

Effect of Girdling and Fruit Thinning on Maturity, Yield and Fruit Quality of "Mit Ghamer" Peach Cultivar

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EFFECTS of girdling and hand thinning of fruits treatments, alone or in combination, on maturity, yield and fruit quality, beside leaf characters of "Mit Ghamer" peach trees (*Prunus persica*, L.) were investigated during 2001 and 2002 seasons. The results indicated that fruit maturity was advanced about 6-7 days by girdling process combined with hand thinning of fruits compared to control (without additional action of girdling nor thinning), while, either girdling or hand thinning alone advanced fruit maturity about 2-3 days compared to control. The highest yield % in the first picking and large fruits (> 90 g) were obtained from thinned plus girdled treatment (70.50, 66.30 and 85, 87 % in the two seasons, respectively). Also, girdling and hand thinning of fruits each alone or in combination improved fruit quality (fruit weight, colour, firmness and total soluble solids). Girdling combined with hand thinning treatment was the superior in its effect on these properties. Furthermore, leaf area, dry weight, total carbohydrates and NPK contents in leaves were increased in both seasons of study.

Peach is one of the most important deciduous fruit trees grown in Egypt especially in Dakahlia Governorate, which occupied about 1008 feddans produced about 10071.9 ton, according to the last statistics of Ministry of Agriculture (2003). The principal commercial peach cultivar grown in Dakahlia Governorate is Mit Ghamer. Trees of this cultivar were resulted from sexual seedlings. So, the trees varied greatly in maturity date, yield and fruit quality within the same orchard.

Improving fruit quality and early maturity for this cultivar are considered the main task for exportation or even for the local market demands. However, there is a relationship between early maturing fruits and their small size (Powell and Howell, 1985). Removing excess fruits to improve fruit size and quality is an important practice in commercial peach orchards. Fruit size was positively related to leaf area per fruit on branches (Palmer *et al.*, 1991) and negative related to fruit per tree (Johnson & Handley, 1989). Final fruit size was negatively related to the physiological age of the fruit at the time of thinning

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(Claypool *et al.*, 1972; Khalil & Stino, 1987; Shaltout *et al.*, 1987 and Nakano & Nakamura, 2002).

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. The previous investigations on fruit trees clarified that although total fruit number and weight per tree are typically reduced by fruit thinning, high returns for large fruit usually improve orchards profitability (Southwick *et al.*, 1995 & Muthoo *et al.*, 1997).

Girdling has been used as a usual cultural practice to reduce vegetative growth, promote flowering, improve fruit set, increase yield and improve fruit quality because it increases the accumulation of carbohydrates in the parts above wounds (Beruter & Feusi, 1997) and enhanced colouring (Agusti *et al.*, 1998). Powell & Howell (1985) found that girdling advanced harvest (3-10 days), increased fruit size (10-25 %) and yield (10-15 Lb/tree). The time of girdling has an effect on fruit size and ripening of peaches and nectarines (Agenbag, 1990; El-Sherbini, 1992; Allan *et al.*, 1993 and Bilgener *et al.*, 1998). Moreover, girdling may enhance ethylene production (Autio & Greene, 1994) and results in a promotion of ripening (Hyodo, 1991).

The aim of this study was to investigate the effect of hand thinning and girdling each alone or in combination on maturity, yield and fruit quality. Also, their effects on leaf area, dry matter accumulation and total carbohydrates as well as N, P, K content in the leaves of peach trees cv. "Mit Ghamer".

Material and Methods

This investigation was carried out during two consecutive seasons (2001 and 2002) on "Mit Ghamer" peach trees (*Prunus persica* (L.) Batsch), grown in a private orchard, Aga city, Dakahlia Governorate, Egypt. Trees were about 15-year-old, seedlings, spaced at 5 x 5 meters apart, grown in loamy soil subjected to flood irrigation, trained to an open-vase system and received the ordinary practices used in this region as recommended by Ministry of Agriculture.

Twelve trees were chosen as uniform as possible, divided into three replicates and each replicate was represented by 4 trees. Each tree has four scaffold branches, similar in diameter and each scaffold branch received one of the following treatments:

- a) Fruits were hand thinned.
- b) Girdled near the base of the branches.
- c) Fruits were hand thinned and girdled.
- d) left as control (unthinned nor girdled).

