

## **EFFECT OF GA<sub>3</sub> AND IAA SPRAYS ON VEGETATIVE GROWTH, TOTAL YIELD AND PHOTOSYNTHETIC PIGMENTS IN STRAWBERRY (*Fragaria ananassa*)**

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### **ABSTRACT**

Studies on growth, yield and photosynthetic pigments in strawberry were carried out under greenhouse conditions in research station of KFU during the two seasons of 1997/1998 and 1998/1999, using GA<sub>3</sub> (50, 100 and 150 ppm) and IAA (100, 200 and 300 ppm). All treatments gave significantly increase in number of leaves per plant, dry / fresh weight ratio, number of runners per plant, number of fruits per plant, average weight of fruit (gm), weight of fruits per plant, fruit weight per meter square, total soluble solid, chlorophyll a, b, total chlorophyll, chlorophyll a / b as compared with control. GA<sub>3</sub> at 150 ppm gave highest increase in all measures of strawberry fruits, while total fruit yield per square meter was clearly increased, after foliar application with GA<sub>3</sub> at 150 ppm and the second treatment with IAA at 200 ppm. Total chlorophyll a + b and chlorophyll b contents were increased after spraying with GA<sub>3</sub> at 150 ppm. However, chl. A/ b was shifted towards chl. A, in untreated strawberry plants. Finally GA<sub>3</sub> application at 150 ppm could be useful for enhancing strawberry fruit yield and its quality.

### **INTRODUCTION**

Strawberry plant is usually grown in the Kingdom of Saudi Arabia under greenhouse conditions. Strawberry plant is one of the new crops in Saudi Arabia. Perusal of available literature concerning GA<sub>3</sub> and IAA application on strawberry. However several investigators have used both chemical successfully for improving strawberry yield. Choma and Himelrick (1984) found that GA<sub>3</sub> at 50 mg / l increased fruit yield and leaf number. In respect of GA<sub>3</sub> application, Danek (1984) showed that GA<sub>3</sub> application increased runner and yield compared with the control of strawberry, Okasha *et al.* (1985) came to comparable result, Lopez *et al.* (1989) found that application of GA<sub>3</sub> at rates of 20 - 80 ppm were increased earliness, productivity, fruit size of strawberry. Miranda *et al.* (1990) found that application of GA<sub>3</sub> and IAA on strawberry plants increased plant morphological characteristics and fruit yield. On the other hand GA<sub>3</sub> at 50, 100 or 200 ppm increased vegetative growth, flowering, fruit yield and increased strawberry fruit anthocyanin content. This study was conducted to determine the effect of GA<sub>3</sub> and IAA on vegetative, fruit quality, total yield and pigments concentration of strawberry plant.

## **MATERIALS AND METHODS**

Two experiments were carried out during the two successive seasons of 1997/1998 and 1998/1999 at the research station in greenhouse, King Faisal University. The cultivar (Chandler) was used, the strawberry seedlings were transplanted on 11<sup>th</sup> September 1997 and 1998, respectively. A complete randomized blocks design with 4 replicates was used. The chemicals used were GA<sub>3</sub> (50, 100 and 150 ppm) and IAA (100, 200 and 300 ppm). The plants were sprayed with each chemical three times, after 30, 60 and 90 days from transplanting, respectively. A control treatment was sprayed with tap water. The plot area was 2.4 x 6 m containing 4 ridge, 0.6 m apart and 6 m long. The planting was done on two sides of ridge and the space between plants was 25 cm. The soil of the experiment was sand, the normal cultural practices were followed according to Agricultural Ministry recommendations. The following data were recorded, number of leaves per plant, dry / fresh weight ratio, number of fruits per plant, average fruit weight, fruits yield per meter square in addition. T.S.S. in fruits and photosynthetic pigments in third leaf from plant top were determined in plant representative sample taken at harvest time (10 plants from each plot) TSS was extracted by using handling refractometer and photosynthetic pigments were extracted in acetone 80 % and measured colorimetrically according to Aranon (1949). The obtained data were statistically analyzed according to the procedure, outlined by Gomez and Gomez (1983).

