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EFFECT OF SOME PRUNING TREATMENTS ON GROWTH AND YIELD OF SOME GRAPE CULTIVARS: [B] - BUD LOAD AND SPUR THICKNESS OF FLAME SEEDLESS GRAPEVINES

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ABSTRACT

In 2003 and 2004 seasons, mature vines of Flame seedless grapevines were pruned at the dormant season to leave 39, 54, 69 and 84 buds per vine with <1.0, 1 : <1.5, or 1.5 : 2 cm thickness fruiting spurs. Raising the bud load per vine was achieved by increasing number of the fruiting spurs. In this respect, increasing vine load from 39 to 84 buds was accompanied with improving fruiting buds %, yield/vine, number of clusters per vine, total acidity %, total carbohydrates, C/N ratio and reducing the shoot length, shoot base diameter, leaf ar~a, pruning weight, cluster weight, berry size and weight, total soluble solids%, total anthocyanin and total N %. All the studied parameters except total acidity were tended to increase with raising the thickness of fruiting spurs. A slight influence on the investigated characters was recorded between using 1 : <1.5 and 1.5:2 cm thickness fruiting spurs.

The highest yield with fairly good quality of Flame grapevines was obtained with a charge of 69 buds per vine with 1 : <1.5 cm thickness fruiting spurs.

INTRODUCTION

One of the most important agricultural practices facing grape production in Egypt and other parts of the world is the pruning. Adjusting the magnitude of severity of winter pruning had a beneficial effect on the limiting factors that greatly governed the yield, quantity and quality of the treated variety. Vine bud load and fruiting spur thickness are two factors responsible for detecting the yield of various grapevine CVS in the following seasons. Using the optimum number of buds per vine as well as adjusting the proper thickness of the selected spurs was favorable for improving yield quantitatively and qualitatively. (Higazi 1985, Wample 1994, Possingham 1994, Pavlov 1995, Zhou and Zhou 1996, Brancadoro *et al.*, 1997, Bakhshi *et al.*, 1998, Sayed 1998, Vilozny *et al.*, 1999, Gobara 1999, Graviano, 1999, Liuni, *et al.*, 1999, Intrieri *et al.*, 1999, Palma *et al.*, 2000, Rives 2000, Garic, 2001, Moretti *et al.*, 2002, Dami *et al.*,, 2003, Terry and Rick, 2003 and Dawn *et al.*, 2004).

The present study was carried out in order to determine the optimum number of buds per vine, as well as, the optimum thickness of fruiting spurs, which may result in a high yield with good quality of Flame seedless grapevines.

MATERIALS AND METHODS

The present experiment was carried out during two successive seasons (2003 and 2004) in a private vineyard at Belkas district, Dakahlia governorate on Flame Seedless grapevines. The vines were twelve year-old, grown in a loam soil under drip irrigation system, spaced 1.5x2.5 meters, trained to bilateral cordon with spur pruning, each had three buds, and trellised with telephone shape system.

Vines were nearly uniform in vigour subjected to the same horticultural practices and pruned during the first week of January in both seasons.

Twelve treatments were conducted. Each treatment represent interaction between vine load x spur thickness. Four vine loads were used, i.e., 39, 54, 69 or 84 buds / vine. Spur length was constant in all treatments (3 buds / spur), while number of spur / vine was varied. Spur thickness used were: (<1.0, 1.0:<1.5 and 1.5:2 cm). These treatments were arranged in a complete randomized block design with 3 replicates in each treatment and 3 vines / replicate.

The measurements:

1-Fruiting buds % :

Fruiting buds % were calculated as follows:-

$$\text{Fruiting buds \%} = \frac{\text{No. of fruiting buds/vine}}{\text{No. of bursted buds/vine}} \times 100$$

2- Vegetative growth :

At growth season's end, the ultimate shoot length (cm), shoot base diameter (cm), leaf area (cm^2) of the apical 5^{th} and 6^{th} leaves using an areameter, and weight of pruning woods/vine (Kg) at the winter pruning were recorded.

3- Yield / vine and yield structure:

Number of clusters/vine and average yield/vine(Kg) were determined at harvest time of the two studied seasons. Yield was harvested, when TSS% of berry juice reached 19-20% in the treatment of the highest bud load + the greatest spur thickness according to Tourky *et al.*, (1995).