Fruits were hand thinned after the natural drop occurred (in the first week of April during the two seasons of study), leaving about 12-15 cm between adjacent fruits.

Girdling (removed a strip of bark tissue) was performed with a double - bladed knife 3/16 inch at the beginning of pit - hardening stage (in the third week of April, Mansoure & Shaltout, 1986) during the two seasons of study.

Twenty fruits per branch were randomly selected and tagged for fruit growth determinations by measuring their diameter at two weeks interval till maturity. Fruits were harvested in different pickings and the percentage of yield harvested in first picking was obtained as measure of precocity. Fruit large percentage (90 g) was calculated for each picking. Twenty five fruits were taken from each replicate to estimate fruit weight (g), volume (ml), dimensions (cm), flesh thickness (cm), flesh firmness (L/inch²), skin colour (%) as visually, total soluble solids (%) and titratable acidity (as malic acid %) in fruit juice.

During mid-August of the two seasons, leaf samples were collected from the middle portion of the current season growth to determine leaf area (cm²) by using a leaf area meter (model C/203 Area Meter, CID, Inc. USA), and the leaf samples were oven-dried at 80 (C to a constant weight and dry weight percentages were calculated. Total carbohydrates were determined using the technique of carbohydrate analysis that was proposed by Dubois *et al.* (1956); nitrogen (%) was determined according to the method of Pregl (1945); phosphorus (%) according to Jackson (1958) and potassium according to Brown & Lilleland (1949).

A randomized complete block design was used. Data obtained were statistically analyzed according to methods described by Snedecor & Cochran (1980) and LSD test was used for comparing between treatments.

Results and Discussion

Fruit growth and maturity

Figure 1 clearly showed that branches which were thinned or/and girdled significantly increased fruit diameter earlier than the control. This means that fruit growth on branches under such treatments was faster and matured earlier compared with those of branches non thinned nor girdled. Thinning plus girdling treatment was the superior one in that respect. This could be due to the effect of this treatment on shortening the second stage of fruit growth, as cleared from the diagram (Fig. 1). Fruits on branches which received this treatment matured earlier by 6 and 7 days, whereas fruits on thinned or girdled branches only matured earlier by 2 and 3 days than control fruits in the two seasons, respectively (Table 1).

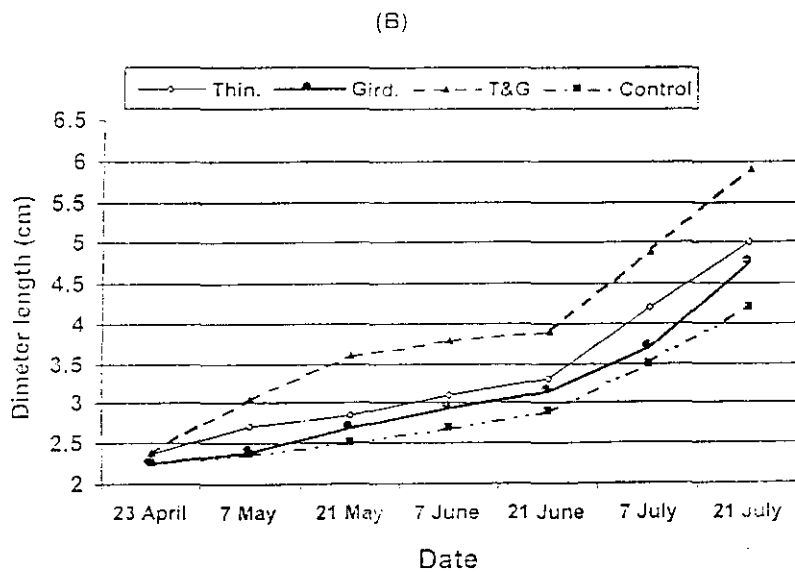
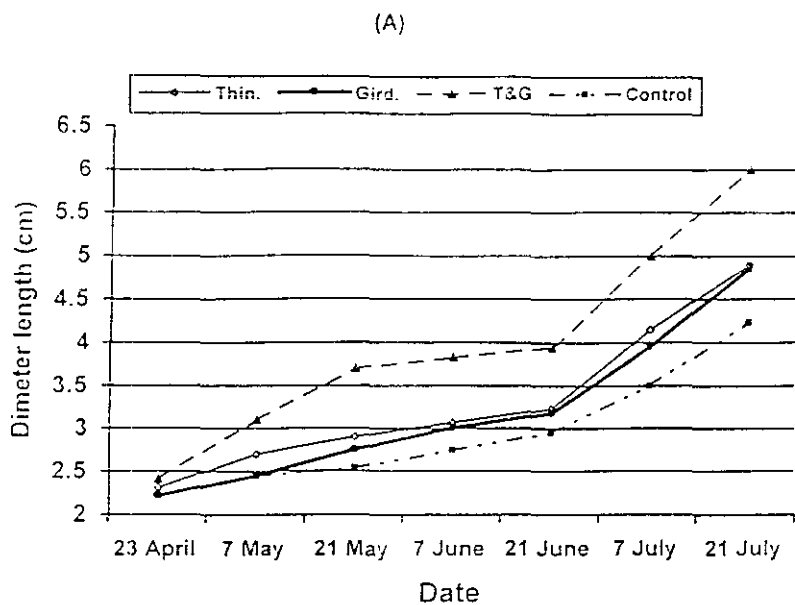