## **RESULTS AND DISCUSSION**

### **Vegetative growth**

Data in Table (1) show that GA<sub>3</sub> application at 150 ppm caused remarkable increase in number of leaves per plant, and dry / fresh weight %. Moreover, IAA at 200 ppm induced a significant increase in the number of runners per plant as compared with control. The results reported in this study are in line with those found by Choma *et al.* (1984); Danek (1984), Okasha *et al.* (1985), they found that GA<sub>3</sub> gave the best result for all growth parameter of strawberry plants. In addition, Miranda *et al.* (1990) found that GA<sub>3</sub> and IAA application gave increase in plant morphological characteristics of strawberry. Thalkur *et al.* (1991) found that GA<sub>3</sub> at 50, 100 or 200 ppm gave an increase in leaf number / plant (7.2) and leaf area of strawberry such results could be based on the fact that GA<sub>3</sub> and IAA induce cell division and elongation (Hess 1975).

### **Yield and its components**

Table (2) show that GA<sub>3</sub> at 150 and IAA at 200 ppm significantly increased number of fruits per plant, average weight of fruit (g), weight of fruits per plant, fruit weight per meter square and TSS %, respectively, as compared with control. In addition all growth substances treatments markedly

increased fruit yield, especially, GA<sub>3</sub> at 150 ppm, similar results was also obtained by Tian *et al.* (1997) who found that IAA foliar application was increased ethylene production, early yield. Ozguven and Kaska (1990) showed that GA<sub>3</sub> applications increased fruit yield of strawberry. Choma and Himelerick (1984) reported that GA<sub>3</sub> at 50 and 100 g /l increased fruit strawberry yield under greenhouse condition. Okasha *et al.* (1985) showed that GA<sub>3</sub> applications increased total fruit yield of strawberry. Lopez *et al.* (1989) found that applications of GA<sub>3</sub> (at rates of 20 - 80 ppm) were increased fruit strawberry yield, earliness, productivity, fruit size. On the other hand, Miranda *et al.* (1990) found that GA<sub>3</sub> application increased total strawberry yield and its components. The increases in yield due to GA<sub>3</sub> and IAA applications may be attributed to an increase in leaf number per plant, and / or to an increase in fruit number and average weight per plant and fruits weight.

**Table (1): Effect of GA<sub>3</sub> and IAA sprays on number of leaves per plant, dry/fresh weight %, number of runners per plant of strawberry during 1997/1998 and 1998/1999 seasons.**

Treatments	No. of leaves/plant	Dry/fresh weight %	No. of runners/plant
<b>Average two seasons</b>			
Control	6.33	10.33	1.66
GA <sub>3</sub> 50 ppm	7.66	15.66	2.33
GA <sub>3</sub> 100 ppm	8.33	13.66	2.33
GA <sub>3</sub> 150 ppm	11.00	16.00	4.00
IAA 100 ppm	8.66	12.33	3.33
IAA 200 ppm	9.33	14.33	5.00
IAA 300 ppm	7.66	12.33	4.33
LSD at 5 %	1.23	1.73	0.84

**Table (2): Effect of GA<sub>3</sub> and IAA sprays on average number of fruits per plant, average weight of fruit, average weight of fruits per plant, average of fruit weight/m<sup>2</sup> and TSS of strawberry during 1997/1998 and 1998/1999 seasons.**

Treatments	No. of fruits/plant	Average weight of fruit (g)	Weight of fruits/plant	Fruit weight/m <sup>2</sup>	TSS
<b>Average two seasons</b>					
Control	5.66	17.76	100.00	1000.00	4.600
GA <sub>3</sub> 50 ppm	7.66	17.96	136.66	1366.00	5.50
GA <sub>3</sub> 100 ppm	7.66	19.06	146.66	1466.66	6.00
GA <sub>3</sub> 150 ppm	9.00	21.76	195.00	1950.00	6.76
IAA 100 ppm	8.00	20.70	163.33	1666.66	5.56
IAA 200 ppm	8.66	20.20	175.00	1750.00	6.20
IAA 300 ppm	8.33	20.83	173.00	1735.33	5.76
LSD at 5 %	1.28	3.944	19.329	184.65	0.53