Representative random samples of 12 clusters / treatment (4 clusters from each replicate) were collected at the harvesting time, and brought to the laboratory for determining average cluster weight (g), No. of berries/cluster and fruit characteristics (physically and chemically).

4- Physical and chemical characteristics of berries (fruit quality) :

Weight of 100 berries (gm), vol. of 100 berries (cm^3), Total soluble solids (TSS%) in berry juice using a hand refractometer, Total titratable acidity (as tartaric acid%) (A.O.A.C, 1985), TSS/acid ratio and total anthocyanin of the berry skin (g/100g fresh weight) according to Husia *et al.*, (1965).

5- Cane content of total carbohydrates and nitrogen :

Three canes/vine were collected at winter pruning for determining total carbohydrates (g/100g dry weight) using the phenol sulphoric acid method as described by Smith *et al.*, (1956). Two internodes (6,7 ones) per each cane were used for determining total nitrogen content, which was determined using the modified micro Kjeldahl method as described by Pregl (1945).

6- Statically analysis :

The statistical analysis of the present data was carried out according to the methods described by Snedecor and Cochran (1980). Treatment means were compared statistically using Duncan's multiple range test at 5% level of probability.

RESULTS AND DISCUSSION

1- Fruiting buds %

Data in Table (1) clearly showed that percentage of fruiting buds/vine was varied significantly according to vine load and fruiting spurs thickness. There was a gradual stimulation in percentage of fruiting buds/vine with increasing vine load from 39 to 84 buds per vine as well as spur thickness from <1.0 cm to 2 cm. Leaving 84 buds per vine loaded on spurs with 1.5 : 2 cm thickness gave the highest percentage of fruiting buds/vine (48.3 and 50.6 % in both seasons 2003 and 2004, respectively), while the lowest percentage of fruiting buds/vine were detected in vines, which had 39 buds/ vine and <1.0 cm spur thickness in the two studied seasons.

It could be concluded that the bud fertility increased propotionally with increasing vine load and spur thickness.

The present results are in conformity with the findings of other researchers [Sayed 1998; Rives 2000; Garic, 2001, Moretti *et al.*, 2002; Dami *et al.*, 2003; Terry and Rick, 2003 and Dawn *et al.*, 2004] who found that increasing vine load increased percentage of fruiting buds/vine.

2- Vegetative growth:-

data in Table (1) obviously revealed that the shoot length, shoot base diameter, leaf area and prunings weight as growth parameters were affected considerably by vine load and spur thickness levels. The growth parameters were increased with either reducing vine load and/or increasing spur thickness. The stimulation of the four growth parameters were clearly observed due to raising spur thickness from 1 : <1.5 to 1.5 : 2 cm. The minimum values of the four growth parameters were detected also due to carrying out pruning and leaving 84 buds on <1.0 cm thickness fruiting spurs. Pruning the vines to leave 39 buds / vine with 1.5 : 2 cm thickness fruiting spurs gave the highest shoot length, shoot base diameter, leaf area and weight of pruning. These results were true in 2003 and 2004 seasons.

The reduction of shoot length, shoot base diameter, leaf area and pruning weight in response to high bud load per vine might be attributed to the great depletion and exhaustion of organic matter, water and mineral elements in growth and development of great number of growing shoots.

The present results are in agreement with those obtained by others (Higazi 1985; Possingham 1994; Pavlov 1995; Gobara 1999; Moretti *et al.*, 2002 and Dami *et al.*, 2003), who found that increasing vine load decreased shoot length, leaf area and prunings weight.

3- Yield/vine and yield structure:

It was evident from the obtained data in Table (2) that varying vine load as well as spur thickness was accompanied with a pronounced effect on yield structure expressed in yield/vine and number of clusters per vine. Increasing number of buds per vine and spur thickness was followed by a gradual promotion of yield as well as weight and number of clusters per vine.

