

Effect of Summer Pruning on Vegetative Growth, Yield and Fruit Quality of "Le-Conte" Pear trees

Atef Moatamed Hussein Moatamed

Horticulture Research Institute, Agriculture Research Center, Giza, Egypt.

ABSTRACT: The aim of this study was to study the effect of time of summer pruning on vegetative growth, yield and whole canopy photosynthesis of Le-Conte pear trees. Summer pruning of Le-Conte 'pear trees (*Pyrus communis*. L) was studied for two consecutive seasons (2009-2010&2010-2011) on ten years old of 'Le-Conte' pear trees budded on *Pyrus betulaefolia* grown in Borg El-Arab region, Alexandria governorate in sandy soil under drip irrigation and planted at 5x6m apart. Summer pruning treatments were removing of 1/2, 1/3 and 3/4 length of shoots per tree. Generally, summer pruning significantly increased the shoot length (cm), leaf area (cm²) and leaf content of chlorophyll. Summer pruning significantly increased the No. of fruiting spurs, fruit set and yield per tree in both seasons. No significant effect on total soluble solids and fruit acidity in both seasons. Concerning of summer pruning date found that pruning during Aug, gave the best result in shoot length, leaf area, content of chlorophyll, No. of spurs, fruit set (%) and the fruit quality. Concerning of removing 1/2 of shoot length increased the leaf content of chlorophyll, fruit set (%) and leaf content of (P&K%). while removing 1/3 of shoot length was best for increasing No. of spurs, yield (Kg), fruit weight, fruit dimension and leaf content of nitrogen (N). removing 3/4 of shoot length gave the best result in leaf content of (Fe, Mn and Zn), firmness, T.S.S and total soluble sugars.

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1-INTRODUCTION

Fruit tree are pruned to restrict tree size, to control tree shape, to maintain balance between vegetative and reproductive growth, to improve fruit size and fruit production to obtain high yield of quality fruit each year.

Summer pruning increased light level in the lower canopy, reduced the yield and may result in the excessive tree vigor. Summer pruning at different levels of pruning severity of fruiting shoots and the elimination or not of the weak unmixed fruiting shoots with only floral buds (Ystaas, 1991; Miller, 2001 and Louis Lorette, 2004). Also, summer pruning was used a tool for breaking apical dominance and increasing twigs and spurs formation of pears (Nasr, 1996) apples (Fathi and Mokhtar, 1998; Abdelwahab et al., 2002 and George et al., 2002), increasing fruit set (Fathi and Mokhtar, 1998) and increased percentage of retained fruit to perfect flowers (Ebied, 2005).

In this regard, Dejong et al., (2002) cleared that summer pruning treatment on apple trees effectively reduced the measured vegetative characters. The most effect treatment for reduction of trunk cross section area (TCSA) growth and annual shoots length was summer pruning at 90 day after full bloom (45% and 38% of the dormant-pruned tree respectively).

More to the point, though, summer pruning increases leaf content of chlorophyll, Zn and Mn. Leaf N content was reduced by summer pruning treatment. All treatments increased leaf content of K,

Ca, Mg, total sugars and carbohydrates. It was a good tool in enhancing and directing physiological status of peach tree toward more yielding and fruit quality (Gabr and Ibrahim (2005). Addition to Tom Organ (2005) cleared that each summer the tree pours all its energy into grower those overly long new branches and then each winter would chop back.

The standard conventional wisdom that it was necessary in order to have a decent tree and a good set of fruit. Because of apical dominance, when a tip is cut off, the next bud back from what is now the tip; this bud will normally sprout next. The top most bud on any strong branch has high concentrations of the natural growth hormone, Indole acetic acid (IAA). Most pomes and stone fruits, set fruit only on new wood. Moreover, Luis Asin (2007) said that summer pruning was the strategies that produced the next shortest shoot length, however, summer pruning registered the lowest return bloom and accumulated yield. Furthermore, Ibrahim et al., (2007) mentioned that summer pruning time was an effective factor for improving the quality of the important Swedish apple cv. Aroma and increase its resistance to bruising and storage decay. Removing cut during August (5-6 weeks before harvesting) improved fruit color and decreased decay without negatively influencing tree yield. Also, Banados et al., (2008) study the effect of the summer pruning date on blue berry cultivars who found that lateral number and length, flower bud number, fruit size and harvest date were measured in the year after pruned. Summer pruning in early

season resulted in more and longer laterals when pruning was done at the end of the summer growing season. Summer pruning may be carried out during the second half of August.

