# Effect of Spraying Gibberellic Acid and Sitofex on Improving Yield and Fruit Quality of Early Sweet Grapes Grown at Minia Region, Egypt

**Abada; M.A.M.; Uwakiem, M,.Kh and Belal, B. E.A.**
Viticulture Dept. Hort. Res. Inst. A.R.C., Giza, Egypt
E. mail: Megawerm@yahoo.coim.

*Received on: 8/7/2015* *Accepted: 6/9/2015*

## ABSTRACT

This study was carried out during 2013 and 2014 seasons to examine the impact of spraying clusters of European grapevine cv. Early Sweet once when average diameter of berries reached 6 mm with $GA_3$ at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm on yield and fruit quality.

Spraying clusters with $GA_3$ or Stiofex was effective in improving yield, cluster and berry weight, dimension, total acidity %, protein %, P, K, and Mg in the juice and decreasing shot berries %, T.S.S. %, reducing sugars %, T.S.S./ acid and total carotenoids relative to control treatment. All $GA_3$ and Sitofex treatments materially delayed date of harvesting and had no effect on berry shape index. The effect either in decrease or increase were associated with increasing concentrations of each growth regulator without substantial differences on the aforementioned characteristics among the higher two concentrations of each auxin. In most cases the uppermost effects were attributed to using $GA_3$.

For promoting yield, fruit quality and nutritional value as well as overcoming the problem of shot berries of Early Sweet grapes grown under Minia region, it is advised to spray the whole clusters once at 6 mm berries diameter stage with $GA_3$ at 20 ppm.

**Key words: $GA_3$, Sitofex, Early Sweet, quality of the berries.**

## INTRODUCTION

Early Sweet is earliest white seedless table grape cv successfully grown under Egypt conditions. It has good eating quality which increased the opportunity of such cv to the local and foreign markets. Small berries and the occurrence of shot berries in clusters consider the main problems of such grapevine cv. (Weaver, 1976).

Many trials had been established for improving yield and fruit quality of different grapevine cvs by application of $GA_3$ and Sitofex. $GA_3$ is known to have a substantial effect on grape quality, since it encourages cell elongation and the biosynthesis of proteins. (Leopold, 1964).

Grapevines (*vitis vinifera* L.) are planted throughout world to be used as dried fruits (raisins), grapes for the fresh market (Table grapes) and juice for concentrate. Natural berry size of Early sweet grapevine cv is not large enough for commercial as table grapes, so cultural practices are used to increase its size several folds. (Weaver, 1976).

Berry size is the main quality factor in international markets. Farmers often overuses the growth regulators, Gibberellic acid ($GA_3$) and for forchlorfenuron (ppm) as an effort to increase berry size and $GA_3$ has been routinely used for seedless grape production to increase berry and bunch weights cell division and cell enlargement as well as promote the biosynthesis of proteins and producing new tissues that enhancing the water and nutrients absorption and induce more vegetative growth shifted the balance of competition between reproductive growth and vegetative organs. Sitofex exhibits cytokinin like properties when applied to plants has material physiological activity on grapevine cvs. It is responsible for regulating of berry setting, berry growth and development Sitofex can be used without any health or environment hazards. (Nickell, 1985).

Using $GA_3$ just after berry setting or when averages of berries diameter ranged form 6 to 8 mm of Crimson seedless cv increased berry weight and dimensions comparing to the check treatment, Dokoozlian (2001). These results were confirmed by the results of Abu- Zahra and Salameh (2012), and Dimovska *et al.* (2014).

Abdel- Fattah *et al.* (2010) stated that using Sitofex at 2.5 to 10 ppm when average diameter of berries reached at least 6 mm was very effective in enhancing berry weight and dimensions in various grapevine cvs. The same trend was also observed by Marzouk and Kassem (2011); Refaat *et al.* (2012) and Guiseppe *et al.* (2014).

The target of this study was examining the impact of spraying clusters of Early Sweet grape cv with $GA_3$ or Sitofex on yield and fruit quality.