Fig. 1. Effect of girdling and hand thinning on fruit growth of peach (as increase of diameter length, cm) during 2001 (A) and 2002 (B) seasons.

TABLE 1. Effect of girdling and hand thinning on maturity, yield % in first picking and large fruits % of Mit Ghamer peach trees.

Treatments	First picking before control (days)		Yield % in first picking		Large fruits % > 90 g	
	2001	2002	2001	2002	2001	2002
Thinning	2	3	40.30	37.00	60.17	58.20
Girdling	2	3	42.21	40.15	56.30	53.15
Thinning + girdling	6	7	70.50	66.30	85.00	87.00
Control	--	--	10.70	8.43	27.10	24.25
L.S.D. at 1%	---	---	9.87	7.44	8.31	5.57
5%			14.94	11.26	12.59	8.44

As for the effect of these treatments on fruit yield % in the first picking and large fruits % (> 90 g), results in Table 1 revealed that the highest yield % in the first picking and large fruits % (> 90 g) were recorded with branches thinned plus girdled treatment (70.50, 66.30 and 85, 87 % in the two season, respectively (Table 1). These results are in agreement with previous findings on peaches reported by Fernandez-Esobar *et al.* (1987), De Villiers *et al.* (1990), El-Sherbini (1992) and Agusti *et al.* (1998). They mentioned that fruits from girdled branches were larger and matured earlier.

Fruit quality characters

For external fruit characters, it was clear from Table 2 and Fig. 2 that branches which thinned or/and girdled significantly increased average fruit weight, volume, diameter, firmness and skin colour% comparing with the control fruits in both seasons of study. On the other hand, fruits from branches thinned only were not significantly increased in their length compared with the control fruits. This finding is in agreement with that reported by Khalil & Stino (1987) who mentioned that fruit length of sun-red nectarine was not markedly affected by thinning treatments. Moreover, the highest values for these characters were obtained from branches which thinned plus girdled. The positive effect of thinning and girdling in improving fruit quality may be explained due to Palmer *et al.* (1991) found that mean fruit weight per tree at harvest time was learning dependent on leaf area per fruit. Since, reducing the number of fruits per tree by thinning increases the leaf/fruit ratio and light interception per fruit. Also, the positive effect of girdling has been related to changes in translocation and accumulation of carbohydrates (Wallerstein *et al.*, 1974), with changes in hormones concentration, both gibberellins (Wallerstein *et al.*, 1973 and Cutting & Lyne, 1993), IAA (Dann *et al.*, 1985) and Cytokinines (Cutting & Lyne, 1993). All these effects may lead to modified source-skin relationships and partitioning of the dry weight between different plant organs (Schechter & Proctor, 1994).