Many others studied the effect of summer pruning on firmness, total soluble solids, the average of fruit weight, fruit size, and the yield as a fruit quality (Fathi and Mokhtar, 1998), on Apple (Ebied, 2005; Gabr and Ibrahim, 2005) and (Atef et al., 2010) on Peach.

The aim of the present study was to maintain the best type and optimal degree of pruning severity to increase yield and improving fruit quality from healthy well pruned 'Le-Conte' Pear trees.

2-MATERIALS AND METHODS:

The present study was carried out during two successive seasons (2009 & 2010) and (2010&2011) at Borg El-Arab region, Alexandria, Egypt.

2.1. Materials:

2.1.1. Sample:

Thirty trees, ten years old of 'Le-Conte' pear trees (*Pyrus Communis* L) grafted on *Pyrus betulaefolia*, as uniform as possible were selected for this study. Planted at 5 x 6m apart in sand soil. The trees received the same horticultural practiced as usually done in this farm under flood irrigation system. Treatments are 3 pruning dates x 3 pruning treatments, beside no summer pruning applied three trees as control as shown in table (1).

The experimental treatments were arranged in a randomized complete block design; each treatment was represented by three replicated trees.

Table (1) summer pruning treatments in (2009-2010) and (2010-2011) seasons

No. of treatments	Pruning date	Pruning treatments
1	Mid-August	Removing 3/4of the shoots length
2	Mid-August	Removing 1/2of the shoots length
3	Mid-August	Removing 1/3of the shoots length
4	Mid-September	Removing 3/4of the shoots length
5	Mid-September	Removing 1/2of the shoots length
6	Mid-September	Removing 1/3of the shoots length
7	Mid October	Removing 3/4of the shoots length
8	Mid October	Removing 1/2of the shoots length
9	Mid October	Removing 1/3of the shoots length
10	Control	Un-pruned trees

2.2. Methods:

2.2.1. Scheme of the work: In the first year of each season i.e., 2009&2010 years during 1st & 2nd seasons, respectively four main branches (limbs) nearly uniform in diameter and well distributed around four geographical directions were carefully selected per each tree just before carrying out the differential investigated summer pruning treatments.

2.2.2. Measurable characteristics:

The response of the various measurable characteristics was recorded during the second year of each experimental season was as follows:-

a- Vegetative Growth Measurements:-

On late August 2010&2011 years during both 1st & 2nd season, respectively 20 developing shoots per tree (5per every limbs) were devoted for determining average shoot length in (cm) and leaf area (cm²) using Leaf Area meter model (1-203, CID, Inc, USA) on 10mature leaves randomly collected from each tree..

b- Flowering and fruiting measurements:-

During each season (2010&2011 years) number of fruiting spurs flowers developing fruitlets per each tagged limb (main branch) for each tree were counted at the initial of flowering, full bloom and one month later, respectively. Then fruit set % was estimated according to the following the equation:

$$\text{Fruit set (\%)} = \frac{\text{No. of developing fruit lets} \times 100}{\text{Total No. of flowers}}$$

Yield:- At harvest time, in mid-August of each season (2010&2011 years) the total yield was estimated as weight of harvest mature fruits (Kg) per each individual tree.

C-Determination of Leaf Chemical Contents:-

C.1.Determination of Leaf Chlorophyll content:-

Leaf chlorophyll reading was recorded using Minolta chlorophyll Meter SPAD-502 (Minolta camera. Co, Lt D Japan) at the field in mid-June. The average of ten readings was taken on the middle of leaves from all over the tree circumference.

C.2.-Determination of Leaf Minerals Composition:-

Leaf minerals contents were determined in mid-July of both seasons. Samples of 30 leaves /tree were taken at random from the previously tagged shoots of each tree. leaf samples were washed with tap water, oven dried at 70 °C to a constant weight and then ground. The ground samples were digested with sulphoric acid and hydrogen peroxide according to Evenhuis and Dewaard (1980) Total nitrogen and phosphorus were determined calorimetrically according to Evenhuis (1978) and Murphy and Riley (1962), respectively. Potassium was determined by a flame Photometer model E.E/L. (Jackson, 1967). Ca, Fe, Zn and Mn were determined by perking – Elmer atomic absorption spectrophotometer model 2380 Al, according to Jackson and Ulrich (1959) and Yoshida et al. (1972).

d- Fruit Quality:-

At harvest time, in mid-August of each season twenty fruits from each tree under study were taken at random to determine fruit quality. In each sample, fruit weighted and the average weight of fruit (g), their dimensions were (diameter (cm) & length (cm)) determined and fruit firmness was estimated by Magness and Taylor pressure tester which has a standard 5/16 of inch plunger and recorded as lb/inch².