## MATERIALS AND METHODS

This study was conducted during 2013 and 2014 seasons on forty- two vines uniform in vigour 5-years old Early Sweet grapevines (*Vitis vinifera L.*) grown in a private vineyard located at West Matay; Matay district, Minia governorate. The selected vines were spaced at 2x 3 m apart, grown in sandy soil and supported with a Gable system. Spur pruning was carried out at the first week of January during both seasons leaving 72 eyes/ vine (20 fruiting spurs x three eyes + six replacement spurs x two eyes). Drip irrigation system was followed. The selected vines received the recommended horticultural practices.

This experiment included the following seven treatments of $GA_3$ and Sitofex.

1-Control.
2-Spraying $GA_3$ at 10 ppm.
3-Spraying $GA_3$ at 20 ppm.
4-Spraying $GA_3$ at 40 ppm.
5-Spraying Sitofex at 2.5 ppm.
6-Spraying Sitofex at 5.0 ppm.
7-Spraying Sitofex at 10 ppm.

Each treatment was replicated three times, two vines per each. Spraying of both $GA_3$ and Sitofex was done once when the average diameter of the berries reached 6 mm (1st week of May). Spraying included the clusters of the selected vines only. Spraying was done till runoff of all clusters using Triton B as wetting agent at 0.05%. The experiment was arranged in randomized complete block design (RCBD). Mead *et al*. (1993).

During both seasons, at harvest date, the following measurements were recorded, yield/ vine (kg.), weights (g), length and width (cm) of cluster, shot berries %, averages berry weight (g) and dimensions (longitudinal and equatorial), berry shape index, T.S.S. %, reducing sugars % according to Lane and Eynon method (1965) & A.O.A.C. (2000), total acidity % (as g tartaric acid / 100 ml juice)according to A.O.A.C. (2000), T.S.S./ acid, total carotenoids as mg/ 100 g juice Hiscox and Isralstam (1979), proteins (A.O.A.C., 2000) and percentages of P, K and Mg in the juice (Wilde *et al.*, 1985).

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

## RESULTS AND DISCUSSION.

**1- Yield/ vine:**

Data in Table (1) clearly show that spraying clusters of Early sweet grapevines with $GA_3$ at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm was significantly effective in improving the yield relative to the check treatment. The promotion on the yield was accompanied with increasing concentrations of each plant growth regulator. Using $GA_3$ at 10 to 40 was significantly preferable than using Sitofex at 2.5 to 10 ppm in improving the yield. A slight and unsignificant promotion on the yield was attributed to increasing concentrations of $GA_3$ from 20 to 40 ppm and Sitofex from 5 to 10 ppm. The maximum yield was produced on the vines that received one spray of $GA_3$ at 40 ppm but the best treatment from economical point of view was the application of $GA_3$ at 20 ppm (since no measurable promotion on the yield was recorded between 20 and 40 ppm of $GA_3$). Under such promised treatment, yield/ vine reached 13.6 and 14.0 kg during both seasons, respectively. The control vines produced 9.1 and 9.6 kg during 2013 and 2014 seasons, respectively. The percentage of increase on the yield due to application of $GA_3$ at 20 ppm over the check treatment reached 49.5 and 45.8 % during both seasons, respectively. The beneficial effects of $GA_3$ on the yield might be attributed to their positive action on increasing cluster weight. The promoting effects of $GA_3$ on the yield was supported by the results of Dimovska *et al*., (2011) and Abu- Zahra and Salameh (2012) on different grapevine cvs.

The results regarding the beneficial effects of Sitofex on enhancing the yield are in harmony with those obtained by Juan *et al*. (2009); Abdel- Fattah *et al*. (2010) and Al- Obeed (2011).

**2- Harvesting date:**

It is clear from the data in Table (1) that all $GA_3$ and Sitofex treatments had significantly delayed on 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.

