# Effect of Spraying Salicylic Acid on Fruiting of Valencia Or Trees

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## ABSTRACT

Growth characters, tree nutritional status, fruit set %, June drop %, yield and fruit quality of Valencia orange response to spraying salicylic acid at 0.0 to 400 ppm either applied once at growth start or twice at growth start a just after fruit setting were investigated during 2012 /2013 and 2013/ 2014 seasons.

Spraying salicylic acid at 100 to 400 ppm once or twice considerably improved all growth characters , leaf p N, P, K, Mg and Ca percentages, initial fruit set %, fruit retention %, yield and fruit quality over the check treatn salicylic acid treatments effectively reduced June drop. Using salicylic acid at 400 ppm once or twice caused a sig reduction on all the aforementioned parameters comparing with using salicylic acid at 100 to 200 ppm. Two s salicylic acid were preferable than using it once in this connection.

Treating Valencia orange trees twice at growth start and just after fruit set with salicylic acid at 200 p responsible for promoting yield and fruit quality.

**Key words: Salicylic acid, growth, fruiting, Valencia orange trees.**

## INTRODUCTION

Recently, many trials were accomplished for promoting yield and fruit quality of Valencia orange trees grown successfully under Middle Egypt conditions by using non- traditional horticultural practices such as application of salicylic acid. Ding *et al.,* (2001); Ding and Wang (2003) and Hayat and Ahmed (2007) found that salicylic acid was responsible for protecting the plants from all stresses and retarding reactive oxygen forms that destroyed the plant cells. They found that treating the trees with salicylic acid was very effective in enhancing metabolism of plants and the biosynthesis of all organic food. Using salicylic acid at 50 to 400 ppm once, twice, or three times was very effective in improving growth, yield and fruit quality in most evergreen fruit crops (Ahmed, 2011; Abd El-Rahman and El- Masry, 2012; Ahmed *et al.,* 2014 and 2015a & b, Omar, 2015 and Abd El- Mageed, 2015).

The target of this study was examining the impact of spraying different concentrations and frequencies of salicylic acid on growth, tree nutritional status, fruit set %, June fruit drop %, yield and fruit quality of Valencia orange trees.

Recently, many trials were accomplished for promoting yield and fruit quality of Valencia orange trees grown successfully under Middle Egypt conditions by using non- traditional horticultural practices such as application of salicylic acid. Ding *et al.,* (2001); Ding and Wang (2003) and Hayat and Ahmed (2007) found that salicylic acid was responsible for protecting the plants from all stresses and retarding reactive oxygen for destroyed the plant cells. They found that the trees with salicylic acid was very effe enhancing metabolism of plants and the biosy of all organic food. Using salicylic acid at 5( ppm once, twice, or three times was very e in improving growth, yield and fruit quality evergreen fruit crops (Ahmed, 2011; A Rahman and El- Masry, 2012; Ahmed *et a* and 2015a & b, Omar, 2015 and Abd El- M 2015).

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## MATERIALS AND METHODS

This study was carried out during 201 and 2013/ 2014 seasons on twenty one unif similar in vigour 15- years old Valencia oran onto sour orange rootstock. The selected tre grown in a private citrus orchard located Saleh Island near Bany Suef city, Ban governorate. The trees were planted at 6x6 apart. The texture of the soil was silty clay water table not less than two meters deep. irrigation system was carried out using Nile The selected trees were subjected to the horticultural practices that already applied orchard.

This experiment included the followin treatments:

1-Control (-untreated trees).

2-Spraying salicylic acid –at 100 ppm once at growth start (1st week of Mar.)
3-Spraying salicylic acid at 200 ppm once at growth start (1st week of Mar.)
4-Spraying salicylic acid at 400 ppm once at growth start (1st week of Mar.)
5-Spraying salicylic acid at 100 ppm twice at growth start (1st week of Mar.) and again just after fruit set ( 1st week of May).
6-Spraying salicylic acid at 200 ppm twice as mentioned in treatment 5.
7-Spraying salicylic acid at 400 ppm twice as mentioned in treatment 5.

Each treatment was replicated three times, one tree per each. The assigned amounts of salicylic acid were solubilized in ethyl alcohol and pH of the solution was adjusted to 6.0 by using 1.0 N sodium hydroxide. Triton B as a wetting agent at 0.05 % was added to all salicylic acid solutions. Randomized complete block design was followed.