As for the first chemical properties ;total soluble solid (T.S.S) was determined by a hand refract meter, acidity of fruit juice was determined (as malic acid) by titration with 0.1 normal sodium hydroxide with phenolphthalein as an indicator ,according to A.O.A.C(1992), total sugar content% were determined according to Malik and Singh (1980),and starch(%)was according to Woodman(1941).

All obtained data were, statistically analyzed according to the method of Sendecor and Cochran (1990)in each L.S.D at 5% level and Duncan multiple range test (Waller and Duncan 1969) were used for comparison between means of each treatment.

3-RESULTS AND DISCUSSIONS**3.1. Vegetative Growth:-****a) Shoot length and Leaf area:-**

Data in Table (2) showed that the effect of date and level of summer pruning on every growth characters are pronounced response to investigated factors. All treatment applied gave significantly tallest shoots, great leaf area and high chlorophyll content compared with control. It is clear that the first treatment (remove 1/3 of branch gave a little effect on the Ave. of shoot length, Ave. of leaf area and chlorophyll content compared with the control in the two seasons. The high pronounced response was obtained from third treatment (removing 3/4 of branch) compared with the control in the two seasons.

On the other hand, data in Table (2) showed also that date of summer pruning are effect on both growth measurement s (shoot length and leaf area), whereas, the late date (Oct.)gave same effect on the two growth measurements.

It is clear, from the data in Table (2), that the second treatment (Sep,) gave moderate effect in both growth measurements (shoot length and leaf area) The highest significant increase was obtained from first treatment (Aug,)in the two seasons 2010/2011.

Referring the interaction effect of Table (2) displaying that specific effect of each investigated factor reflected directly on their combinations. Hence, the tallest shoot length with the greatest leaf area was markedly in concomitant to the severest pruning level (3/4 of shoot) applied early in August.

Data in a harmony with Marini and Barden (1987); Zayan et al., (2002) who concluded that total shoot growth was statistically increased by summer pruning. Also, Gabr and Ibrahim.(2005); Gabr et al., (2006) and Atef et al., (2010) indicated that summer pruning severity increased shoot number and shoot length of " Florida Prince& Desert Red " peach trees.

b) Chlorophyll content:-

Concerning of summer pruning on chlorophyll content, data in Table (2) showed that the pronounced response was found with the earliest date (Aug.).With regard to the response of leaf chlorophyll content, Table (2) show that the response followed to some extent the same trend previously found with growth measurements, but the rate was less pronounced. Anyhow, all pruning treatments (levels) increased chlorophyll but the intermediate level (1/2 of shoots) was more effective.

On the other hand, pruning at the earliest date was the most effective, especially in 2nd season. Consequently, the summer pruning at the earliest date (Aug.) regardless of its level resulted in significant increase in leaf chlorophyll content as consider to most other combinations during two experimental seasons so, the reduction of chlorophyll values in leaves of the summer pruned trees is expected due to the reduction of light penetration into the tree canopy.

The data was with a line with, (Gabr and Ibrahim.2005; Gabr et al., 2006 and Atef et al., 2010) who said that summer pruning increased leaf content of chlorophyll. But Mika (1986)stated that removing shoot apex by summer pruning decreased the photosynthetic activity of leaves.

C-Flowering Growth:-**C-1) Number of spurs:-**

It was clear from data in Table (3) that shoots were apices removing in summer apical dominance were disappeared in the removing shoots, and induced a limited number of lateral buds to grow as spurs. On the other hand, summer pruning in August by removing (1/2) of shoot length increased the average of Spurs number in the two seasons (20.67&18.7) compared with the control.

Also, it noticed that removing 1/3 of shoot in any time of treatment under study gave a high significant value in average of spur number in both seasons under study. Moreover, the interaction effect between level (degree) and date of summer pruning revealed that removing 1/3 of shoot length gave the highest number of spurs in both seasons (2009/2010& 2010/2011) under study.

These results are confirmed with those reported that summer pruning improved bud formation (Abdel-Wahab et al., 2002; Zayan et al., 2002 and Ebied 2005).

C-2) Percentage of fruit set:-

Regarding the effect of different degree (level) of summer pruning and dates under investigation study on fruit set, it is cleared from table (3) that all summer pruning treatments increased fruit set severity of pruning decreased compared with the control. Removing 1/2 of shoots length increased fruit set percentage followed by removing 1/3 of shoots length, removing 3/4 of shoots gave no clear effect in this respect compared with the control.