Table (1) : Effect of bud load and fruiting spur thickness on *fruiting buds% and vegetative* growth of Flame Seedless grapevines in seasons 2003 and 2004

Treatments		Fruiting buds (%)		Shoot length (cm)		Shoot diameter (cm)		Leaf area (cm^2)		Weight of wood pruning/vine (Kg)	
Bud load	Spur thickness	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
39	<1 0 cm	40.0 f	38.6 f	151.5 bc	149.7 bc	1.23 e	1.26 e	132.30 cd	143.30 bc	1.60 ab	1.61 ab
	1.0:<1.5 cm	41.0 ef	41.0 e	162.5 a	158.2 a	1.39 bc	1.49 bc	136.70 ab	147.30 a	1.82 a	1.63 a
	1.5:2 cm	41.6 e	41.3 e	160.0 a	159.5 a	1.47 a	1.55 a	137.30 a	148.00 a	1.62 a	1.63 a
54	<1 0 cm	44.3 d	44.0 d	148.5 cd	145.7 cd	1.20 ef	1.23 ef	129.30 de	139.30 d	1.55 cde	1.58 bc
	1 0:<1 5 cm	44 6 d	46 3 c	158.5 a	156.0 ab	1.36 cd	1.47 bcd	133.70 bc	144.30 ab	1.57 bcd	1.60 ab
	1.5:2 cm	46.7 c	46.7 c	150 0 bc	153.1 ab	1.41 b	1.51 ab	134.60 abc	145 00 ab	1.58 bc	1.60 ab
69	<1.0 cm	46.7 c	48.1 bc	145 6 de	137.8 ef	1 18 f	1.22 ef	126.30 e	135.30 e	1.52 ef	1.56 cd
	1.0:<1.5 cm	47.6 abc	50.1 ab	152.9 b	142.5 de	1.36 cd	1.46 cd	129.30 de	139.70 cd	1.54 def	1.58 bc
	1.5:2 cm	48 0 ab	50.3 a	154.1 b	141 6 de	1.40 bc	1.48 bcd	130.00 d	140.00 cd	1 54 def	1.59 bc
84	<1.0 cm	47.0 bc	48.1 bc	138.2 f	131.9 f	1.17 f	1.20 f	122.20 f	131.70 e	1 51 f	1.54 d
	1 0:<1.5 cm	48.0 ab	50.3 a	142.7 e	139.3 de	1.32 d	1.44 d	126.00 e	134.60 e	1 52 ef	1.56 cd
	1.5:2 cm	48.3 a	50 6 a	141.3 ef	138.1 ef	1.37 bc	1.44 d	126.30 e	135.00 e	1.53 ef	1.56 cd

Mean having the latter in the same column do not significantly differ using Duncan *multiple range test at 5% level of probability*

Table (2) : Effect of bud load and fruiting spur thickness on yield and yield structure of Flame Seedless grapevines in seasons 2003 and 2004

Treatments		Yield / vine (Kg)		No. of clusters		Cluster Weight (g)		No. of berries/cluster	
Bud load	Spur thickness	2003	2004	2003	2004	2003	2004	2003	2004
39	<1.0 cm	8.61 g	8.94 g	22.00 g	23.00 f	391.30 ab	388.70 cd	151.26 a	156.79 a
	1.0:<1.5 cm	9.41 d	10.53 e	22.30 g	25.00 e	422.00 a	421.00 ab	159.58 a	166.53 a
	1.5:2 cm	9.79 c	11.32 cd	23.00 fg	25.30 e	425.70 a	447.30 a	158.67 a	169.15 a
54	<1.0 cm	8.89 f	9.65 f	24.00 ef	26.70 d	370.30 bc	361.30 de	150.75 a	154.69 a
	1.0:<1.5 cm	9.77 c	11.11 d	25.00 de	28.00 cd	390.90 ab	396.80 bc	150.44 a	163.32 a
	1.5:2 cm	9.80 c	11.31 cd	25.00 de	28.40 bc	392.00 ab	398.30 bc	150.47 a	163.40 a
69	<1.0 cm	8.87 f	9.86 f	26.00 cd	29.60 b	341.00 c	333.00 ef	150.57 a	150.53 a
	1.0:<1.5 cm	9.92 c	11.19 d	27.30 abc	31.00 a	363.30 bc	361.00 de	152.24 a	153.30 a
	1.5:2 cm	10.25 b	11.46 bc	28.00 ab	31.30 a	366.00 bc	366.00 d	151.37 a	154.28 a
84	<1.0 cm	9.11 e	10.36 e	26.90 bc	31.30 a	338.80 c	331.00 f	161.05 a	152.81 a
	1.0:<1.5 cm	10.22 b	11.59 ab	28.30 ab	32.20 a	361.00 bc	360.00 def	164.77 a	155.37 a
	1.5:2 cm	10.43 a	11.69 a	28.50 a	32.30 a	366.00 bc	362.00 de	163.92 a	159.36 a