During both seasons, the following measurements were carried out.

1-Some vegetative growth characters namely shoot length(cm), shoot thickness (cm) and leaf area $(cm)^2$ (Ahmed and Morsy, 1999) in the Spring growth cycle.
2-Leaf pigments namely chlorophylls a & b, total chlorophylls and total carotenoids (as mg/ 100 g F.W.) (Hiscox and Isralstam, 1979).
3-Percentages of N, P, K, Mg and Ca in the leaves of non fruiting shoots in the spring growth cycle (Summer, 1985 and Wilde *et al.*, 1985).
4-Percentages of initial fruit setting–, June fruit dropping and fruit retention
5-Yield expressed in weight / tree (kg.) and number of fruits / tree.
6-Physical characters of the fruits namely weight (g.), volume ($cm^3$), height and diameter (cm) of fruit, percentages of fruit peel weight and pulp and fruit peel thickness(cm).
7-Chemical characteristics of the fruits namely T.S.S. %, total acidity % ( as g citric acid/ 100 ml juice., total and reducing sugars % and vitamin C ( as mg / 100 ml juice, (Lane and Eynon 1965 and A.O.A.C., 2000).

Statistical analysis was done using new L.S.D. at 5% for making all comparisons among the seven treatments means (Mead *et al.*, 1993).

## RESULTS AND DISCUSSION.

**1- Growth characters:**

Data in Table(1) revealed that spraying salicylic acid at 100 to 400 ppm once at growth start or twice at growth start and just after fruit set significantly stimulated shoot length and thickness and leaf area relative to the control treatment. The promotion was significantly associated with increasing concentrations from 0.0 to 200 ppm. A significant reduction on such three growth characters was observed with increasing concentration from 400 ppm. Carrying out two sprays of salicy at 100 to 400 ppm was significantly superi using it once in stimulating all growth ch The maximum values were recorded on th that received two sprays of salicylic acid ppm. The vice versa was obtained on u trees. These results were true during both sea

**2- Pigments and nutrients in the leaves:**

It is clear form the obtained data in Tab 2) that chlorophylls a & b, total chlorophyl carotenoids as well as percentages of N, P, and Ca in the leaves were significantly enha response to foliar application of salicylic aci to 400 ppm once or twice rather than the treatment. There was a gradual and sig promotion on these plant pigments and n with increasing concentrations from 0.0 to 2( Increasing concentration from 200 to 40 caused a significant reduction in these value applications of salicylic acid at the concentrations significantly enhanced thes pigments and nutrients rather than using on Treating Valencia orange trees twice with s acid at 200 ppm gave the greatest values. The values were recorded on untreated trees. results were true during both seasons.

**3- Percentages of initial fruit setting retention and June drop.**

It is noticed from the data in Table carrying out one or two sprays of salicylic 100 to 400 ppm significantly was accompani improving the percentages of initial fruit fruit retention and reducing the percentage drop over the check treatment. The effe significantly depended on increasing concen from 0.0 to 200 ppm. Using salicylic acid ppm was significantly associated with r percentages of initial fruit set and fruit retent increasing the percentages of June drop o application of salicylic acid at 100 to 200 Application of salicylic acid twice prementioned concentrations significantl preferable than using it once in improving fruit set and fruit retention and reducing Jun A significant reduction on initial fruit set a retention and promotion in June drop were o with increasing salicylic acid concentratio 200 to 400 ppm regardless the frequen application. The maximum values of initial (6.3 & 6.9 %), and fruit retention (1.38 & were recorded on the trees that received two of salicylic acid at 200 ppm. Under such p treatment, the lowest June drop values (0.5 %) were recorded. The untreated trees produ lowest values of initial fruit set (2.7 & 3.8 fruit retention



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(1.18 and 1.15 %) and the highest June drop (1.1 & 1.4 %) during 2013 % 2014 seasons, respectively. These results were true during both seasons.

