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EFFECT OF SOME GROWTH REGULATORS ON YIELD AND FRUIT QUALITY OF PICUAL OLIVE TREES.

BY

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ABSTRACT

The present study was carried out during the two successive reasons of 2007 and 2008 on Picual olive cv. Trees of 10- years old grown in a sandy soil to study the effect of some growth regulators such as GA_3 and NAA either alone or in combination on fruit drop, yield and quality of olive cv. Picual. The tested treatments were **1.** Control (spraying with tap water). **2.** GA_3 at 30 ppm. **3.** GA_3 at 60 ppm. **4** GA_3 at 30 ppm and NAA at 90 ppm **5.** GA_3 at 30 ppm and NAA at 135 ppm. **6.** NAA at 135 ppm. The tested GA_3 and NAA treatments were foliar sprayed ten days after fruit set. Maximum fruit drop % was recorded by NAA at 135 ppm. Adding 30 ppm of GA_3 to NAA either at 90 or 135 ppm improved fruit drop% in comparison with NAA alone. Maximum fruit yield/ tree was obtained when Picual olive trees sprayed with GA_3 at 60 ppm in comparison with other treatments including control. The increase in yield/tree is attributed to increase the percentage of retained fruits. Maximum fruit weight and volume were obtained with combination of GA_3 at 30 ppm and NAA at 135 ppm. Maximum fruit length and diameter were obtained with NAA at 135 ppm. Sprays GA_3 at 60 ppm led to maximum increase in pulp %. GA_3 and NAA either alone or in combination increased TSS as well as TSS/Acid ratio of fruit juice and decreased total acidity than control. Maximum oil percentage was recorded by using GA_3 a 60 ppm in comparison with other treatments. Consequently, it is preferable to spray Picual olive trees with GA_3 and NAA either alone or in combination 10 days after fruit set to enhance tree yield and fruit quality.

Key words: GA_3, NAA, Picual olive, Fruit drop, Fruit quality

INTRODUCTION

Olive "*Olea europaea,* L." is one of the most important fruit crops in Egypt since it cultivated in a big area and ranks the fourth place among the fruit crops acreage where it attained 135692 feddan in 2007 with total production of 507053 tons/ year according to the latest census of Ministry of Agriculture, Egypt. The Picual variety is one of the most important commercial olive varieties which can be used for pickling, oil extraction or for the double purposes. Under sandy soil conditions, olive plants gave low yield especially in the newly reclaimed areas such as sides of the desert roads, Sinai and the north western coast.

As a matter of fact, olive tree is naturally characterized with alternate bearing habit as it tends to gain a large crop in one year and a very little crop in the following year (Daood, 2002). Growth regulators substances either promoting i.e. gibberellins (Southwick *et al.*, 1995), auxins,(Eris and Barut, 1993) cytokinins or inhibiting (retarding) ones i.e. paclobutrazol (Daood, 2002), Alar and CCC were usually used to regulate flowering and cropping of such trees and consequently advance or delay fruit maturation and or ripening. Therefore, the present study was conducted to study the effect of foliar application of GA_3 and NAA either alone or in combinations on the performance of Picual olive cultivar especially fruit drop, yield and fruit quality.

MATERIALS AND METHODS

The present study was conducted at a private farm at Berkash, Giza Governorate on the side of Alexandria desert road 30 km from Cairo during the two successive seasons of 2007 and 2008 on Picual olive trees of 10-years old grown in sandy soil were chosen to study the effect of some growth regulators on fruit drop, yield and fruit quality. Chosen trees for the experiment were of normal growth and uniform as far as possible in their growth vigor. Planting distance was 6x5 m a part and trees received the regular fertilization and pest control programs as adopted in the farm. Drip irrigation system was applied. The treatments were applied, 10 days after fruit set as foliar application on the trees as follows:

1. Control treatment (the trees were sprayed with tap water).
2. GA_3 at 30 ppm
3. GA_3 at 60 ppm
4. GA_3 at 30 ppm + NAA at 90 ppm.
5. GA_3 at 30 ppm + NAA at 135 ppm.
6. GA_3 at 0.0 ppm + NAA at 135 ppm.

Each treatment was replicated five times with one tree per replicate and ten liters of applied solution were sprayed on each tree using a compression sprayer. A complete randomized block design was adopted in this experiment.

The measurements:

Fruit drop percentage:

Four main branches were tagged and the number of fruits per 1 m length of fruiting shoots was recorded 10 days after fruit set and at harvest date. Consequently, the fruit drop % was recorded according to the following equation:

$$\textbf{Fruit drop percentage} = \frac{\text{No.of fruit set - No. of retained fruits at harvest}}{\text{No. of fruits at fruit set}} x100$$

The yield:

Fruit yield of Picual cultivar was harvested at color grade full deep purplish in mid October in the two seasons and yield /tree was calculated in kg/tree.

Fruit characteristics:

Physical parameters:

Samples of thirty fruits from each replicate were chosen to determine 1. Fruit weight. 2. Fruit length. 3.Fruit diameter . 4. Fruit size. 5. Pulp fruit %. 6. Fruit shape index (L/D ratio).

Chemical characteristics:

Fruit samples were taken (2 kg from each treatment) at the suitable stage of harvest to determine the following TSS %, Total acidity % and- Fruit oil content (% dry weight).

Oil extraction and determination (% d.wt) was calculated according to A.O.A.C, (2000).

Statistical analysis.

The obtained data were subjected to analysis of variance (ANOVA) according to Snedecor and Cochran (1968) using Mstat program. Least significant differences (L.S.D) were used to compare between means of treatments according to Waller and Duncan (1969) at probability of 5%. Means in each row followed by the same letter(s) are not significantly different.

