100): 307-312.

Cutting J.G.M. and M.C. Lune (1993): Girdling and the reduction in shoot xylem sap concentration of cytokinins and gibberllins in peach. J. Hort. Sci. 68:619-626.

Dann, I.R.; R.A. Wildes and D.J. Chalmers (1984): Effect of limb girdling on growth and development of competing fruit and vegetative tissues of peach trees. Aust. J. plant Phys. 11(1-2):49-58.

Di Vaio, C.; A. Petito and M. Buccheri (2001): Effect of girdling on gas exchanges and leaf mineral content in the "Independence" nectarine. J. Plant Nutr. 24(7):1047-1060.

Dubois, M; K.A. Gilles, J.K. Hamiton, P.A.Robers and F. Smith (1956): Colorimetric method for determination of sugars and related substances. Analytical Chemistry. 28(3):350-356

El-Beacy, A.B. (2001): Effect of thinning and girdling on yield and fruit qualities of peach. M. Sc. Thesis Faculty of Agriculture, Mansoura Univ., Egypt. 56p.

Eliwa, G.I. (2003): Effect of girdling and fruit thinning on maturity yield and fruit quality of Mit Ghamer peach trees. Egypt. J. Hort. 30, 3-4, 281-290.

El-Shaikh, A.A.; B.M. Khalil and A.Y. Hamza (1999): The effect of girdling and some growth regulators on fruit drop of persimmon. Egypt. J. Agric. Res. 77(4): 1707-1724.

Fernandez-Escobar R.; R. Martin; P. Lopez-Rivares and M. Pazsuarez (1987): Girdling as a means of increasing fruit size and earliness in peach and nectarine cultivars. J. Hort. Sci. 62(4):463-468.

Ferree, D.C. and C.G. Forshey (1988): Influence of pruning and urea sprays on growth and fruiting of spur-bound "Delicious" apple trees. J. Amer. Soc. Hort. Sci. 113(5):699-703.

Freed, R.S.P.; S.P. Eisensmith; S. Goetez; D. Reicosky; V.W. Smail and P. Wolberg (1989): User's guide to MSTAT-C A software program for the design, management and analysis of agronomic research experiments Michigan state Univ. U.S.A.

Gabr, M.A. and Fatma A. Ibrahim (2005): Effect of summer pruning, ringing or girdling on growth yield of trees, quality and storage ability of peach fruits. A. vegetative growth, leaf constituents, yield and fruit quality. Proceeding of the 6th Arab. Conf. of Hort. Ismailia, Egypt. 246-255.

Harima, S.; R. Nakano; A. Inaba and Y. Kubo (2006): Effect of trunk girdling and Mulching with reflective plastic film on postharvest fruit softening of "Tonewase" Japanese persimmon. Hort. Res. (Japan) 5(2):185-191.

Ilha, L.L.H.; G.A.B. Marodin; E. Seibert and C.I.N. Barradas (1999): Effect of thinning and trunk girdling on growth, production and quality of Japanese plums. Pesquisa Agropecuaria Brasileira. 12:2211-2217.

Magness, J.R. and C.F. Taylor (1925): An improved type of pressure tester for the determination of fruit maturity U.S. Dept. Agric. Circ., 350-8.

Matsumoto, T.; H. Itamura; T. Kurahashi; S. Maki and S. Matsumoto (2007): Effects of girdling, defoliation and Flooding treatments on fruit softening before and after harvest in "Saijo" persimmon (*Diospyros kaki* Thunb.). Hort. Res. (Japan) 6(1):119-123.

Peach, K. and I.M.V. Tracey (1968): Modern methods of plant analysis. (11):37-38.

Rami, M. (1982): Formula for determination of chlorophyllous pigments extracted with N, N-dimethyl formamide. Plant Physiol. (69):1376-1381.

Rami, M. and D. Porath (1980): Chlorophyll determination in intact tissues using N, N. Dimethyl formamide. Plant Physiol. (65):478-479.

Said, I.A.; M. Fawzia Eissa and EmanA. Kandil (2003): Effect of winter pruning, hand thinning and girdling on "Canino" apricot growth, yield and quality. Minia, Egypt., J. of Agric. Res. and Develop. 23(2): 301-328.

Satoh, M.; P.E. Kriednann and B.P. Loveys (1977): Changes in photosynthetic activity and related processes following decapitation in mulberry trees. Physiologia Plantrum, (41):303-10.

Snedecor, G.W. and W.G. Cochran (1972): Statistical methods 6th Ed. The Iowa state Univ. press Ames, Iowa, U.S.A.

Westwood, M. N. (1993): Temperature-zone pomology. Physiology and culture. (3rd ed). Timber press, Portland, Orgon. 488.

استجابة اشجار المشمش كانينو للتحليق و خف الثمار

علاء الدين ثابت ابو العز[*]، رافت احمد على مصطفي[**]
[*]كلية الزراعه – جامعة سوهاج،[**]كلية الزراعه – جامعة اسيوط

اجريت هذه الدراسه خلال ثلاث مواسم متعاقبه 2006 و 2007 و 2008 علي تاثير التحليق و الخف اليدوى للثمار منفردا او التحليق مع الخف اليدوى على النمو والحاله الغذائيه والمحصول وجودة الثمار لصنف المشمش الكانينو النامى فى منطقة الكوثر بسوهاج وقد اشارت النتئج المتحصل عليها ان التحليق و الخف احدث زياده معنويه فى المساحه الورقيه والوزن الجاف لها والكثافه النوعيه للورقه ومحتوى الاوراق من الكلوروفيل الكلى ومحتوى الفروع من الكربوهيدرات ونسبة الكربون الى النتروجين بها ومحصول الثمار ونضج وجودة الثمار مقارنة بالكنترول . التحليق منفردا او التحليق مع خف الثمار كان تاثيره كان متفوقا فى تلك الصفات فى مواسم الدراسه الثلاثه. تبكير وقت النضج الثمار بحوالى 3-4 ايام بالتحليق منفردا او بالتحليق مع خف الثمار مقارنة بالكنترول وخف الثمار وكانت اعلى نسبة محصول تم الحصول عليها من التحليق منفرد او التحليق مع خف الثمار. التحليق منفردا كان متفوقآ فى تاثيره على هذه الصفه. ايضا التحليق منفردا او التحليق مع خف الثمار حسن جودة (الوزن والصلابه ونسبة المواد الصلبه الذائبه و السكريات الكليه) . معاملات التحليق مع خف الثمار كانت متفوقه فى تاثيرها على تلك الخواص ومن ناحيه اخرى فان اكبر مساحه ورقيه تم الحصول عليها من التحليق منفردا او التحليق مع خف الثمار. التحليق منفردا كان متفوق في تاثيره علي هذه الصفه . التحليق منفرد او التحليق مع خف الثمار حسن الوزن الجاف للورقه والكثافه النوعيه لها. معاملة التحليق مع الخف الثمار علي مسافة 10 سم كانت متفوقه في تاثيرها على هذه الصفات. التحليق منفردا او التحليق مع خف الثمار حسن محتوي الاوراق من الكلورفيل الكلي ولم يكن هناك اختلاف معنوى بينهم.

من تلك النتائج يتضح ان تحليق الافرع الثانويه منفردا يمكن التوصيه بانه احسن معامله بين المعاملات المختبره لتحسين المحصول وجودة ثمار المشمش الكانينو.