Moreover, removing 1/2 of shoot length in Aug. gave a high significant value on fruit set (14.30 & 15.27%, respectively) and removing 1/3 of shoot

length in Aug. (13.60 & 14.60%, respectively) and 1/2 of shoot length in Sep. (14.60 & 16.60%, respectively) in both seasons under study (2009/2010 & 2010/2011). So, the interaction between date and degree (level) of removing shoot length (summer pruning) it noticed that removing 1/2 of shoot length gave the best result (13.06 & 14.10%) in both seasons under study.

These results are in same line with those reported that summer pruning improved fruit set (Zayan et al., 2002; Gabr and Ibrahim, 2005; Gabr et al., 2006) and suppressed drop and increased fruit set (Marini and sowers 1991; Tom Organ 2005 and Atef et al., 2010).

Table (2) Effect of summer pruning shoot length (cm), leaf area (cm²) and chlorophyll content of "Le-Conte" Pear trees during season 2009/2010 and 2010/2011

Date Degree of removing	Ave. of shoot length(cm)				Ave. of leaf area(cm ²)				Chlorophyll content			
	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)
Season 1												
Control	62.40d	62.40d	62.40d	62.40 D	21.86de	21.86de	21.86de	21.86 D	42.24bcd	42.24bcd	42.24bcd	42.24 A
1/3of branch	79.87c	77.63c	54.77e	70.76 C	25.95d	22.10 de	22.70 de	23.58 C	43.03ab	42.14cd	41.94d	42.37 A
1/2of branch	82.90b	79.53c	53.70e	72.10 B	27.21 b	25.35 d	24.31 d	25.62 B	43.36a	42.65abcd	42.21bcd	42.74 A
3/4of branch	87.78a	82.90b	60.83d	77.04 A	28.89 a	26.82c	26.41 c	27.37 A	43.24a	42.37bcd	42.19bcd	42.60 A
Ave.(B)	78.24 A	75.62 B	57.92 C		25.98 A	24.03 B	23.82 C		42.97A	42.35 A	42.15 AB	
Season 2												
Control	63.10f	63.10f	63.10f	63.10 D	24.01de	24.01de	24.01de	24.01 BC	42.12cd	42.12cd	42.12 cd	42.12 A
1/3of branch	81.20d	74.60e	54.17g	69.99 C	24.49cd	21.12f	24.22cde	23.28 C	43.95a	42.12cd	41.60bc	42.50A
1/2of branch	84.33c	84.43c	58.40g	75.72 B	26.21b	23.26e	24.56cd	24.67 B	43.52a	42.60bc	42.21cd	42.80 A
3/4of branch	91.57a	88.83b	61.53fg	80.64 A	27.93a	26.02b	25.00c	26.32 A	43.21ab	42.41bcd	42.30cd	42.60 A
Ave.(B)	80.05 A	77.74 B	59.30 C		25.66 A	23.60 C	24.45 B		43.20A	42.31 B	42.06 B	

Means within each column followed by the same letter(s) are not significantly different at 5% level.

C-3) Yield (Kg) per tree:-

It was obvious from data in table (3) that data of yield per tree (kg) as effected by summer pruning treatments increased the fruit yield (Kg/tree) in all treatments and both seasons compared with the control. Moreover, the yield goes in the same trend with fruit set percentage. Herein, the best summer pruning degree was in removing 1/2 of shoot length (83.79 & 83.30 Kg/tree) in 2009/2010 and 2010/2011 seasons under study.

Also, summer pruning in August gave the highest result (82.28 & 83.82 Kg/tree) compared with other dates under study. Data revealed that removing 1/3 of shoot in August gave the highest significant value on fruit yield (87.93 & 90.91 Kg/tree) followed by removing 1/2 of shoot in August (89.73 & 88.43 Kg/tree) in both seasons under study.

These results are in harmony with those who reported that summer pruning increased the yield Luis Asin et al., 2007; Gabr et al., 2005 and 2006 and Zayan et al 2002. So, it could be seen that summer pruning degree and date of summer pruning significantly increased spurs flowers, flowers and fruit set as increased yield. And the increasing of spurs

reflected on the increasing of flowers number and the yield per tree (Kg).

3.2. Leaf mineral content:-

3.2. a) Macro-elements content:-

Data in table (4) showed that the effect of summer pruning treatments and the dates of pruning on nitrogen, phosphorus, potassium and calcium percentages. It gave high effect on N (%), P (%) and K (%) values on leaf content of 'Le-Conte' trees. Removing 1/3 of shoot length increased leaf content of N (1.99 & 2.07%), while, P (0.34 & 0.39 %) and K (1.80 & 1.74 %) in both seasons under study, while the other level (degree) of summer pruning gave a moderate increased of leaf mineral content compared with the control.