RESULTS AND DISCUSSION

1. Tree fruiting

1.1. Fruit drop%

Figs.(1 and 2) shows that GA_3 generally reduced fruit drop % of Picual olive trees in the two studied seasons in comparison with other treatments including control. The results cleared that fruit drop percentage was reduced gradually by increasing GA_3 concentration and attained the lowest value when GA_3 reached 60 ppm. The obtained results are in agreement with the findings of Gur *et al.* (1993) on Rhodes and Early Grand peach and also with that of Southwick *et al.*, (1995) on apricot who reported that GA_3 spray reduced fruit drop %. The results also are in agreement with that obtained by Daood (2002) who cleared that spraying GA_3 at 25 or 100 ppm, 10 days after fruit set on Picual olive trees significantly increased the retained fruit percentage and reduced the total fruit drop

percentage in comparison with the control. Ou *et al.*, (2006) found that spraying GA_3 on plum significantly enhanced the retained fruit percentage and reduced drop percentage. Figs.(1 and 2) indicates that spraying NAA at 135 pm, 10 days after fruit set significantly increased drop percentage of Picual olive trees in comparison with other treatments and control where it recorded the maximum value of drop percentage. These results are in agreement with that of Eris and Barut (1993) on Gemlik olive cultivar and Daood (2002) on Picual olive trees who reported that NAA treatments at 100 and 150 ppm greatly increased fruit drop percentage. These results are acceptable since NAA is used in fruit thinning in many fruit species especially olive trees in the "On" year season to regulate annual bearing of trees and improving fruit quality (Daood 2002). The results in Figs.(1 and 2) indicated also that adding GA_3 at 30 ppm to NAA at 90 ppm or 135 ppm decreased drop percentage of Picual cultivar than NAA alone in the two seasons. Slight insignificant difference was noticed between NAA at 90 ppm or 135 ppm and GA_3 at 30 ppm. These results may be acceptable since GA_3 (according to the data in Fig. 1) at any given concentration reduced fruit drop percentage in the two seasons. These results can be supported by the finding of El-Shewy (1999) on guava, who reported that GA_3 at 75 mg/L and 50 mg/L NAA reduced fruit shedding either during June or pre-harvest drop. In general, data in Figs.(1 and 2) concluded that GA_3 at 60 ppm alone reduced fruit drop percentage in comparison with other treatments including control. On the other hand, NAA at any tested concentration either alone or in combination with GA_3, increased drop percentage in the two seasons in comparison with other treatments including control.

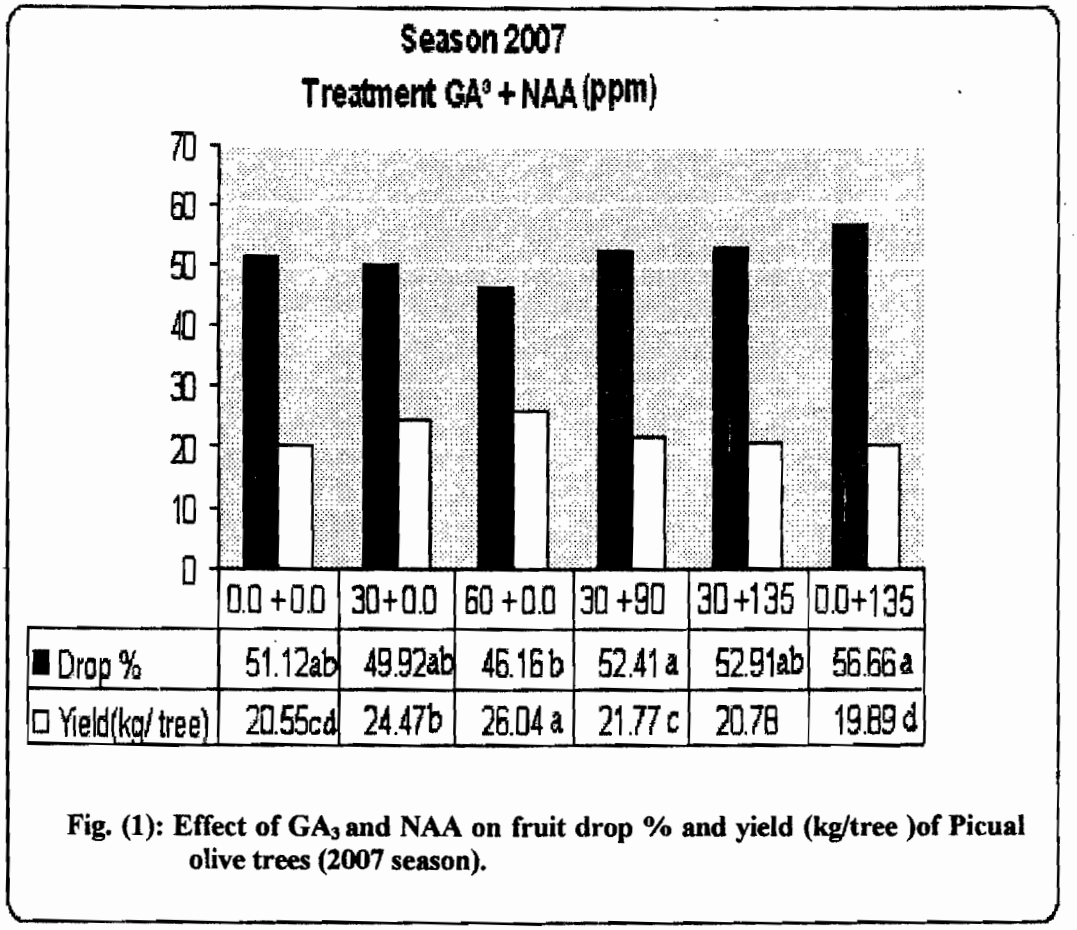


Fig. (1): Effect of GA_3 and NAA on fruit drop % and yield (kg/tree)of Picual olive trees (2007 season).