Mean having the latter in the same column do not significantly differ using Duncan multiple range test at 5% level of probability

The increase in the yield expressed as weight/vine among in response to different vine load levels was insignificant in some cases. Significant promotion of yield and number of clusters per vine were registered, when spur base thickness was <1.0, 1 : <1.5 and 1.5 : 2 cm thickness spurs. The best results in regard to yield/vine were obtained on vines pruned to 84 buds/vine with 1.5 : 2 cm thickness spurs(10.43 kg/vine in 2003 and 11.69 kg/vine in 2004). These results were true in both seasons. The severe pruning (39 buds/vine) and the thinner spurs (<1.0 cm thickness) gave the minimum yield (8.61 kg/vine in 2003 and 8.94 kg/vine in 2004).

The results in Table (2) showed clearly that the increase in fruit yield/vine can be attributed to the increase in number of cluster/vine and not to cluster weight. Oppositely, cluster weight decreased as the yield/vine increased. The great number of growing shoot as a result of high bud load was responsible for the high clusters number and low cluster weight.

These results are in harmony with those obtained by others (Zhou and Zhou 1996; Brancadoro *et al.*, 1997; Sayed 1998; Gobara 1999; Vilozny *et al.*, 1999; Terry and Rick 2003 and Dawn *et al.*, 2004) who found that increasing vine load increased number of clusters and yield.

Thus, it can be seen that high bud load at 84 buds/vine and <1.0 cm thickness spurs resulted in the lowest cluster weight among all treatments (338.8 and 331.0 g in both seasons respectively). These results could be ascribed to the increase in number of clusters per vine.

No significant differences between all treatments were recorded in relation to the number of berries.

These results are in coincidence with those obtained by others [Higazi 1985; Sayed 1998; Vilozny *et al.*, 1999; Gobara 1999; Zhou and Zhou 1996; Braneaddaro *et al.*, 1997; Rives 2000 and Dami *et al.*, 2003] who found that increasing vine load decreased weight of cluster/vine.

4- Physical and Chemical characteristics of berries (fruit quality) :

Data in Table (3) showed that varying vine load and spurs thickness significantly affected berry weight and size, total soluble solids, total acidity% and total anthocyanin. Increasing number of buds/vine led to a slight increase in total acidity % and a reduction in berry weight and size, a slight reduction in total soluble solids% and total anthocyanin. The *vice versa* was obtained as a result of increasing spur thickness. Raising the spur thickness from <1.0 to 1.5:2 was effective in improving quality of the berries expressed as increasing berry weight, total soluble solids% and total anthocyanin and in reducing the total acidity%. Raising spur thickness from 1 : <1.5 to 1.5 : <2 cm had a slight promotion in quality of the berries. The effect of severe pruning and the thick spurs in advancing fruit ripening, which can be seen in increasing the ratios of TSS/acid might be regarded during the operation of winter pruning of Flame seedless grape variety.

These results, in general are in agreement with those obtained by others (Wample 1994; Pavlov 1995; Bakhshi *et al.*, 1998; Sayed 1998; Gobara 1999 and Terry and Rick 2003) who found that increasing vine load decreased quality of the berries expressed as decreasing berry weight, total soluble solids% and total anthocyanin and in increasing the total acidity%.

