Iran Agricultural Research
Volume 1, No. 1, 1982

تحقیقات کشاورزی ایـــــــــران
جلد اول شماره اول ۱۳۶۱

In the name of Allah

بنام خدا

NOTE

EFFECT OF PRE- AND POST-BLOOM GA_3 APPLICATIONS ON THE GROWTH AND DEVELOPMENT OF 'YAGHOOTI' GRAPES[1]

اثر کاربرد اسیدجیبرلیک قبل وبعـــد از گل دهی برروی رشدونمو انگوریا قوتـی

E. Tafazoli and M. Khosh-Khui[2]

عنایت اله تفضلی ومرتضی خوشخوی
دانشیاران بخش باغبانی دانشگاه شیراز

ABSTRACT

Pre-bloom application of GA_3 reduced the number of berries of 'Yaghooti', *Vitis vinifera* L., grapes, whereas post-bloom application did not affect fruit set, although it greatly increased cluster weight by producing large and elongated berries. GA_3 acted as a fruit thinning agent when applied in the pre-bloom stage of growth and as a growth stimulator when applied post-bloom. The effect of GA_3 seemed to be due to its action on the ovule rather than pollen.

خلاصـــه

درحالیکه کاربرد اسیدجیبرلیک قبـل از گل دهی موجب کاهش تعداد ستـه هـــای انگوریا قوتـــی *Vitis vinifera* L. گردید، کاربرد پس از گل دهی اثری بـر روی تشکیل میوه نداشت اما بمیـــزان زیادی موجب افزایش وزن خوشه بـــا تولید دسته های بزرگ وکشیده گردیـــد. اسیدجیبرلیک هنگامی که قبل از گل دهی بکاربرده شد بعنوان یک عامل تنـــک کننده میوه، وهنگامیکه بعد از گل دهی بکاررفت بعنوان یک محرک رشد عمـــل نمود. بنظر میرسد که اثر اسیدجیبرلیک برروی تخمک بوده وبرروی گرده اثـــر نداشته است.

INTRODUCTION

There are reports of successful experiments carried out to enlarge the berry size of seedless grapes by mechanical or chemical means. Girdling has long been shown to be effective (6). Growth regulators such as some auxins (4-chlorophenoxyacetic acid, 4-CPA), cytokinins, and GA_3 have also influenced this character (7, 8, 9, 11, 13).

Kuykendall *et al.* (7) and Meynhardt and Ginsburg (8)

---

1. Contribution from the Department of Horticulture, College of Agriculture, Shiraz University, Shiraz, Iran. Received 30 March 1982. Paper No. K-514-60.

2. Associate Professors of Horticulture.

reported that the berry size of 'Thompson Seedless' and 'Black Corinth' grapes were increased by GA_3 application. Reports are also available on the effect of GA_3 on the number of berries per cluster. Tafazoli (9) showed that application of 25 ppm of GA_3 at 50% bloom resulted in reduction of number of berries per cluster. The present experiments were undertaken to study the effects of different concentrations and time of GA_3 application on berry size of 'Yaghooti' grapes, a stenospermocarpic cultivar of *Vitis vinifera* L., in view of the current interest in improving fruit growth with gibberellin.

MATERIALS AND METHODS

Two separate experiments were conducted at the Kooshkak Agricultural Experiment Station of the College of Agriculture of Shiraz University, 85 km north of Shiraz, Iran in 1980. Six-year old 'Yaghooti' vines were head-pruned in the previous winter to four canes, each having 8 buds. In the first experiment, applications of GA_3 at concentrations of 0, 25, 50, and 100 ppm were applied to foliage and clusters one week before calyptra fall. In the second experiment, concentrations of 0, 250, 500, and 1000 ppm GA_3 were applied to another set of plants when 75% or almost all calyptras had fallen. Tween 80 at 0.1% was used as a wetting agent and plants were sprayed to the point of run-off. The experiments were laid out each in a randomized complete block design with four replications. There were 5 plants in each replication. Data were analyzed statistically and means were compared using Duncan's multiple range test (4).

The number of clusters were adjusted to 17 per vine prior to the beginning of the experiments. Plants were harvested after 17 weeks when the fruits were mature and the following measurements were taken: cluster weight, number of

berries per cluster, average berry weight, berry volume, number of shot berries, berry length/width ratio, yield, soluble solids, and acidity. Cluster volume was evaluated by inserting the cluster in a given volume of water and measuring the volume increment. A hand refractometer was used to measure soluble solids. Acidity was determined by diluting 10 ml of the juice to 50 ml with distilled water and titrating with 0.133 N NaOH. Phenolphthalein was used as an indicator. The results were expressed as grams of tartaric acid per 100 ml of juice (3). Pollen grains were germinated on orchid agar to test pollen viability.

RESULTS

In pre-bloom application of GA_3, yield per plant, average cluster weight, number of berries, and shot berries per cluster were reduced when compared with untreated control (Table 1). Reductions occurred in the characters mentioned proportionately with increased GA_3 concentration. All GA_3 concentrations increased average berry weight, while total acidity, soluble solids, and fruit shape as judged by berry length/width ratio were not affected.