**4- Yield/ tree:**

Yield expressed in weight (kg.) and number of fruits / tree as shown in Table (3) was significantly improved owing to using salicylic acid once or twice at 100 to 400 ppm comparing to the check treatment. The promotion on the yield expressed in weight was significantly related to increasing concentrations of salicylic acid from 0.0 to 200 ppm. A significant reduction in the yield expressed in weight and number of fruits/ tree was observed with increasing concentration of salicylic acid form 200 to 400 ppm regardless the number of sprays. Using salicylic acid twice significantly was preferable in improving the yield than using it once. The maximum values of yield (52.0 & 52.5 kg) during both seasons, respectively, were recorded on the trees that received two sprays of salicylic acid at 200 ppm. The untreated trees produced the minimum values (36.6 & 38.0 kg) during both seasons, respectively. The percentages of increase in the yield due to using the promised treatment over the check treatment reached 34.7 and 38.2 % during 2012/2013 and 2013/2014 seasons, respectively. These results were true during both seasons.

**5- Fruit quality:**

It is clear from the data in Tables (4 & 5) that treating Valencia orange trees once or twice with salicylic acid at 100 to 400 significantly was very effective in improving fruit quality in terms of increasing weight, size, height and diameter of fruit , pulp %, T.S.S.%, total and reducing sugars % and vitamin C content and reducing fruit peel weight %, fruit peel thickness and total acidity % over the control treatment. Increasing concentrations form 200 to 400 ppm regardless the frequencies of application had undesirable effects on fruit quality. The best results were obtained due to carrying out two sprays of salicylic acid when compared with using one spray. Significant differences for all quality parameters were observed among all salicylic acid concentrations. The best results were obtained due to treating the trees twice with salicylic acid at 200 ppm. Untreating the trees with salicylic acid gave worst effects on the fruit quality. These results were true during both seasons.

The beneficial effects of salicylic acid on stimulating growth characters might be attributed to its essential roles in enhancing cell division and the biosynthesis of organic foods and plant pigments (Hayat and Ahmed, 2007). The beneficial effects of salicylic acid on plant metabolism and uptake and translocation of nutrients (Ding *et al*., 2001) could result in enhancing plant pigments and different nutrients. The outstanding positive action of salicylic acid on enhancing C/N in favour of enhancing flowering as well as the tolerance of plants to all stresses as well as its effe reducing June drop could explain its eff enhancing initial fruit set and fruit retentio and Wang, 2003). The promoting effect of s acid on improving initial fruit set and fruit r as well as reducing June drop could interp positive action on the yield. The promoting e salicylic acid on the biosynthesis and trans of plant pigments and Mg could explain the action of it on fruit quality.

These results are in agreement with obtained by Ahmed (2011); Abd El- Rahm El- Masry (2012); Ahmed *et al*., (2014), (2 b); Omar (2015) and Abd El-Mageed (20 different evergreen fruit crops.

## CONCLUSION

The best results with regard to yield a quality of Valencia orange trees were obtai to treating the trees twice at growth start an just after fruit set with salicylic acid 200 ppm

~~**1- Yield/ vine:**~~

~~Data in Table (1) clearly show that s clusters of Early sweet grapevines with $GA_3$ 40 ppm or Sitofex at 2.5 to 10 ppm was signi effective in improving the yield relative to th treatment. The promotion on the yiel accompanied with increasing concentrations plant growth regulator. Using $GA_3$ at 10 to significantly preferable than using Sitofex a 10 ppm in improving the yield. A slig unsignificant promotion on the yield was at to increasing concentrations of $GA_3$ from 2 ppm and Sitofex from 5 to 10 ppm. The m yield was produced on the vines that recei spray of $GA_3$ at 40 ppm but the best treatme economical point of view was the applic $GA_3$ at 20 ppm (since no measurable promo the yield was recorded between 20 and 40 $GA_3$). Under such promised treatment, yiel reached 13.6 and 14.0 kg during both respectively. The control vines produced 9.1 kg during 2013 and 2014 seasons, respectiv percentage of increase on the yield application of $GA_3$ at 20 ppm over the treatment reached 49.5 and 45.8 % duri seasons, respectively. The beneficial effects on the yield might be attributed to their action on increasing cluster weight. The pr effects of $GA_3$ on the yield was supported results of Dimovska *et al*., (2011) and Abu and Salameh (2012) on different grapevine c~~

~~The results regarding the beneficial ef Sitofex on enhancing the yield are in harmo those obtained by Juan *et al*. (2009); Abdel *et al*., (2010) and Al Obeed (2011).~~