Table (3) : Effect of bud load and fruiting spur thickness on physical and chemical characteristics of berries of Flame Seedless grapevines in seasons 2003 and 2004

Treatments		Weight of 100 Berries (g)		Volum of 100 Berries (cm^3)		TSS (%)		Acidity (%)		TSS/acid ratio		Total anthocyanin (%)	
Bud load	Spur thickness	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
39	<1.0 cm	250.10 ab	235.60 ab	226.30 ab	211.00 abc	19.50 b	20.20 bcd	0.51 cd	0.56 bc	38.24 bc	36.07 bc	32.90 b	33.40 b
	1.0:<1.8 cm	256.30 a	245.00 a	230.40 ab	221.10 ab	19.80 a	20.60 ab	0.50 d	0.54 c	39.60 b	38.15 ab	34.25 a	34.46 a
	1.5:2 cm	260.10 a	246.70 a	238.30 a	223.90 a	19.90 a	20.80 a	0.45 e	0.54 c	44.22 a	38.52 a	34.45 a	34.61 a
54	<1.0 cm	241.00 bc	227.10 bc	218.10 abc	205.20 bcd	19.30 c	19.80 cde	0.53 abcd	0.57 bc	36.42 cd	34.74 cd	31.50 cd	32.30 d
	1.0:<1.5 cm	251.20 ab	235.00 ab	227.70 ab	210.50 abc	19.50 b	20.20 bcd	0.52 bcd	0.56 bc	37.50 bc	36.07 bc	32.70 b	33.24 b
	1.5:2 cm	253.20 a	235.80 ab	227.30 ab	210.90 abc	19.60 b	20.30 abc	0.52 bcd	0.56 bc	37.89 bc	36.25 abc	33.90 a	34.18 a
69	<1 0 cm	220.50 de	217.90 cd	196.80 cde	192.20 de	19.00 d	19 70 de	0.55 abc	0.60 ab	34.55 de	32.83 de	31.10 cd	31.98 de
	1.0:<1.5 cm	230.10 cd	227.00 bc	208.40 bcd	202.30 cd	19 20 c	20 00 cd	0.53 abcd	0.58 abc	36.23 cd	34.48 cd	31.70 c	32.45 cd
	1.5:2 cm	233.20 c	228.80 bc	206.90 bcd	204.50 bcd	19.30 c	20.70 ab	0.53 abcd	0.58 abc	36.42 cd	35.69 c	32.40 b	33.00 bc
84	<1 0 cm	202.30 f	208.10 d	177.30 e	184.10 e	18.80 e	19.40 e	0.57 a	0.62 a	32.98 e	31.29 e	30.25 e	31.32 e
	1.0:<1.5 cm	211.20 ef	216.90 cd	186.40 de	193 10 de	19.00 d	19.80 cde	0.56 ab	0 60 ab	33.93 e	33.00 de	31 00 d	31.90 de
	1.5:2 cm	212.30 ef	219.00 cd	190.50 de	195.20 cde	19.20 c	19.90 cde	0.56 ab	0 60 ab	34.29 de	33.17 de	31.60 cd	32.38 cd

Mean having the latter in the same column do not significantly differ using Duncan multiple range test at 5% level of probability

We can conclude that, the best results with regard to yield and quality of the berries of Flame grapevines were obtained as a result of pruning the vines leaving 69 buds/vine with 1 : <1.5 cm thickness fruiting spurs.

5-Total contents of Cane carbohydrates and nitrogen in the obtained canes:

It is clear from the data in Table (4) that varying vine load from 39 to 84 buds/vine and spur thickness from <1.0 to 1.5 : 2 cm had an pronounced effect on percentages of total carbohydrates, total N and C/N ratio in the canes of Flame seedless grapevines. Results also reveal that increasing vine load and spur thickness resulted in a gradual promotion of total carbohydrates percentage and C/N ratio and caused a progressive reduction in percentage of N in the canes. Significant differences were observed among these criteria all levels of vine load and spur thickness except between the two higher levels of bud load (69 and 84 buds per vine and 1 : <1.5 and 1.5 : <2 cm for spur thickness). Maximum values of total carbohydrates and C/N ratios and the minimum values of N % were recorded in case of vines bearing 84 buds/vine and had 1.5 : 2 cm thickness spurs. Leaving 39 buds per vine with <1.0 cm thickness spurs resulted in the maximum N % and the minimum total carbohydrates % and C/N ratios. These results were true in both seasons.