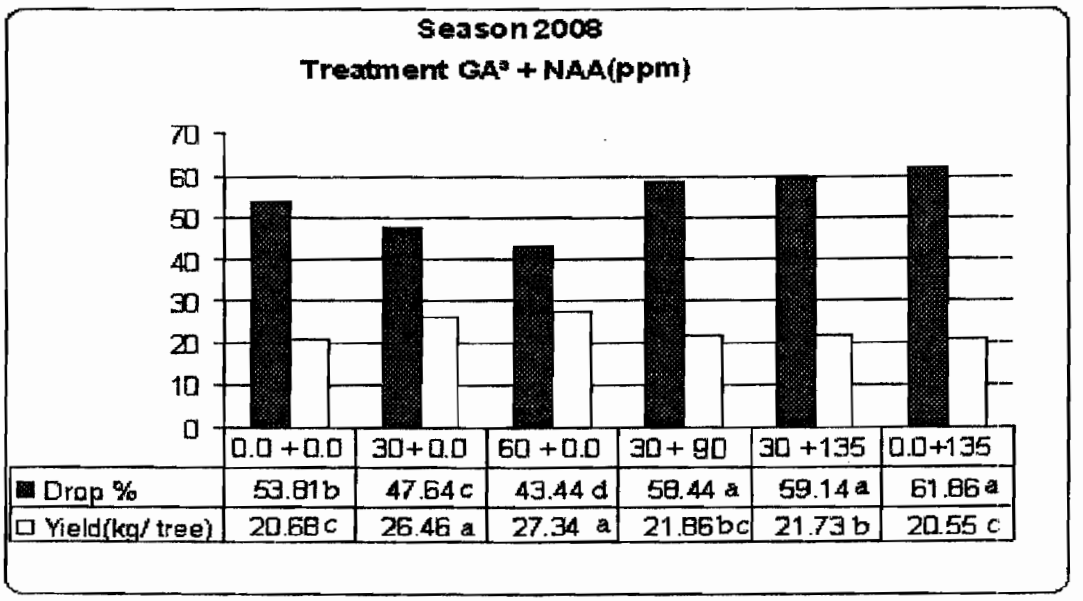


Fig.(2): Effect of GA_3 and NAA on fruit drop % and yield (kg/tree)of Picual olive trees (2008 season).

1.2. Yield (kg/tree)

Figs. (1 and 2) indicates that spraying Picual olive trees with GA_3 at any tested concentration increased tree yield where it attained maximum value when GA_3 concentration reached 60 ppm in comparison with other tested treatments and control. These results are in agreement with that obtained by Daood (2002) who cleared that spraying Picual olive trees with GA_3 at 25 or 100 ppm 10 days after fruit set significantly increased yield of trees. In addition, 40 up to110 GA_3 ppm significantly reduced fruit drop and increased fruit yield/tree. Our results in Figs. (1 and 2) indicated that foliar spray of Picual olive trees with NAA alone at 135 ppm insignificantly decreased tree yield (kg/tree) in the two tested seasons in comparison with control. These results may be acceptable with regard to the thinning effect of NAA especially at high concentration. These results are in harmony with that obtained by Barranco and Krueger (1990) on Manzanillo olive trees as they reported that spraying trees with NAA decreased tree yield. Data also clear that spraying Picual olive trees with a combination of GA_3 at 30 ppm and NAA at 90 or 135 ppm caused insignificant increase in fruit yield/tree in comparison with NAA alone or that of control treatment. The results indicated that slight insignificantly increase in fruit yield/tree was recorded by using combinations of NAA at 90 ppm and GA_3 at 30 ppm in comparison with that of NAA at 135 ppm combined with 30 ppm of GA_3. These results are in a harmony with those of El-Shewy (1999) who reported that spraying guava trees with combination of NAA and GA_3 led to an increase in fruit yield/ tree in comparison with control.

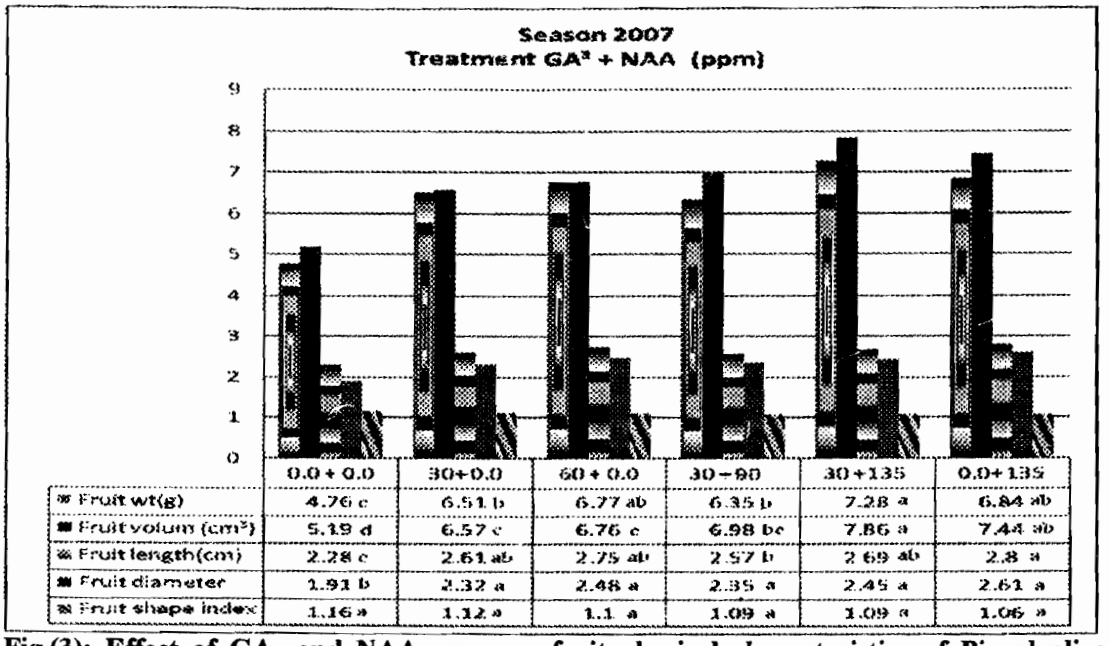
2. Fruit quality.