While, the summer pruning in August gave the highest values of N, P and K in two seasons under study. N increased by removing 1/2 of shoot in August (2.06 & 2.12%) followed by September (1.67 & 2.06%) in two study seasons.

P and K increased by removing 1/2 of shoot in Aug. (0.38 & 0.43% for P and 1.83 & 1.79% for K) followed by in Sep. (0.36 & 0.40% for P and 1.83 & 1.73% for K) in both seasons under study compared with the control.

But the highest value of Ca recorded in removing 3/4 of shoot length and in Oct. compared with the control trees in two successive seasons under study (2009/2010 & 2010/2011). So, it noticed that the summer pruning by removing 3/4 of shoot, general and in mid Oct. especially gave the lowest values in N, P and K. It may be due to enter the trees in dormancy

states. These data are in a line with Zayan et al., (2002) who indicated that the increment in the growing points resulted in more vegetative growth, which increased concentrations in leave.

Table (3) Effect of summer pruning on spurs number, fruit set and yields of "Le-Conte" Pear trees during 2009/2010 and 2010/2011 seasons.

Date Degree of removing	Ave. of spurs number				Ave. of fruit set (%)				Ave. of Yield (kg)			
	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)
Season 1												
Control	13.00de	13.00de	13.00de	13.00 C	11.50 de	11.50 de	11.55 de	11.50 C	74.03d	74.03d	74.03d	74.03 C
1/3of branch	18.00b	19.67ab	16.00c	17.89 A	13.60 b	13.30 bc	10.90 f	12.60 B	87.93a	84.36b	77.81c	83.37 B
1/2of branch	20.67a	16.00c	12.33e	16.33 B	14.30 a	13.60 b	11.30 ef	13.06 A	89.73a	84.50b	77.14c	83.79 A
3/4of branch	14.67cd	13.33de	9.67f	12.56C	12.00 c	12.00 d	10.90 f	11.63 C	77.44c	76.12c	68.58e	74.05 C
Ave.(B)	16.59 A	15.50 B	12.75 C		12.85 A	12.60 A	11.15 B		82.28 A	79.75 B	74.39 C	
Season 2												
Control	12.67cd	12.67cd	12.67cd	12.67 C	12.47de	12.47de	12.47de	12.47 C	74.76f	74.76f	74.76f	74.76 D
1/3of branch	16.00b	19.00a	16.00b	17.00 A	14.60b	14.30bc	11.90f	13.60 B	90.91a	83.90c	73.62f	82.80 B
1/2of branch	18.87a	16.67b	13.67c	16.30 B	15.27a	14.60b	12.30ef	14.10 A	88.43b	84.09c	77.50e	83.30 A
3/4of branch	13.33c	10.33e	11.67d	11.80 D	13.97c	13.00d	11.87f	12.9 0 C	81.19d	78.22e	69.25g	76.20 C
Ave.(B)	15.22 A	14.67 B	13.50 C		14.08 A	13.59 B	12.14 C		83.82 A	80.24 B	73.78 C	

Means within each column followed by the same letter(s) are not significantly different at 5% level.

3.2. b) Micro-elements content:-

Table (5) shows obviously that the response of leaf Fe, Zn and Mn of Le-Conte pear to severity and date of summer pruning varied from one element to another. Delaying pruning date from August to Oct. resulted in decreasing significantly leaf Fe content during both season.

However, the reverse was true with both Mn and Zn content whereas the trend took the other way around difference were so pronounced and reached level of significance particularly with comparing both earliest and latest pruning dates (Aug. & Oct.) each other during two seasons. As for the effect of summer pruning level, it is quite evident that no specific firm

trend could be detected for three micro nutrient elements except with Fe & Mn content, whereas the severest rate (3/4shoots) increased both elements not only than two other removing levels but also control. On the other hand such trend was absent with leaf Zn content. Referring the interaction effect, Table (5) reveals that specific effect of each investigated factor reflected directly on their combinations. Herein, the highest leaf Fe and Mn contents were significantly coupled with Le-Conte pear trees summer pruned at the severest level (3/4 shoots) in August & October, respectively.