Table (4) : **Effect of bud load and fruiting spur thickness on total carbohydrates and nitrogen of canes of Flame Seedless grapevines in seasons 2003 and 2004**

Treatments		Total carbohydrates (%)		Total nitrogen (%)		C/N ratio	
Bud load	Spur thickness	2003	2004	2003	2004	2003	2004
39	<1.0 cm	13.22 g	13.71 f	1.66 a	1.74 a	7.96 e	7.88 f
	1.0:<1.5 cm	14.80 f	14.09 e	1.60 b	1.65 b	9.25 d	8.54 f
	1.5:2 cm	14.92 f	14.15 e	1.59 b	1.63 b	9.38 d	8.68 f
54	<1.0 cm	15.46 e	14.52 d	1.40 c	1.42 c	11.04 c	10.23 e
	1.0:<1.5 cm	16.00 d	14.84 c	1.35 d	1.30 d	11.85 c	11.42 d
	1.5:2 cm	16.05 d	14.85 c	1.33 d	1.29 d	12.07 c	11.51 d
69	<1.0 cm	16.60 c	15.60 b	1.20 e	1.28 d	13.83 b	12.19 cd
	1.0:<1.5 cm	16.95 ab	16.25 a	1.15 f	1.20 e	14.74 ab	13.54 ab
	1.5:2 cm	16.97 a	16.30 a	1.09 g	1.15 fg	15.57 a	14.17 a
84	<1.0 cm	16.66 bc	15.85 b	1.19 e	1.26 d	14.00 b	12.58 bc
	1.0:<1.5 cm	16.97 a	16.16 a	1.14 f	1.19 ef	14.89 ab	13.58 ab
	1.5:2 cm	16.99 a	16.20 a	1.07 g	1.13 g	15.88 a	14.34 a

Mean having the latter in the same column do not significantly differ using Duncan multiple range test at 5% level of probabillity

The promotion in total cane carbohydrates in response to increasing vine load was mainly attributed to the effect of increasing vine size as a result of increasing the number of buds retained on the vine, which stimulated carbohydrates synthesis by photosynthesis. However, the reduction of N might be ascribed to the depletion of N in forming new tissues, and that could result in raising C/N ratio in favor of improving productive capacity of the vine.

Similar results were reported by (Gobara 1999; Moretti *et al.*, 2002; Dami *et al.*, 2003; Terry and Rick 2003 and Dawn *et al.*, 2004) who found that increasing vine load lead to decrease of N% and increase the total carbohydrates % and C/N ratios.

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تأثير بعض معاملات التقليم على النمو والمحصول لبعض أصناف العنب
ب) حمولة البراعم وسمك الدابرة الثمرية على كرمات عنب الفليم سيدلس

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خلال موسمى ٢٠٠٣-٢٠٠٤ تم تقليم كرمات عنب الفليم الناضجة فى خلال مرحلة السكون. حيث تم ترك على الكرمة ٣٩-٥٤-٦٩-٨٤ بسمك أقل من ١سم أو ١:أقل من ١,٥ سم أو ١,٥:٢سم. وقـد تـم زيادة حمولة البراعم على الكرمة عن طريق زيادة عدد الدوابر الثمرية. كان زيادة حمولة الكرمة من ٣٩-٨٤ برعم على الكرمة مصحوبا بزيادة النسبة المئوية للبراعم الثمرية والمحصول وعدد العناقيد فى الكرمة، والنسبة المئوية للحموضة الكلية والنسبة المئوية للكربوهيدرات الكلية بينما أدى إلى تقليل طول وسمك الفرخ ومساحة الورقة ووزن خشب التقليم فى نهاية الموسم ووزن العنقود ووزن وحجم ١٠٠ حبة والنسبة المئوية للمواد الصلبة الذائبة الكلية والنسبة المئوية للنيتروجين. وكانت جميع المقاييس التى تـم دراسـتها ماعـدا المحصول والنسبة المئوية للحموضة الكلية والنيتروجين تميل إلى الزيادة مع سمك الدوابر الثمرية وكـان التأثير خفيفا على هذه المقاييس عند زيادة سمك الدابرة من (١سم إلى أقل من ١,٥ سم) إلى (١,٥إلى ٢سم). ويمكن القول بأن أحسن المعاملات التى أعطت أفضل النتائج بخصوص المحصول وجودة الحبات هى عند تحميل الكرمة ٦٩ عين من دوابر ثمرية ذات سمك ١سم إلى أقل من ١,٥ سم.