2.1. Fruit physical properties.

2.1.1. Fruit weight, volume, length and diameter.

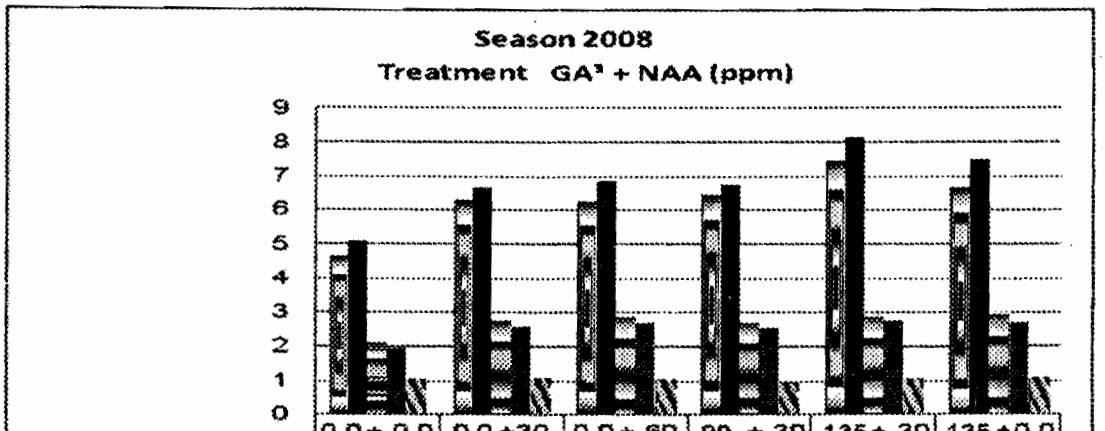
Figs. (3 and 4) clearly shows that spraying Picual olive trees 10 days after fruit setting with GA_3 at any tested concentration significantly increased fruit weight, volume, length and diameter than that of control treatment. The results also cleared that GA_3 at the two tested concentrations gave insignificant decrease in fruit shape index (length/ diameter ratio) and produced nearly round fruit due to higher growth rate of diameter than that of the control treatment. These results are in agreement with that of Daood, (2002) who reported that spraying Picual olive trees with 50 and 100 ppm increased the physical fruit parameters than control. The results in Figs.(3 and 4) also cleared that spraying Picual olive trees 10 days after fruit setting with NAA either individually or in combination with GA_3 increased fruit weight, volume, length and diameter than control treatment. These

results are in agreement with that obtained by Wang *et al.* (1997) on Apricot who cleared that NAA increased fruit diameter, volume and length but fruit shape index (length /diameter ratio) slightly changed with NAA treatments.



	0.0 + 0.0	30+0.0	60 + 0.0	30+90	30+135	0.0+135
Fruit wt(g)	4.76 c	6.51 b	6.77 ab	6.35 b	7.28 a	6.84 ab
Fruit volum (cm³)	5.19 d	6.57 c	6.76 c	6.98 bc	7.86 a	7.44 ab
Fruit length(cm)	2.28 c	2.61 ab	2.75 ab	2.57 b	2.69 ab	2.8 a
Fruit diameter	1.91 b	2.32 a	2.48 a	2.35 a	2.45 a	2.61 a
Fruit shape index	1.16 a	1.12 a	1.1 a	1.09 a	1.09 a	1.06 a

Fig.(3): Effect of GA_3 and NAA on some fruit physical characteristics of Picual olive trees(2007 season).



	0.0+ 0.0	0.0 +30	0.0+ 60	90 + 30	135+ 30	135+0.0
Fruit wt(g)	4.61 c	6.29 b	6.26 b	6.47 b	7.45 a	6.68ab
Fruit volum (cm³)	5.07 d	6.68 c	6.88bc	6.77 c	8.14 a	7.49ab
Fruit length(cm)	2.11 c	2.79 b	2.93 a	2.71 b	2.95 a	3 a
Fruit diameter	1.92 d	2.57 bc	2.7 ab	2.55 c	2.74 c	2.72 ab
Fruit shape index	1.09 ab	1.08 ab	1.07 ab	1.03 b	1.06 ab	1.11 a

Fig.(4): Effect of GA_3 and NAA on some fruit physical characteristics of Picual olive trees (2008 season).

