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EFFECT OF SUMMER PRUNING ACCOMPAINED WITH GA_3 SPRAY ON FLOWERING, FRUITING, AND VEGETATIVE GROWTH OF "FLORIDA PRINCE" PEACH.

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ABSTRACT

Field experiments were conducted during the two successive seasons 2001 and 2002 to determine the effect of summer pruning after harvest coupled with GA_3 spray at 500 ppm on vegetative growth during current season and flowering and fruiting characteristics of "Florida Prince" peach in the following season. Summer pruning was carried out on May 15th, June 15th, or July 15th by removing one third of current and previous interior shoots, two weeks after harvest. Four weeks after each summer pruning date and GA_3 spray, five current season's growths located at the exterior part of the canopy were sampled for the determination of leaf chlorophylls, shoot length and diameter. Flowering and fruiting characteristics, in the following season, were also determined for a similar sample of exterior shoots in addition to the percentage of double fruits on each shoot as a physiological disorder. Each summer pruning date plus GA_3 spray led to the formation of longer shoots as compared with the control. Shoot diameter, however, did not significantly vary among all treatments. Furthermore, exterior shoots of trees that received GA_3 spray in addition to summer pruning had significantly lower chlorophyll content than the control. In the season following summer pruning and GA_3 spray, these treatments caused a consistent reduction in the number of flowers per exterior shoot, as well as flowering density, number of fruits per

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exterior shoot and fruiting density as compared with the control. Moreover, the most reduction in these characteristics was obtained with May 15th pruning plus GA_3. Formation of double fruits was eliminated by summer pruning in the middle of May or June plus GA_3 in both seasons. The outcome of this study supported the role of summer pruning plus GA_3 on regulating the peach tree load of fruits and inducing shoot elongation in the following season.

INTRODUCTION

Peach trees are characterized by their annual heavy bearing. Peach trees bear fruit on 1-year-old twigs. At each node, three buds could be present, one narrow middle vegetative bud and two plumper side flower buds (Jackson, 1986). Hand labor is preferred for fruit thinning (Larue and Gerdts. 1983). Most peach varieties set far more fruits than the trees can mature to marketable size. Moreover, results with thinning by mechanical shakers or chemicals are too inconsistent for widespread use. Pole thinning is sometimes used by growers of processing fruit but because of the importance of fruit spacing this practice is seldom used by fresh-fruit growers. Thus, hand thinning significantly add to the production costs of peach.

Since flower bud differentiation in peach trees occurs during the current summer and buds open in the following spring, summer pruning could be utilized to remove some undesired internal shoots which reflect on the vigor and growth of outside shoots.

On the other hand, gibberellic acid is known to stimulate cell elengation and reduce flower bud induction (Stiles. 1984). Thus, coupling summer pruning with GA_3 spray on current season shoots would be an appropriate approach to obtain longer flowering shoots than untreated trees.

The objective of this study was to investigate the effect of the combination of summer pruning and GA_3 spray on flowering and growth of “Florida Prince” peach tree.

MATERIALS AND METHODS

This study was carried out during the two successive seasons 2001 and 2002. Experiments were conducted in a private orchard at El-Tahrir, Beheira governorate. Peach trees of "Florida Prince" cultivar were four years old and budded on Nemaguard rootstock.

Trees were under standard cultural practices such as fertilization, irrigation, pest control, soil management and dormant pruning. Trees were spaced at 4×4m and under drip irrigation system.

After two weeks of harvest, when the shoot averaged 15 cm in length, the following treatments were applied: (a) control (no summer pruning or GA_3 spray), (b) summer pruning on May 15; (c) summer pruning on June 15; (d) summer pruning on July 15. All summer pruning dates, in this study, were coupled with GA_3 spray (at 500 ppm) to the whole tree following that pruning. Summer pruning was accomplished by removing about one third of current and previous season shoots that are located in the interior of the canopy. These shoots were pruned off at their point of origin at each pruning date. Four weeks after each summer pruning, five current season's growths located at exterior part of the canopy were sampled from each replicate tree. Measurements were taken for shoot length (cm) and diameter (cm), then chlorophyll content of leaves was qualitatively determined by using SPAD Minolta chlorophyll meter (SPAD-502, Japan). During the season following summer pruning and GA_3 spray, a similar sample of exterior shoots was taken for the determination of flowering and fruiting characteristics (Table 2) which were : number of flowers per shoot, blooming density (expressed as the number of fruits per one meter of twig) and the percentage of double fruits (a physiological disorder that adversely affects marketability).

Treatments were replicated three times in a complete randomized block design and 36 trees were assigned 4 treatments. Each replication contained 3 trees, and 3 replications were used with each treatment. Data were statistically analyzed by using the Costat computer software. Mean separation in columns was accomplished by using the least significant difference (LSD) test at p=0.05.