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 was a slight reduction on such unfavourable phenomenon with increasing concentrations of $GA_3$ form 20 to 40 ppm and Sitofex from 5 to 10 ppm. The minimum values of shot berries (7.3 and 6.9 % during both seasons, respectively) were recorded on the clusters harvested from vines treated with $GA_3$ at 40 ppm. The maximum values of shot berries (12.0 & 12.5 %) during both seasons were recorded on the untreated vines during both seasons. The reducing effect of $GA_3$ on shot berries might be attributed to its important role on enhancing cell division and the biosynthesis of proteins Nickell (1985). These results were supported by the results of Wassel *et al*. (2007) and Abu-Zahra and Salameh (2012).

**5- Fruit quality:**

Data in Tables (2, 3 & 4) clearly show that spraying clusters with GA3 at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm significantly was accompanied with enhancing weight, longitudinal and equatorial of berry, total acidity%, proteins % and percentages of P, K and Mg and T.S.S. %, reducing sugars %, T.S.S. / acid and total carotenoids relative to the check treatment. The effect either increase or decrease was associated with increasing concentrations of each auxin. Using $GA_3$ significantly changed these parameters than using Sitofex. A slight effect was recorded on these quality parameters with increasing concentrations of $GA_3$ from 20 to 40 ppm and Sitofex from 5 to 10 ppm. From economical point of view, the best results with regard to fruit quality were observed due to treating clusters with $GA_3$ at 20 ppm. Untreated vines produced unfavourable effects on fruit quality. These results were true during both seasons. The effect of $GA_3$ on increasing berry weight and dimensions might be attributed to its effect in promoting cell division and enlargement of cells, water uptake and the biosynthesis of proteins Nickell (1985). These results were in concordance with those obtained by Williams and Ayars (2005) and Dimovska *et al*. (2014).

The higher content of Sitofex from cytokinins surely reflected on enhancing cell division and the elongation of berries Nickell (1985). These results were in agreement with those obtained by Abu-Zahra (2013) and Retamales *et al*. (2015).

## CONCLUSION

Treating Early Sweet grapevines once when the average berries reached 6mm with $GA_3$ at 20 ppm was responsible for promoting yield and fruit quality.

## REFERENCES

Abdel- Fattah, M.E.; Amen, K.A.; Alaa, A.B. and Eman, A.A. (**2010**). Effect of berry thinning, CPPU spraying and pinching on cluster and berry quality of two grapevine cultivars. Assiut J. of Agric. Sci., **40(4)**: 92-107.

Abu- Zahra, T.R. (**2013**). Effect of plant hormones application methods on fruit quality of Superior seedless grape. Bioscience Biotechnology Research Asia Vol. **10(2)**: 527-531.

Abu- Zahra, T.R. and Salameh, N. (**2012**). Influence of Gibebrellic acid and cane girdling on berry size of Black Magic grape cultivar . Middle East Journal of Scientific Research **11(6)**: 718-722.

Al- Obeed, R.S. (**2011**). Enhancing the shelf life and storage ability of Flame seedless grapevine by agrochemicals preharvest foliar applications. Middle East Journal of Scientific Research **8 (2)**: 319-327.

Association of Official Agricultural Chemists (A.O.A.C.) (2000). Official Methods of Analysis (A.O.A.C), 12th Ed., Benjamin Franklin Station, Washington D.C., U.S.A. pp. 490-510.

Dimovska, V.; Ivanova, V.; Ilieva, F. and Sofijanova, E. (**2011**). Influence of bioregulator gibberellic acid on some technological characteristics of cluster and berry from some seedless grape varieties. Journal of Agric. Science and technology BI 1074-1058.

Dimovska, V.; Petropulos, V.I.; Salamovska, A. and Ilieva, F. (**2014**). Flame seedless grape variety (*Vitis vinifera* L.) and different concentration of gibberellic acid (GA3). Bulgarian Journal of Agric. Sci., **20** (No.1), 137-142.

Dokoozlian, N.K. (**2001**). Gibberellic acid applied at bloom reduces fruiit set and improves size of "Crimson seedless" Table grapes. Hort.science **36(4)**: 706-709.