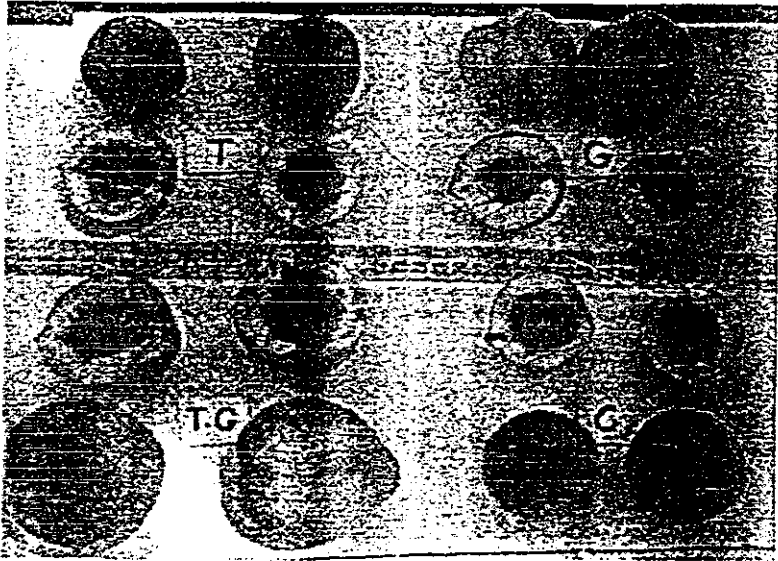


Fig. 2. Effect of girdling and thinning on external fruit characters of Mit Ghamer peach fruits (T= thinning, G= girdling, T.G= thinning + girdling and C= control).

TABLE 2. Effect of girdling and hand thinning on external fruit quality characters of Mit Ghamer peach during two seasons.

Characters	Fruit weight (g)		Fruit volume (cm ³)		Fruit diameter (cm)		Fruit length (cm)		Firmness (Linch [*])		Skin colour %	
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Thinning	115.0	110.3	91.25	90.10	5.29	5.19	5.58	5.50	14.60	13.20	48	43
Girdling	103.3	95.1	87.67	84.40	5.20	5.10	5.28	5.20	14.60	14.40	35	37
T&G*	155.0	155.7	131.0	127.3	6.13	5.95	6.21	6.00	15.27	15.20	59	55
Control	78.6	75.3	69.23	70.50	4.90	4.85	4.99	4.90	11.01	10.70	25	22
L.S.D.at 1%	11.9	8.0	3.46	3.03	0.38	0.26	0.32	0.34	0.49	0.38	4.8	5.2
5%	18.0	12.1	5.24	4.59	0.57	0.40	0.43	—	0.75	0.53	7.0	8.0

*T&G= Thinning + girdling

As for internal fruit quality characters, fruit thinning and/or girdling treatments significantly affected fruit flesh thickness, TSS % and acidity % in both seasons of study (Table 3). In other words, these treatments highly significantly increased average fruit flesh thickness and TSS %, but decreased the average acidity % compared with the control ones in both seasons of study. Moreover, hand thinned plus girdled branches treatment was more effect in these respects. The above results are in line with those reported by El-Sherbini (1992); Allan *et al.* (1993) and Agusti *et al.* (1998) for the positive effect of girdling on peach fruit characters, Hassanin (1997); Bilgener *et al.* (1998) and Fathi *et al.* (2002) for hand thinning on peach fruit characters and El-Peacy

(2001); Nakano & Nakamura (2002) and Valentini & Arroyo (2002) for hand thinning plus girdling on peach fruit characters.

TABLE 3. Effect of girdling and hand thinning on internal fruit quality characters of peach during two seasons.