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RESULTS AND DISCUSSION

The data shown in Table 1 indicated that growth of exterior shoots 4 weeks after treatment was influenced by summer pruning dates combined with GA_3 spray in various degrees. All summer pruning dates along with GA_3 spray led to the formation significantly longer exterior shoots when compared with the control during the current season. Furthermore, there was no significant difference among the three treatments in shoot length (Table 1). Variation in shoot diameter in the above shoots were not statistically significant in spite of the shoot elongation. With regard to chlorophyll content in the leaves of exterior shoots during the current season, the data in Table 1 showed that control leaves had significantly higher content than the three treatments and this trend was consistent during both seasons of the study. Moreover the least chlorophyll content was obtained when summer pruning was carried out early in the middle of May coupled with GA_3 spray as compared with other summer pruning dates. The general trend was an increase in leaf chlorophyll content during the current season when the summer pruning plus GA_3 was delayed (Table 1).

With regard to flowering and fruiting characteristics of exterior shoots in the following season, the data in Table 2 showed that there was a remarkable reduction in the number of flowers per shoot due the summer pruning plus GA_3 spray in previous season. However, the reduction in the number of flowers per shoot was much more drastic when summer pruning plus GA_3 were conducted early in the middle of May while there were no significant differences for that character between June 15 and July 15 pruning.

Similar trend of results was obtained with regard to the number of flowers per one meter of exterior shoots (termed as flowering density) where the highest flowering density was present in the control shoots as compared with the treatments in both seasons. Furthermore, each of June 15 or July pruning combined with GA_3 spray resulted in similar flowering density in both seasons. In a similar way, early summer pruning in the middle of May plus GA_3 caused a marked reduction in flowering density in the following season (Table 2).

The pattern of the number of fruits per shoot in both seasons agreed with flowering characteristics (Table 2).

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Control shoots had much higher fruiting than those of the treatments (Fig. 1). However, May 15 pruning in both seasons combined with GA_3 spray caused a drastic reduction in fruiting of exterior shoots. On the other hand, each of June 15th, or July 15th combined with GA_3 spray resulted in a reasonable number of fruits per shoot in both seasons and were not statistically different in their fruiting pattern.

A typical trend of results was obtained with fruiting density. The highest fruiting density was found in the control shoots, while the lowest was that of summer pruning in May 15th plus GA_3 spray.

The formation of double fruits, as a physiological disorder, was also affected by used treatments. Use of summer pruning in the middle of May or June in previous summer along with GA_3 spray resulted in the elimination of double fruits from shoots of the following seasons. Control shoots, on the other hand, had significantly greater number of disordered fruits than May 15th or June 15th pruning in both seasons.

Results of this study provided more evidences on the role of gibberellic acid and dates of summer pruning on vegetative growth of the current season and flowering and fruiting characteristics of the following season. Spraying GA_3 following summer pruning caused shoot elongation of exterior shoots samples 4 weeks after spray, with a trend of thicker shoot diameter even though the difference in this diameter between the treatments and the control was not significant. The role of GA_3 on cell elongation and increasing phloem loading with carbohydrates has been reported and proved by many researchers (Takahashi *et al*., 1991; Arteca, 1996).

Early summer pruning in the middle of May may have deprived the tree from a source of cytokinins for extended period of time during the critical time of flower bud induction.

Cytokinins have been reported to promote flowering (Bernier and Kinet, 1985). Cytokinins may have an indirect effect on flowering since they can increase the translocation of a flower stimulus and assimilates from induced leaves (Ogawa and King, 1979).

Early summer pruning decreases the amount of leaf surface for a good part of the season which reflects on the reduction of photosynthates and the tree vigor (Jackson, 1986).

Late-summer pruning on the other hand, has a similar but more limited dwarfing effect since the length of time with fewer leaves is less. Furthermore, both mid-and late summer pruning may reduce

flowering by decreasing the number of buds. However, the remaining buds were still capable of forming flowers in the following spring as was the case in this study. In a similar manner, Mizutani *et al*., (1996) found that GA_3 application at 500ppm following summer pruning promoted shoot elongation and vegetative bud formation of "Saotome" peach and GA_3 application after fruit harvest were affective measures for enhancing vegetative bud formation and overcoming the problem of excessive number of flower buds.

Increasing gibberellin content early in previous season seems to be related to the prevention of double fruit formation in the following season. However, the direct effect of this hormone on a physiological disorder such as double fruiting needs further investigation.

Table 1. Effect of summer pruning date accompanied with GA_3 spray on current season outside shoots characteristics of "Florida Prince" peach.