2.1.2. Pulp %

Data of Fig (5 and 6) cleared that spraying Picual olive trees 10 days after fruit setting with GA_3 at any given concentration slightly increased fruit pulp % in comparison with control. These results are in agreement with that of Daood, (2002) who reported that spraying Picual olive trees 10 days after fruit setting with GA_3 increased pulp % in comparison with control. The increase in fruit pulp% with GA_3 may be due to the role of gibberellic acid in stimulating cell

enlargement of pulp tissues much more than the seed (Daood, 2002). On the other hand, data of Fig (5 and 6) indicated that using NAA alone at 135 ppm led to a big reduction in pulp % in comparison with control. This result is in agreement with that obtained by Navarro *et al.* (1990) on olive who cleared that NAA decreased pulp % compared with control. Combination between NAA at 90 or 135 ppm and GA_3 significantly improved pulp % in comparison with spraying NAA alone. This improving in fruit pulp % may be as mentioned above due to the role of gibberellic acid in stimulating cell enlargement of pulp tissues much more than the seed.

2.2. Fruit chemical properties.

2.2.1. TSS %.

+Data in Figs. (7 and 8) showed that TSS percentage of Picual olive cultivar significantly increased in the two seasons in comparison with control treatment, where they attained maximum level when the trees were sprayed with 60 ppm of GA_3. Regarding NAA, data in Figs. (7 and 8) also cleared that using NAA at 135 ppm led to a significant increase in TSS compared with other treatments including control. The data also indicated that adding GA_3 at 30 ppm to NAA either at 90 or 135 ppm led to a significant increase in TSS in comparison with control while insignificant difference was noticed between these treatments and GA_3. These results are in agreement with that of Brahmachari *et al.* (1996) who reported that TSS as well as TSS/ Acid ratio of Guava fruits were increased by spraying the trees with some growth retardants.

2.2.2. TSS/Acid ratio

Data in Figs. (7 and 8) showed that TSS/ acid ratio significantly increased in the two seasons in comparison with control treatment, where they attained maximum level when the trees were sprayed with 60 ppm of GA_3. Regarding NAA, data in Figs. (7 and 8) also cleared that using NAA at 135 ppm led to a significant increase TSS/Acid ratio compared with other treatments including control. The data also indicated that adding GA_3 at 30 ppm to NAA either at 90 or 135 ppm led to a significant increase in TSS/Acid ratio in comparison with control while insignificant difference was noticed between these treatments and GA_3. These results are in agreement with that of Brahmachari *et al.* (1996) who reported that TSS/ Acid ratio of Guava fruits were increased by spraying the trees with some growth retardants.

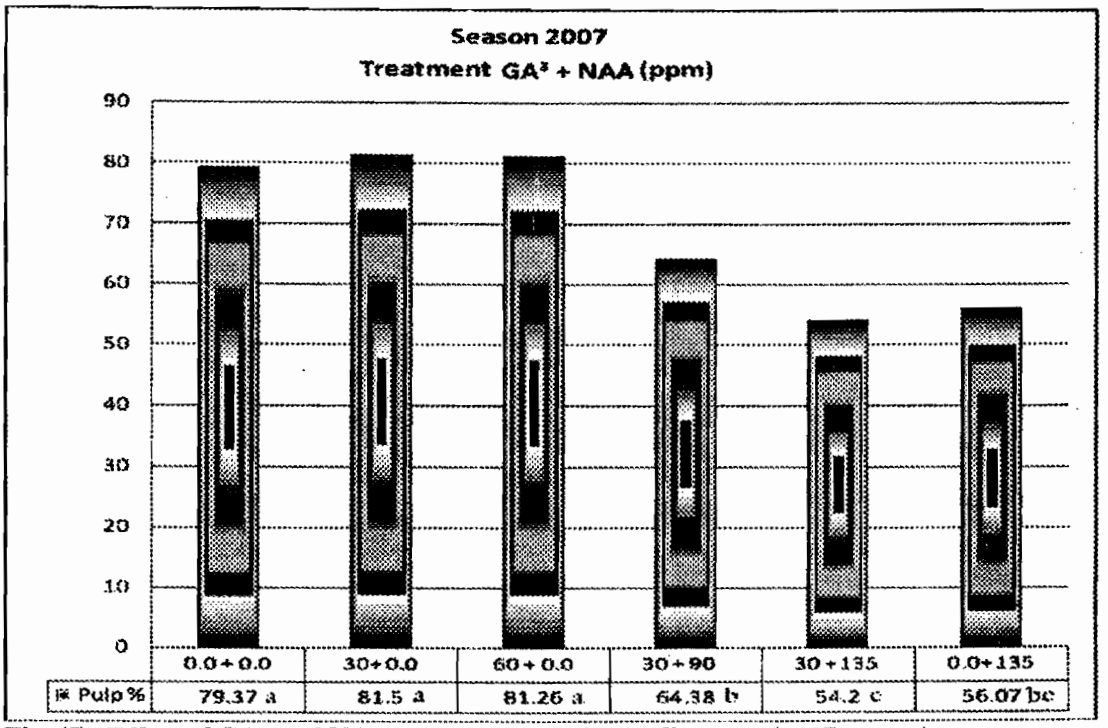


Fig. (5): Effect of GA_3 and NAA on pulp % of Picual olive trees(2007 season).