~~**2- Harvesting date:**~~

~~It is clear from the data in Table (1) that and Sitofex treatments had significantly del~~

the harvesting date of Early Sweet grapevines rather than the control treatment. The degree of delayness on harvesting date was correlated to the increase of the concentrations of both $GA_3$ and Sitofex. Using $GA_3$ significantly delayed harvesting date comparing with using Sitofex. Increasing concentrations of $GA_3$ from 20 to 40 ppm and Sitofex form 5 to 10 ppm failed to show significant delay on harvesting date. A considerable advancement on harvesting date was observed on untreated vines the great delay on harvesting date was observed on the vines that received $GA_3$ at 40 ppm during both seasons. $GA_3$ and Sitofex were shown by many authors to retard the release of ethylene and the disappearance of pigments such as chlorophylls and carotenoids and onest of maturity start. Also they were responsible for prolonging pre-maturity stages Nickell (1985). These results regarding the delaying effect of $GA_3$ and Sitofex on harvesting date were in harmony with those obtained by Wassel *et al*., (2007), Kassem *et al.* (2011), Abu Zahra and Salameh (2012) and Refaat *et al*. (2012).

**3- Cluster weight and dimensions:**

It is evident from the data in Table (1) that treating clusters with $GA_3$ at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm was significantly accompanied with enhancing weight, length and width of cluster relative to the control treatment.

was a slight reduction on such unfav
phenomenon with increasing concentrations
form 20 to 40 ppm and Sitofex from 5 to 1
The minimum values of shot berries (7.3 an
during both seasons, respectively) were reco
the clusters harvested from vines treated wi
at 40 ppm. The maximum values of shot
(12.0 & 12.5 %) during both seasons were r
on the untreated vines during both seasor
reducing effect of $GA_3$ on shot berries m
attributed to its important role on enhanc
division and the biosynthesis of proteins
(1985). These results were supported by the
of wassel *et al.* (2007) and Abu-Zahra and S
(2012).

**5- Fruit quality:**

Data in Tables (2, 3 & 4) clearly sh
spraying clusters with GA3 at 10 to 40
Sitofex at 2.5 to 10 ppm significant
accompanied with enhancing weight, long
and equatorial of berry, total acidity%, pro
and percentages of P, K and Mg and T.
reducing sugars %, T.S.S. / acid an
carotenoids relative to the check treatme
effect either increase or decrease was as
with increasing concentrations of each auxin
$GA_3$ significantly changed these paramete
using Sitofex. A slight effect was recorded
quality parameters with increasing concentra
$GA_3$ from 20 to 40 ppm and Sitofex from
ppm. From economical point of view, t
results with regard to fruit quality were o
due to treating clusters with $GA_3$ at 2
Untreated vines produced unfavourable eff
fruit quality. These results were true duri
seasons. The effect of $GA_3$ on increasin
weight and dimensions might be attribute
effect in promoting cell division and enlarge
cells, water uptake and the biosynthesis of
Nickell (1985). These results were in conc
with those obtained by Williams and Ayars
and Dimovska *et al.*, (2014).

The higher content of Sitofex from cy
surly reflected on enhancing cell division
elongation of berries Nickell (1985). These
were in agreement with those obtained b
Zahra (2013) and Retamales *et al.* (2015).

## CONCLUSION

Treating Early Sweet grapevines once w
average berries reached 6mm with $GA_3$ at
was responsible for promoting yield an
quality.

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The promotion was significantly associated with increasing concentrations of $GA_3$ and Sitofex. Using $GA_3$ was significantly favourable than using Sitofex in this respect. The maximum values were recorded on the vines that received one spray of $GA_3$ at 40 ppm. Meaningless promotion was detected with increasing concentrations of $GA_3$ from 20 to 40 ppm and Sitofex from 5 to 10 ppm. The untreated vines produced the minimum values during both seasons. The positive action of $GA_3$ on cluster weight and dimensions might be attributed to its essential role on stimulating cell division and enlargement of cells, the water absorption and the biosynthesis of proteins which will lead to increase berry weight. Dimovska *et al.*, (2011); Abu-Zahra and Salameh, (2012) and Dimovska *et al.*, (2014).

The previous essential role of CPPU on cluster weight was attributed to its higher content of cytokinin when applied to plants (Nickell, 1985).