Table (4) Effect of summer pruning on content of macro nutrients of "Le-Conte" Pear trees during 2009/2010 and 2010/2011

Date Degree of removing	Ave. of N (%)				Ave. of P (%)				Ave. of K (%)				Ave. of Ca (%)			
	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)
Season 1																
Control	1.92de	1.92de	1.92de	1.92 C	0.34cd	0.34cd	0.34cd	0.34 A	1.70e	1.70e	1.70e	1.70B	1.33de	1.33de	1.33de	1.33 C
1/3of branch	2.06a	1.97b	1.94cd	1.99 A	0.37a	0.35bc	0.31e	0.34 A	1.77b	1.71d	1.61g	1.70 b	1.26f	1.32de	1.33de	1.30 D
1/2of branch	1.96 bc	1.91e	1.92de	1.93 B	0.38a	0.36ab	0.29fg	0.34 A	1.83a	1.83a	1.74c	1.80A	1.30e	1.41bc	1.38c	1.36 B
3/4of branch	1.84f	1.84f	1.78g	1.82 D	0.32d	0.30ef	0.26g	0.29 B	1.65f	1.61g	1.56h	1.61 C	1.42ab	1.34d	1.45a	1.40 A
Ave.(B)	1.95 A	1.91 B	1.89 C		0.35 A	0.34 A	0.30 B		1.74 A	1.71 B	1.65 C		1.33 C	1.35 B	1.37 A	
Season 2																
Control	1.97de	1.97de	1.97de	1.97 B	0.38c	0.38c	0.38c	0.38 B	1.69cd	1.69cd	1.69cd	1.69 B	1.38e	1.38e	1.38e	1.38 C
1/3of branch	2.12a	2.06b	2.04c	2.07 A	0.41b	0.37c	0.34d	0.37 C	1.76ab	1.70bc	1.62de	1.69 B	1.36f	1.39e	1.42cd	1.39 B
1/2of branch	1.98d	1.93f	1.96e	1.95 B	0.43a	0.40b	0.32e	0.39 A	1.79a	1.73abc	1.71bc	1.74 A	1.39e	1.41d	1.46b	1.42 A
3/4of branch	1.92f	1.89g	1.89g	1.90 C	0.35d	0.34d	0.31e	0.34 D	1.68cd	1.63de	1.62de	1.64 C	1.43c	1.31g	1.49a	1.41 A
Ave.(B)	2.00 A	1.96 B	1.97 B		0.39 A	0.37 A	0.34 B		1.73A	1.69 B	1.66 C		1.39 B	1.37 C	1.44 A	

Means within each column followed by the same letter(s) are not significantly different at 5% level.

Table (5) Effect of summer pruning on content of micro nutrients of "Le-Conte" Pear trees during 2009/2010 and 2010/2011 season

Date Degree of removing	Fe (p.p.m)				Mn (p.p.m)				Zn (p.p.m)			
	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)
Season 1												
Control	190.33d	190.33d	190.33d	190.33 B	45.00b	45.00b	45.00b	45.00 A	22.67cde	22.67cde	22.67cde	22.67 A
1/3of branch	191.33cd	187.67ef	186.00f	188.33 D	42.00e	44.00c	44.67b	43.56 C	22.33de	24.67a	23.00bcd	23.30 A
1/2of branch	191.00cd	192.33bc	186.00f	189.78 C	43.00d	44.00c	45.33b	44.11B	22.00de	24.00ab	21.67c	22.5 A6
3/4of branch	195.00a	193.0b	188.00e	192.00 A	44.00c	46.33a	47.00a	45.78 A	23.67 abc	24.33a	20.33f	22.7 A8
Ave.(B)	191.92 A	190.83 B	187.58 C		43.50 B	44.83 A	45.50 A		22.52 B	23.92 A	21.92 C	
Season 2												
Control	193.00d	193.00d	193.00d	193.00 B	46.67c	46.67c	46.67c	46.70 B	25.00b	25.00b	25.00b	25.00 A
1/3of branch	191.33e	190.00e	187.33f	189.55 C	47.33c	43.00e	46.33c	45.55 C	21.00e	25.00b	24.00bcd	23.33 B
1/2of branch	196.00b	194.00cd	190.33e	193.44 B	45.00d	46.67c	49.00b	46.89 B	21.00e	24.33bc	27.00a	24.10 A
3/4of branch	197.67a	195.33bc	194.00cd	195.67 A	49.00b	49.00b	50.67a	49.55A	23.33cd	23.00d	24.00bcd	23.40 B
Ave.(B)	194.00 A	193.10 A	191.30 B		47.00 B	46.34 C	48.17 A		22.60 C	23.33 B	25.00 A	

Means within each column followed by the same letter(s) are not significantly different at 5% level

However, with leaf Zn content no specific trend could be detected during both seasons.