### **Photosynthetic pigments**

Chlorophyll b and total chlorophyll significantly increased in case of GA<sub>3</sub> at 150 ppm (Table 3). The results showed that IAA at 100 ppm increased chlorophyll a, similar results was also obtained by Hall *et al.* (1974) who found that IAA at 100 ppm increased chl a, b on the other hand, Thakur *et al.* (1991) showed that GA<sub>3</sub> at 200 ppm increased fruit anthocyanin content of strawberry. From the results discussed above, GA<sub>3</sub> at 150 ppm and IAA at 200 ppm proved to be the best for increasing strawberry production.

**Table (3): Effect of GA<sub>3</sub> and IAA sprays on photosynthetic pigments in leaves f strawberry during 1997/1998 and 1998/1999 seasons.**

<b>Treatments</b>	<b>Chl. (a) mg/g F.W</b>	<b>Chl. (b) mg/g F.W</b>	<b>Chl. (a+b) mg/g F.W</b>	<b>Chl. a/b mg/g F.W</b>
<b>Average two seasons</b>				
Control	0.300	0.295	0.595	1.017
GA <sub>3</sub> 50 ppm	0.380	0.303	0.685	1.270
GA <sub>3</sub> 100 ppm	0.353	0.370	0.725	0.958
GA <sub>3</sub> 150 ppm	0.375	0.390	0.765	0.961
IAA 100 ppm	0.391	0.373	0.741	1.049
IAA 200 ppm	0.375	0.345	0.730	1.086
IAA 300 ppm	0.300	0.325	0.625	0.922
LSD at 5 %	0.014	0.012	0.033	0.045

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## تأثير حمض الجبريليك واندول حمض الخليك على النمو الخضري والمحصول الكلي والصبغات في الفراولة (الشليك)

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أجريت دراسات على النمو والمحصول والصبغات النباتية في الفراولة وذلك تحت ظروف البيوت المحمية في محطة الابحاث الخاصة بجامعة الملك فيصل خلال موسمي 1998/1997 ، 1999/1998 ، مستخدما حمض الجبريليك بتركيزات 50 ، 100 ، 150 جزء في المليون و اندول حمض الخليك بتركيزات 100 ، 200 ، 300 جزء في المليون .

أشارت النتائج إلى أن جميع المعاملات أعطت زيادة معنوية في عدد الأوراق لكل نبات - نسبة الوزن الجاف / الطازج - عدد السيقان المدارة لكل نبات - عدد الثمار لكل نبات - متوسط وزن الثمرة بالجرام - متوسط وزن الثمار للنبات - متوسط وزن الثمار في المتر المربع - المواد الصلبة الكلية - كلوروفيل أ ، ب - الكلوروفيلات الكلية - كلوروفيل أ / ب وذلك بالمقارنة بالكنترول.

أعطى حمض الجبريليك بتركيز 150 جزء في المليون زيادة في جميع القياسات الخاصة بثمار الفراولة ، بينما أشارت النتائج أن الزيادة في المحصول الكلي من الثمار في المتر المربع كان واضحا بعد الرش بحمض الجبريليك بتركيز 150 جزء في المليون بينما احتل الرش باندول حمض الخليك المرتبة الثانية وذلك بتركيز 200 جزء في المليون.

بينما أوضحت النتائج أن الزيادة في محتوى الأوراق من الكلوروفيلات الكلية أ + ب وكلوروفيل ب كانت بعد الرش بالجبريلين بتركيز 150 جزء في المليون وأكثر من ذلك كلوروفيل أ / ب كانت في اتجاهه كلوروفيل أ وذلك في النباتات الغير معاملة.

أخيرا: الرش باستخدام حمض الجبريليك بتركيز 150 جزء في المليون أعطى أفضل نتائج لزيادة ثمار الفراولة وجودتها.