**4- Shot berries %:**

Data in Table (2) obviously reveal that percentage of shot berries in the clusters of Early Sweet grapevines was significantly controlled with spraying $GA_3$ at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm relative to the check treatment. Using $GA_3$ was preferable than using Sitofex in reducing the percentages of shot berries. There was a gradual reduction on the percentage of shot berries with increasing concentrations of $GA_3$ and Sitofex. There

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# تأثير رش حامض السلسليك على الاثمار فى اشجار البرتقال الفالنشيا

~~رش حامض الجبريليك والسيتوفكس فى تحسين المحصول وجودة حبات العنب الايرلى سويت فى منطقة المنيا– مصر~~

رندا السيد يونس هباس

قسم بحوث الموالح– معهد بحوث البساتين– مركز البحوث الزراعية– الجيزة– مصر

~~محمد على مجاور عبادة، ماهر خيرى بواقيم، بسام السيد عبد المقصود بلال~~

~~قسم بحوث العنب – معهد بحوث البساتين– مركز البحوث الزراعية– الجيزة– مصر~~

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دراسة درجة استجابة صفات النمو الخضرى والحالة الغذائية للشجرة والنسبة المئوية لعقد الثمار المبدئى والنهائى يونيو وكمية المحصول وخصائص الجودة للثمار فى اشجار البرتقال الفالنشيا لرش حامض السلسليك بتركيز ما الى 400 جزء فى المليون مرة واحدة فى بداية النمو الخضرى ومرتان فى بداية النمو الخضرى وبعد عقد باشرة وذلك خلال موسمى 2012/ 2013، 2013/ 2014.

هناك تحسن واضح فى جميع صفات النمو الخضرى وصبغات الورقة وعناصر النتروجين والفوسفور يوم والماغنسيوم والكالسيوم فى الورقة والنسبة المئوية للعقد المبدئى والنهائى وكمية المحصول وخصائص الجودة ند رش حامض السلسليك بتركيز من 100 الى 400 جزء فى المليون مرة او مرتان وذلك بالمقارنة بمعاملة ى. وكان هناك انخفاض واضح فى جميع المقاييس عند استخدام حامض السلسليك بتركيز 400 جزء فى ذلك بالمقارنة باستخدام حامض السلسليك بتركيز من 100 الى 200 جزء فى المليون وكان استخدام رشتين ض السلسليك افضل من استخدام رشة واحدة فى هذا الصدد.

رش اشجار البرتقال الفالنشيا مرتان فى بداية النمو وبعد عقد الثمار مباشرة بحامض السلسليك بتركيز 200جزء ن يكون فعالا لتحسين كمية المحصول وخصائص الجودة للثمار.

~~يت هذه الدراسة خلال موسمى 2013، 2014 لاختبار تاثير رش عناقيد صنف العنب الايرلى سويت مرة ندما يصل متوسط قطر الحبات الى 6 ملليمتر بحامض الجبريليك بتركيز من 10 الى 40 جزء فى المليون وفكس بتركيز 2.5 الى 10 جزء فى المليون على كمية المحصول وخصائص جودة الحبات.~~

~~رش العناقيد بحامض الجبريليك او السيتوفكس فعالا فى تحسين كمية المحصول ووزن وابعاد العنقود زيادة النسبة المئوية للحموضة الكلية فى العصير والنسبة المئوية للبروتين وعناصر الفوسفور والبوتاسيوم يوم فى العصير وفى تقليل النسبة المئوية للحبات الصغيرة والنسبة المئوية للمواد الصلبة الذائبة الكلية ت المختزلة والنسبة ما بين المواد الصلبة الذائبة الكلية والحموضة والكاروتينات الكلية فى العصير مقارنة الكونترول. وقد أدت جميع معاملات حامض الجبريليك والسيتوفكس الى تأخير موعد جمع المحصول ولم تأثير على شكل الحبات، وكانت التاثيرات سواء بالنقص او بالزيادة مرتبطة بزيادة التركيزات المستخدمة من كسينات وبدون فرق معنوى يذكر بين التركيزين الاعلى من كل منظم نمو وفى معظم الأحيان فقد كانت المرغوبة تعود الى استخدام حامض الجبريليك.

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ل تحسين كمية المحصول وجودة الحبات والقيمة الغذائية لها وعلاج مشكلة الحبات الصغيرة فى عناقيد
يرلى سويت المنزرع في منطقة المنيا فأنه ينصح برش العناقيد مرة واحدة عندما يصل متوسط قطر الحبات
ر بحامض الجبريليك بتركيز 20 جزء فى المليون.

**الدالة:** حامض السلسليك– النمو – الإثمار – اشجار البرتقال الفالنشيا. حامض الجبريلليك– السيتوفكس–
يرلى.

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