Treatments	Shoot Length (cm)		Shoot Diameter (cm)		Leaf Chlorophyll (SPAD)	
	Seasons					
	2001	2002	2001	2002	2001	2002
SP* At 15/5+ GA_3	55.3 a	54.7 a	0.48 a	0.50 a	15.5 c	15.13 d
SP at 15/6 + GA_3	58.3 a	64.7 ab	0.45 a	0.50 a	23.7 b	25.0 c
SP at 15/7 + GA3	55.3 a	52.0 a	0.47 a	0.48 a	27.33 b	26.43 b
Control	41.3 b	41.0 b	0.38 a	0.43 a	39.97 a	41.07 a
LSD**(P=0.05)	12.7	9.2	0.143	0.088	6.29	1.39 b

* sp stands for summer pruning.

** Mean separation in columns by the least significant difference test at P=0.05.

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Table 2. Effect of summer pruning time accompanied with GA_3 spray on flowering and fruiting characteristics of "Florida Prince" peach in the following season.

Treatment	No. Flowers/ Shoot		Flowering Density (No. Flowers/1m shoot)		No. Fruits/ shoot		Fruiting Density (No. Fruits/ 1m shoot)		% Double Fruits	
	Seasons									
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
SP* At 15/5+ GA_3	1.3c	1.0c	2.3c	1.78b	0.66c	0.7c	1.17c	1.20c	0.0b	0.0b
SP at 15/6 + GA_3	6.7b	5.3b	11.33b	10.88b	4.6b	3.7b	8.13b	7.73b	0.0b	0.0b
SP at 15/7 + GA3	5.7b	5.0b	10.44b	9.85b	4.0b	3.0b	7.33b	5.35b	1.33ab	1.66a
Control	15.0a	14.7a	36.23a	35.23a	9.0a	9.7a	21.97a	23.63a	2.0a	2.66a
LSD**(P=0.05)	1.97	3.25	2.36	10.99	1.66	1.63	5.20	3.39	1.53	1.45

* sp stands for summer pruning.

** Mean separation in columns by the least significant difference test at P=0.05.

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Control 15/5 15/6 15/7

Figure 1: Effect of date of summer pruning accompanied with gibberellic acid on fruiting density of "Florida Prince" peach cultivar.

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الملخص العربى

تأثير التقليم الصيفى مصحوبا بالرش بالجبرالين على التزهير والأثمار والنمو الخضرى لصنف الخوخ "فلوريدا برنس"

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تم اجراء التجارب الحقلية فى موسمين متتاليين 2002/2001 وذللك لتحديد تأثير التقليم الصيفى بعد جمع المحصول مصحوبا بالرش بالجبرالين بتركيز 500 جزء فى المليون على النمو الخضرى أثناء موسم النمو الحالى والتزهير والأثمار للموسم التالى للمعاملة وذللك لصنف الخوخ "فلوريدا برنس". وقد تم أجراء التقليم الصيفى فى ثلآث مواعيد (15 مايو، 15 يونية، 15 يولية)وذلك بازالة ثلث عدد الأفرع الحديثة والأفرع عمر سنة من داخل قمة الشجرة وذلك بعد أسبوعين من جمع المحصول.ثم الرش بالجبرالين بتركيز 500جزء فى المليون.

وبعد أربعة أسابيع من اجراء التقليم الصيفى والرش بالجبرالين ،تم أخذ عينة عشوائيةمكونة من خمس أفرع على محيط الشجرة وذلك لقياس محتوى الأوراق من الكلوروفيل ،وطول وسمك الأفرع .وفى الموسمك التالى للمعاملة تم قياس التزهير والأثمار على نفس الأفرع الموجودة على محيط الشجرة اضافة الى عددالثمار المزدوجة الموجودة على كل فرع والتى تعتبر كاختلال فسيولوجى.وقد أدت المعاملة بالتقليم الصيفى والرش بالجبرالين فى التواريخ المذكورة الى زيادة معنوية فى متوسط طول الفرع مقارنة بالكونترول فى حين أن سمك الأفرع لم يتأثر معنويا بالمعاملات المختلفة.

علاوة على ذلك أدت المعاملة بالتقليم الصيفى والجبرالين إلىانخفاض ملحوظ فى متوسط عدد الأزهار وكذلك انخفاض كثافة الأثمار وذلك مقارنة بالكونترول.علاوة على ذلك فان أقصى انخفاض فىهذة الصفات السابق ذكرها أظهرتها المعاملة المبكرة بالتقليم الصيفى مصحوبا بالرش بالجبرالين فى 5/15.كذلك أدت المعاملة بالتقليم الصيفى مصحوبا بالرش بالجبرالين فىكل من 5/15 و6/15 الى انعدام تكون الثمار المزدوجة فى كلا موسمى الدراسة.من هذه الدراسة يتضح دور التقليم الصيفى والمعاملة بالجبرالين على انتظام الحمل فى المحصول فى بساتين الخوخ وكذلك استطالة الأفرع فى الموسم التالى للمعاملة.