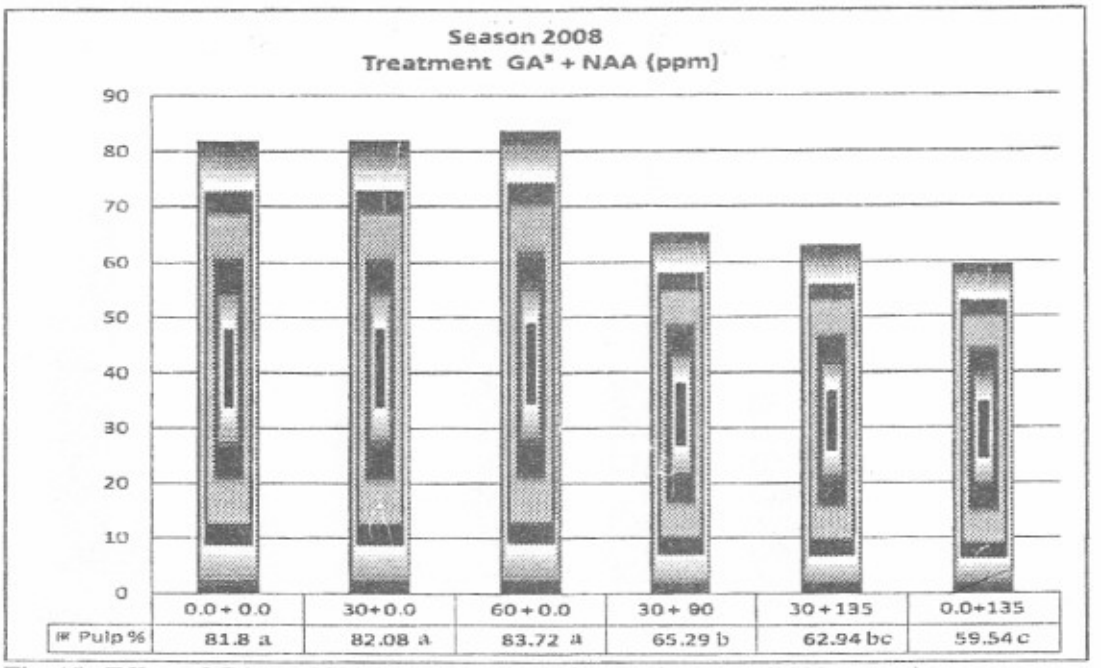


Fig. (6): Effect of GA_3 and NAA on pulp% of Picual olive trees (2008 season).

2.2.3. Oil content (% of d.wt).

The results in Figs. (7 and 8) also showed that oil content of Picual olive treas increased by spraying the trees with GA_3. Higher concentration of GA_3 (60ppm) increased fruit oil content more than did 30 ppm GA_3 in both seasons. The results are in agreement with that obtained by Lazovic *et al.* (1998) on Manzanillo olive trees and with that of Daood (2002) on Picual olive trees, who reported that GA_3 greatly increased fruit oil percentage compared with control. Data presented in Figs.(7 and 8) also cleared that oil content of Picual olive treas increased by spraying the trees with NAA either alone or in combination with GA_3. Similar results were obtained regarding NAA where Eris and Barut (1993) on Manzanillo olive trees and Daood, (2002) on Picual olive trees reported that NAA treatments greatly increased fruit oil %.

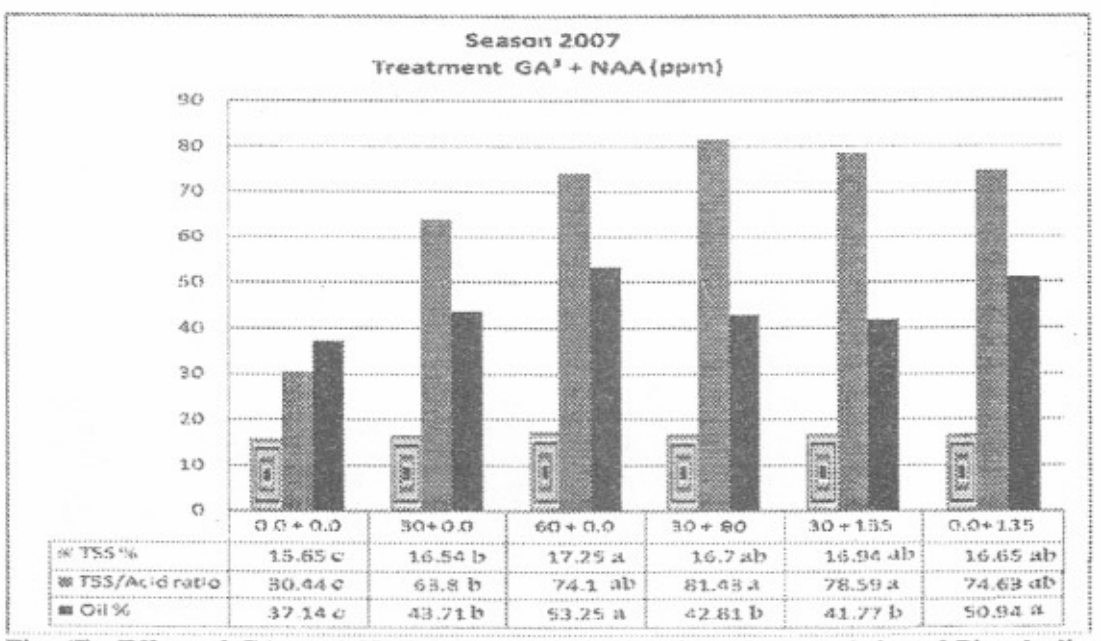
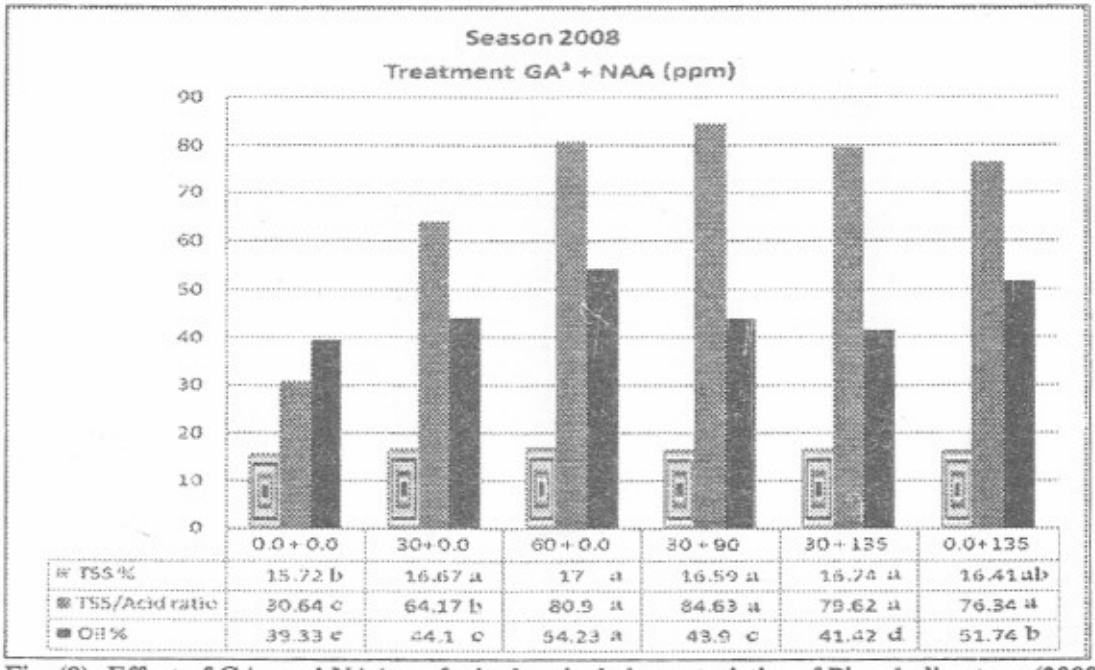