It could be concluded that the reduction in micro nutrients to build new organs (Zayan et. al, 2002).

3.3. Physical Properties of Fruits:-

3.3.1) Fruit weight:-

Data in table (6) revealed that summer pruning affected on "Le -Conte" fruits in the both seasons under study. There was a significant increasing in average of fruit weight in all summer pruning treatments due to the increments in fruit set and yield. Herein, the highest significant increase were in removing 1/3 (121.76 & 120.62 g) in August.

Removing 1/3of shoot length increased the fruit weight (116.26&111.97 g) followed by 1/2 and 3/4 of shoot length compared with the control trees. And the best date for summer pruning was in August (113.23&112.40, respectively) in both seasons 2009/2010 and 2010/2011 under study. It can be indicate that fruit weight is related to shoot length and short shoots tend to produce small fruits because short shoots have a few leaves to support the growth of fruit.

These results are in accordance with those who reported that summer pruning treatments effect on

fruit weight Miller (2001); Louis Lorette, (2004) and Banados et al., (2008).

3.3. 2) Fruit diameter and length:-

It's noticed that the dimensions of fruits go in same trend with the weight; there is a positive significant increasing between treatments in both seasons under study due to the increment in fruit weight (Table 6). The obtained results are in a same trend with the conclusion of Gabr and Ibrahim (2005); Gabr et al (2006) who mentioned that summer pruning increased fruit diameter and length.

3.3.3) Fruit firmness:-

Data in Table (6) show that summer pruning was affected on firmness of fruit by removing 3/4of shoots gave the highest value in both seasons compared with the control. However, summer pruning in Oct. increased the fruit firmness in the two seasons of this study. Herein, removing 3/4 of shoot length in Oct. was the highest firmness in two successive seasons under study.

Gabr and Ibrahim (2005); Gabr et al., (2006) mentioned that summer pruning effect on firmness.

Table (6) Effect of summer pruning on physical properties of "Le-Conte" Pear trees during 2009/2010 and 2010/2011 seasons.

Date Degree of removing	Ave. of fruit weight (g)				Ave. of fruit diameter (cm)				Ave. of fruit length (cm)				Ave. of fruit firmness (Inch/lb ²)			
	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)
Season 1																
Control	103.06 f	103.06 f	103.06 f	103.06 f	5.50 f	5.50 f	5.50 f	5.50 D	6.10 e	6.10 e	6.10 e	6.10 B	16.00	16.00	16.00	16.00 C
1/3of branch	121.67 a	117.49 b	109.64 d	116.26 A	6.63 a	6.30 b	5.77 de	6.23 B	6.93 a	6.67 b	6.33 cd	6.64 A	16.07	16.27	17.13	16.49 B
1/2of branch	118.80 b	115.38 c	107.74 de	113.97 B	6.27 b	6.10 c	5.70 e	6.02 A	6.87 a	6.60 b	6.30 d	6.59 A	16.83	16.93	17.33b	17.03 A
3/4of branch	109.38 d	107.52 e	98.91 g	105.27 C	5.83 d	5.73 e	5.30 g	5.60C	6.40 c	6.30 d	5.87 f	6.19 B	17.20 c	16.50	17.60a	17.10 A
Ave.(B)	113.23 A	110.89 B	104.84 C		6.06 A	5.91 B	5.57 C		6.58 A	6.42 B	6.15 C		16.53 B	16.43 B	17.02 A	
Season 2																
Control	103.31e	103.31e	103.31e	103.31 B	5.43 e	5.43 e	5.43 e	5.43 D	6.03 e	6.03 e	6.03 e	6.03 C	16.13	16.13	16.13	16.13 C
1/3of branch	120.62a	112.16c	103.15e	111.97 A	6.43 a	6.20 b	5.43 e	6.02 A	7.07 a	6.70 b	6.03 e	6.60 A	16.40	16.57	17.00	16.66 B
1/2of branch	115.65b	110.84c	106.55d	111.01 A	5.87 c	5.77 c	5.80 c	5.81 B	6.80 b	6.40 cd	6.37 cd	6.52 A	16.80	16.80	17.30	16.97 A
3/4of branch	110.01c	105.85de	98.55f	104.80 B	5.87 c	5.63 d	5.33 e	5.61 C	6.47 c	6.30 d	5.83 f	6.20 B	16.83	16.27	17.43	16.84 A
Ave.(B)	112.40 A	108.04 B	102.89 C		5.90 A	5.76 B	5.50 C		6.59 A	6.36 b	6.07 C		16.54 B	16.44 B	16.97 A	

Means within each column followed by the same letter(s) are not significantly different at 5% level

3.4. Fruit Chemical Properties:-

Data concerning the values of T.S.S and total acidity as affected by summer pruning treatment as shown in Table(7).