Guiseppe; F.; Andream, M.; Guiseppe, N. Carmela, P. Angela, M.; Isabella, C. Piero, M., Mariangela, V. and Vito, G. (**2014**). Girdling, Gibberellic acid, and forchlorfenuron effect yield, quality and metabolic profile of table grape cv. Italia. Am. J. Enol. Vitic. 65.3.

Hiscox, A. and Isralstam B. (**1979**). Method for the extraction of chlorophylls from leaf tissue without maceration. Can. J. Bot. **57**: 1332-1334.

Juan, P.Z.; Bernardo, A.L. and Paulina, N. (**2009**). Preharvest applications of growth regulators and their effect on postharvest quality of table grapes during cold storage. Postharvest Biology and technology **51**. 183-192.

Kassem, H.A.; Al- Obeed, R.S. and Soliman, S. S. (**2011**). Improving yield, quality and profitability of Flame seedless grapevine grown under arid environmental by growth regulators preharvest applications. Middle East Journal of Scientific research **8 (1)**: 165-172.

Lane, J. H. and Eynon, L. (**1965**). Determination of reducing sugars by means of Fehlings solution with methylene blue as indicator A.O.AC. Washington D.C.U.S.A. pp. 490-510.

Leopold, A. C. (**1964**). Plant growth and development. pp. 133-143.TATA McGraw – Hill publishing Comp. LTD. Bombay New Delhi.

Marzouk, H.A. and Kassem, H.A (**2011**). Improving yield, quality and shelfe life of Thompson seedless grapevine by preharvest foliar application. Scientia Horticulruea **130**: 425-430.

Mead, R.; Currnow, R. N. and Harted, A. M. (**1993**). Statistical Biology. 2"d Ed. Methods in Agriculture and Experimental and Hall, London pp. 10-20.

Nickell, L.G. (**1985**). New plant growth regulator increase grape size. Proc. Plant growth reg. Soc. of Am. 12. 1-7.

Refaat, S.S.E.; Ghada, Sh.Sh. and Ola, A.A.(**2012**). Effect of foliar spraying with gibberllic acid and/ or sitofex on bud behaviour, vegetative growth, yield and cluster quality of Thompson seedless grapevines. Journal of American Science, **8 (5)**: 99: 21- 34.

Retamales, J.; Bangerth, F. Cooper, T. and Callejas, R. (**2015**). Effect of CPPU and GA3 on fruit quality of Sultanina table grape. Ishs Acta Hoerticulturae 394: plant Bioregulators in Horticulture.

Wassel, A.H.; Abdel Hameed, M.; Gobara, A and attia, M. (**2007**). Effect of some micronuitrients, gibberellic acid and ascorbic acid on growth, yield and quality of white Banaty seedless grapevines. African Crop Science Conference Proceeding Vol. **8** p. 547-553.

Weaver, R. J.(**1976**). Grape Growing . A Wiley Interscience Puplication John Wiley & Davis. New York. London. Sydney. Tronto. Pp 160-175.

Wilde, S. A.; Corey, R. B.; Lyer, I. G. and Voigt, G. K. (**1985**). Soil and Plant Analysis for Tree Culture. 3rd Oxford & IBH publishing Co., New Delhi, pp. 1 – 218.

Williams, L.E. and Ayars, J.E. (**2005**). Water use of Thompson seedless grapevines as affected by the application of Gibberellic acid ($GA_3$) and trunk girdling practices to increasing Berry size. Agriculture and Forest Meterology, **129**: 85-94

**الملخص العربى**

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

**محمد على مجاور عبادة، ماهر خيرى يواقيم، بسام السيد عبد المقصود بلال**

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

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

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

لأجل تحسين كمية المحصول وجودة الحبات والقيمة الغذائية لها وعلاج مشكلة الحبات الصغيرة فى عناقيد العنب الايرلى سويت المنزرع في منطقة المنيا فأنه ينصح برش العناقيد مرة واحدة عندما يصل متوسط قطر الحبات 6 ملليمتر بحامض الجبريليك بتركيز 20 جزء فى المليون.

**الكلمات الدالة: حامض الجبريلليك– السيتوفكس– العنب الايرلسويت– خصائص الجودة للحبات.**