Fig. (7): Effect of GA_3 and NAA on some fruit chemical characteristics of Picual olive trees(2007 season).

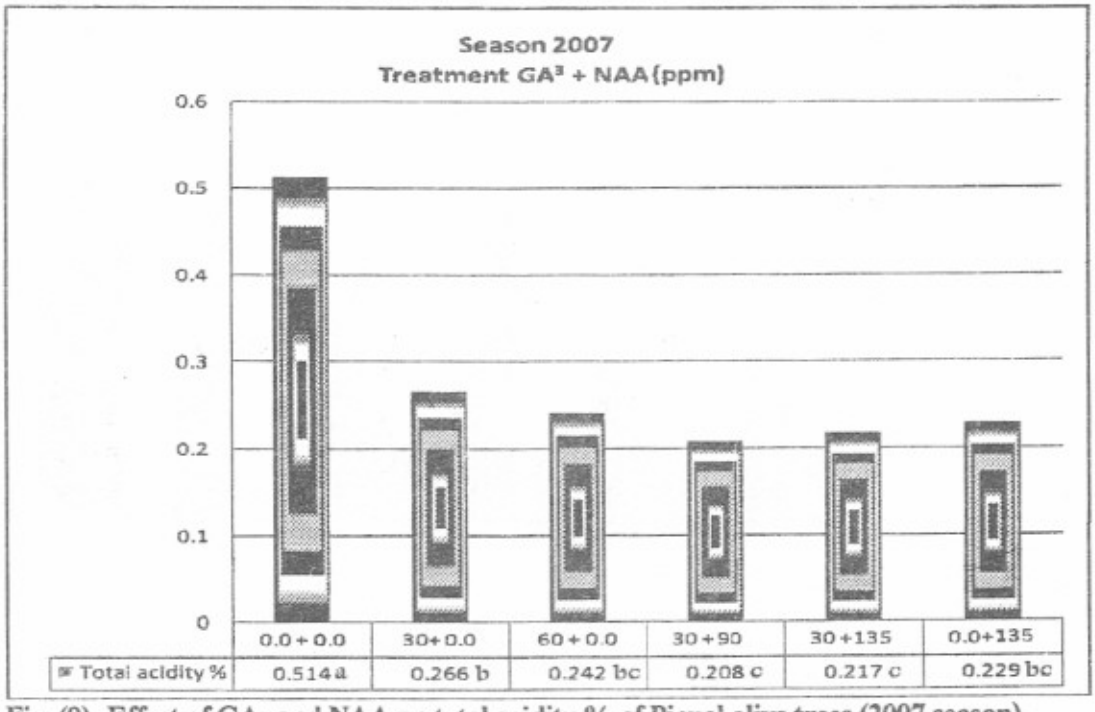


	0.0+0.0	30+0.0	60+0.0	30+90	30+135	0.0+135
TSS%	15.72 b	16.67 a	17 a	16.59 a	16.74 a	16.41 ab
TSS/Acid ratio	30.64 c	64.17 b	80.9 a	84.63 a	79.62 a	76.34 a
Oil%	39.33 e	44.1 c	54.23 a	43.9 c	41.42 d	51.74 b

Fig. (8): Effect of GA_3 and NAA on fruit chemical characteristics of Picual olive trees(2008 season).

2.2.4. Ttotal acidity %

Data in Fig.(9 and 10) showed that spraying Picual olive trees 10 days after fruit setting with GA_3, NAA either individually or in a combination at all tested concentrations led to a decrease in total acidity%. In this regard NAA treatment recorded the least total acidity % in comparison with control and other treatments. These results are in agreement with that of Brahmachari *et al.* (1996) who reported that TSS as well as TSS/ Acid ratio of Guava fruits were increased by spraying the trees with some growth retardants.



	0.0+0.0	30+0.0	60+0.0	30+90	30+135	0.0+135
Total acidity %	0.514 a	0.266 b	0.242 bc	0.208 c	0.217 c	0.229 bc

Fig. (9): Effect of GA_3 and NAA on total acidity % of Picual olive trees (2007 season).