Characters	Flesh thickness (cm)		TSS %		Acidity %	
	2001	2002	2001	2002	2001	2002
Treatments						
Thinning	2.00	2.00	11.33	11.47	0.94	0.36
Girdling	1.95	1.97	10.73	10.00	0.77	0.32
T&G*	2.4	2.27	11.95	11.50	0.84	0.34
Control	1.68	1.65	8.40	9.40	1.11	1.20
L.S.D. at 1%	0.09	0.16	0.11	0.14	0.11	0.11
5%	0.13	0.25	0.17	0.22	0.17	0.17

*T&G= Thinning + girdling

Leaf characteristics

Concerning the effect of hand thinning and/or girdling on average leaf area (cm^2), dry weight % and total carbohydrate %, data in Table 4 indicated that leaves collected from branches thinned and/or girdled gave highly significant increase in their leaf area, dry weight % and total carbohydrate % than the control ones. The highest values for these properties recorded with branches thinned plus girdled. Also, the same trend was found with NPK status in the leaves. These findings agreed with Schechter & Proctor (1994) and Beruter & Feusi (1997). The above results could be explain the positive effect of thinning and girdling treatments in improving fruit quality (Tables 2 and 3).

TABLE 4. Effect of girdling and hand thinning on Mit Ghamer peach leaf characters during two seasons.

Characters	Leaf area (cm^2)		Dry weight (%)		Total carbohydrate (%)		N %		P %		K %	
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Treatments												
Thinning	33.16	31.20	44.54	44.50	19.50	19.10	2.32	2.35	0.223	0.249	2.30	2.25
Girdling	36.12	35.46	45.75	45.80	20.40	20.50	2.35	3.55	0.249	0.255	2.22	2.31
T&G*	42.21	41.20	48.43	46.92	21.90	21.07	3.30	3.30	0.250	0.270	2.53	2.55
Control	28.04	25.25	41.43	41.13	17.20	17.63	2.19	2.15	0.210	0.215	1.39	1.90
L.S.D. at 1%	4.41	2.23	2.25	2.54	1.29	1.12	0.29	0.50	0.015	0.025	0.17	0.31
5%	7.13	3.45	3.41	3.84	1.95	1.69	0.44	0.75	0.024	0.033	0.25	0.43

*T&G= Thinning + girdling

Finally, it can be concluded from this study that fruit hand thinning (12-15 cm space) after natural drop occurred and girdling at the beginning of pit-hardening stage greatly enhanced "Mit Ghamer" peach fruit quality and advanced fruit maturity (6-7 days) resulting in an increase in growers returns, since their fruits can arrive earlier to more demanding markets.

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(Received 29 / 12 / 2003)

تأثير التحليق وخف الثمار على النضج والمحصول وصفات الجودة لثمار خوخ صنف ميت عمر

جلال اسماعيل عليه

معهد بحوث البساتين - مركز البحوث الزراعية - القاهرة - مصر.

أجريت هذه الدراسة على أشجار بالغة لصنف خوخ ميت عمر في مزرعة خاصة بمركز أجا - دقهلية خلال موسمي ٢٠٠١، ٢٠٠٢ لدراسة تأثير التحليق والخف اليدوي للثمار كلا على حدة أو معا على ميعاد النضج وصفات المحصول وجودة الثمار وكذلك المساحة الورقية ومحتوى الأوراق من المادة الجافة، الكربوهيدرات الكلية، النيتروجين، الفوسفور، البوتاسيوم.

وقد أوضحت النتائج أن معاملة خف الثمار والتحليق أدت إلى تكبير النضج بحوالي ٦-٧ أيام عن الكنترول بالإضافة إلى زيادة المحصول في الجمعة الأولى (٧٠,٥% - ٦٦,٣% من المحصول الكلي للشجرة) وزيادة نسبة الثمار كبيرة الحجم (٨٥ - ٨٧% أكبر من ٩٠ جم).

كذلك أظهرت النتائج أن معاملات التحليق والخف سواء منفردة أو معا أدت إلى تحسين صفات الجودة للثمار (وزن، لون القشرة، الصلابة والمواد الصلبة الذاتية الكلية) حيث أن التحليق والخف معا كان أكثر تفوقاً في هذه الصفات. كذلك أدى التحليق والخف معا إلى زيادة المساحة الورقية، نسبة المادة الجافة، الكربوهيدرات الكلية، النيتروجين، الفوسفور والبوتاسيوم للأوراق مما أدى إلى تحسين الحالة الغذائية للشجرة وانعكس ذلك على تكبير المحصول وتحسين صفات الجودة لثمار خوخ صنف ميت عمر.