Total soluble solids percentage of "Le- Conte "pear fruits were significantly affected by all different summer pruning treatments and dates in both seasons (Table7).

Removing 3/4 in mid Aug. gave the highest TSS percentage followed by other treatments and the control trees in all dates for the two successive seasons, respectively.

It is cleared that there are significant difference were found between the degrees of summer pruning in total acidity compared with control.

In this respect, Gabr and Ibrahim 2005 and Gabr et al., 2006 reported that response of TSS and acidity was varied of significance from season to another of summer pruning.

Total soluble sugar and starch go in the same trend of response to all summer pruning treatments (Table7). A total soluble sugar (%) was affected by removing 1/2 of shoot length in Aug. followed by other treatments as the control trees. Starch recorded the highest value with trees pruned by removing 3/4 of shoot length in any date of pruned and the lowest ones with the pruned trees by removing 1/2 of shoot in Aug. compared with control, in both seasons (2009/2010 and 2010/2011)

Table (7) Effect of summer pruning on chemical properties of "Le-Conte" Pear trees during 2009/2010and2010/2011seasons

Date Degree of removing	T.S. S (%)				Total acidity (%)				Total sugar (%)				Starch (%)			
	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)	Aug.	Sep.	Oct.	Ave. (A)
Season 1																
Control	10.47 de	10.47 de	10.47 de	10.47 D	0.43 ab	0.43 ab	0.43 ab	0.43 A	7.99 ab	7.99 ab	7.99 ab	7.99 A	2.74bc	2.74bc	2.74bc	2.74B
1/3of branch	10.27 e	10.47de	10.73 bc	10.49 C	0.44 a	0.42 ab	0.43 a	0.43 A	8.03 ab	7.90 ab	7.85 b	7.93 A	2.66 cd	2.82 b	2.76 b	2.75B
1/2of branch	10.50 d	10.53 cd	11.00 a	10.68 B	0.41 b	0.42 ab	0.45 a	0.43 A	8.07 a	7.88 b	7.90 ab	7.95 A	2.63 d	2.83 b	2.78b	2.75B
3/4of branch	11.00 a	10.73 bc	10.93 ab	10.89 A	0.42 ab	0.40 b	0.42 ab	0.41 A	7.83 b	7.92 ab	7.90 ab	7.88 B	2.93 a	2.91 a	2.98 a	2.94 A
Ave.(B)	10.56 B	10.55 B	10.78 A		0.43 A	0.42 A	0.43 A		7.98 A	7.92 A	7.91 A		2.74 B	2.83 A	2.82 A	
Season 2																
Control	10.67 d	10.67 d	10.67 d	16.1	0.46 a	0.46 a	0.46 a	0.46 A	7.99 ab	7.99 ab	7.99 ab	7.99A	3.28 de	3.28 de	3.28 de	3.28 Bc
1/3of branch	10.50 e	10.47 de	10.70 bc	16.7	0.45 a	0.43 b	0.40a	0.43A	8.03 ab	7.90 ab	7.85 b	7.93 AB	3.22e	3.33bcd	3.30 cd	3.28 BC
1/2of branch	10.60d	10.60 cd	10.60 c	17.0	0.45 a	0.45 a	0.42 c	0.44A	8.07 a	7.88 b	7.90 ab	7.95 A	3.28 de	3.33bcd	3.36 bc	3.32 B
3/4of branch	11.07 a	10.83	10.80 b	17.1	0.45 a	0.41 c	0.44 a	0.43A	7.83 b	7.92 ab	7.90 ab	7.86 C	3.39 b	3.37 bc	3.56 a	3.44 A
Ave.(B)	16.5	16.4	17.0		0.45A	0.44A	0.43A		7.89A	7.92A	7.91A		3.29 B	3.33 B	3.38 A	

Means within each column followed by the same letter(s) are not significantly different at 5% level

It can be concluded that "Le-Conte pear trees budded on *Pyrus Communis* should prune by summer moderate treatments (removing 1/2of shoots) in August to induce vegetative growth, enhance physiological status of the tree and increase yield as a weight with a good quality. Also, Le-Conte pear tree pruned by removing 1/3of shoots to allow the light penetration to get a good vegetative growth, improve nutritional status, flowering and fruit set which is return as increasing in yield.

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