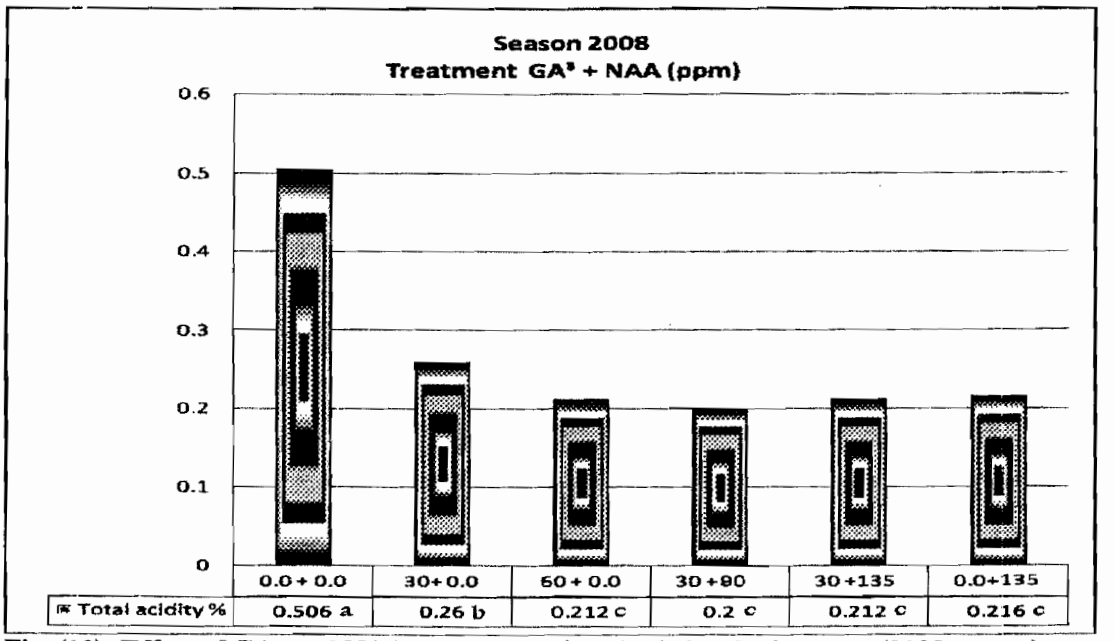


Fig. (10): Effect of GA_3 and NAA on total acidity % of Picual olive trees (2008 season).

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تأثير بعض منظمات النمو علي المحصول وصفات جودة الثمار في صنف الزيتون البيكوال

جمال عبدربه السيد عبدربه
قسم البساتين – كلية الزراعة – جامعة الازهر بالقاهرة

أجرى هذا البحث فى مزرعة خاصة بمنطقة برقاش بمحافظة الجيزة خلال عامى ٢٠٠٧ و٢٠٠٨ على اشجار زيتون متماثلة فى نموها وإثمارها (صنف البيكوال) عمر ١٠ سنوات نامية فى ارض رملية على مسافة ٦ x ٥ م لدراسة تأثيرالرش بحمض الجيربليك وكذلك نفتالين حمض الخليك اما منفردين أو فى صورة خلائط على المحصول و جودة الثمار واشتملت الدراسة على المعاملات الاتية:-
١. المقارنة بالرش بماء الصنبور ٢. الرش بالجبرالين بتركيز ٣٠ و ٦٠ جزء /المليون ٣. الرش بالجبرالين بتركيز ٣٠ جزء /المليون مدعما بنفثالين حمض الخليك بتركيز ٩٠ جزء /المليون ٤. الرش بالجبرالين بتركيز ٣٠ جزء /المليون مدعما بنفثالين حمض الخليك بتركيز ١٣٥ جزء /المليون ٥. الرش بنفثالين حمض الخليك بتركيز ١٣٥ جزء /المليون. وتم الرش بعد عشرة ايام من عقد الثمار. وقد اوضحت النتائج ما يلى:

- استخدام حمض الجبريليك رشا على الاشجار بتركيز ٦٠ جزء فى المليون أدى الى تقليل تساقط الثمار الى اقل نسبة بالمقارنة بكل المعاملات الاخرى بما فيها الاشجار التى لم تعامل.
- أكبر محصول (كجم/ شجرة) تم الحصول عليه عند استخدام حمض الجبرليك بتركيز ٦٠ جزء فى المليون مقارنة بالمعاملات الاخرى بما فيها الاشجار التى لم تعامل.
- افضل وزن وحجم للثمار تحصل عليها عند استخدام خليط من حمض الجبريليك بتركيز ٣٠ جزء فى المليون ونفتالين حمض الخليك بتركيز ١٣٥ جزء فى المليون.
- أعطت المعاملة بنفتالين حمض الخليك منفردا بتركيز ١٣٥ جزء فى المليون أفضل النتائج بالنسبة لطول وقطر الثمرة مقارنة بالمعاملات الآخرى .
- رش الاشجار بحمض الجبريليك بتركيز ٦٠ جزء/ المليون أدى الى أكبر زيادة فى نسبة اللب للثمرة مقارنة بالمعاملات الآخرى.
- جميع المعاملات أدت الى زيادة نسبة المواد الصلبة الذائبة وكذلك نسبة المواد الصلبة الذائبة /الحموضة بينما أدت الى انخفاض نسبة الحموضة مقارنة بالاشجار التى لم تعامل.

أفضل نسبة للزيت بالثمارظهرت عند رش الآشجار بحمض الجبريليك بتركيز ٦٠ جزء فى المليون بالمقارنة بالمعاملات الاخرى