In post-bloom application of GA_3, the most compact clusters, judged by visual rating, and greatest bunch weight resulted from 500 and 1000 ppm GA_3 (Fig. 1). The number of berries per cluster was not affected, but individual berries were significantly larger and heavier in treated plants than in control. The highest berry weight was obtained with 1000 ppm GA_3. However, there was no significant difference between 500 and 1000 ppm (Table 2). The number of shot berries per cluster, soluble solids, and total acidity of the juice were reduced by GA_3 treatment. Berry shape was significantly affected by all concentrations. With increased GA_3 concentrations, length/width ratio of the berries increased progressively. Consequently, GA_3 treated plants had elongated berries, while berries

Table 1. Effects of pre-bloom application of GA_3 on several characteristics of 'Yaghooti' grapes.

GA_3 conc. (ppm)	Yield/ plant (g)	Average cluster wt. (g)	Average berry wt. (g)	Berry volume (cm^3)	Berries/ cluster	Shot berries/ cluster	Total acid (g tartaric/ 100 ml)	Soluble solids (%)	Length width ratio
0	3383a*	199a	0.89b	0.81b	223a	52a	0.65a	21.6a	1.11a
25	3150a	175b	1.11a	0.86b	157b	41ab	0.60a	21.1a	1.13a
50	2320b	166c	1.15a	0.89b	123c	35b	0.62a	20.1a	1.15a
100	2108b	124d	1.19a	1.11a	104c	32b	0.63a	20.0a	1.14a

*Mean separation, within columns, by Duncan's multiple range test at the 5% probability level.

Table 2. Effect of post-bloom application of GA_3 on several characteristics of 'Yaghooti' grapes.

GA_3 conc. (ppm)	Yield/ plant (g)	Average cluster wt. (g)	Average berry wt. (g)	Berry volume (cm^3)	Berries/ cluster	Shot berries/ cluster	Total acid (g tartaric/ 100 ml)	Soluble solids (%)	Length width ratio
0	3410c*	194c	1.06c	0.98c	209a	46a	0.69a	20.5a	1.11b
250	4236b	241b	1.45b	1.37b	184a	19b	0.55b	19.0ab	1.28a
500	4584a	259a	1.60ab	1.50ab	184a	17b	0.57b	18.4b	1.28a
1000	4677a	267a	1.71a	1.62a	189a	21b	0.57b	18.0c	1.25a

*Mean separation, within columns, by Duncan's multiple range test at the 5% probability level.

of control plants were more rounded.

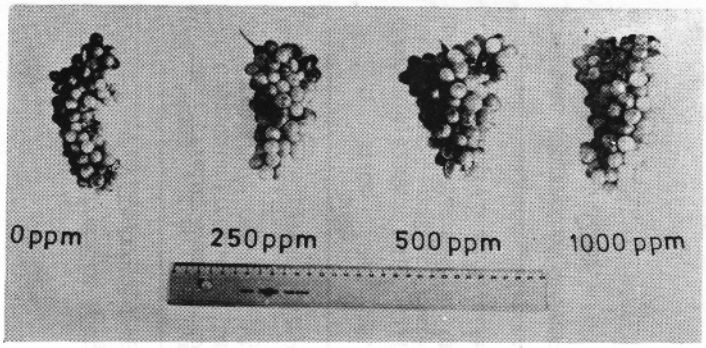

Fig. 1. Effects of post-bloom applications of different concentrations of GA_3 on berry development of 'Yaghooti' grapes.

DISCUSSION

GA_3 had two effects on the development of berries in the 'Yaghooti' grapes. The first was inhibitory. Treatments with GA_3 before flower opening affected fertilization or caused embryo abortion, thus significantly reducing the number of berries set. This is in agreement with results reported by Barritt (1), Christodoulou *et al.* (2) and Tafazoli (9). The GA_3-treated plants had an abundance of viable pollen grains, and pollen culture from control and treated plants in orchid agar revealed that there was no difference between the rate of pollen growth. Failure to develop embryo (set) may therefore have resulted from GA_3-induced sterility of ovules, or possibly from very early embryo abortion. Treatment with GA_3 has been observed to reduce seed number in citrus flowers (5). Similar results have also been reported in strawberries where GA_3 action

was on the gynoecium (ovule) rather than pollen (10). These results are in contrast with those reported by Weaver and McCune (12) indicating that GA_3 has pollenicidal effect. When flowers opened and fertilization took place at calyptra fall, the inhibitory effect of GA_3 was totally lost. Further experiments are currently underway to investigate in more detail the effect of GA_3 on grape ovules.

The second effect of GA_3 was stimulation of berry growth. Cluster compactness noted was due to enlargement and elongation of berries in the cluster and not increased berry number. Thus clusters appeared to be more compact and weighed more.

It can be concluded that pre-bloom GA_3 treatment reduced the number of berries per cluster which might be attributed to a reduction of carpel fertility and acted as a fruit thinning agent, whereas when applied post-bloom it did not affect berry number but greatly increased cluster weight by producing large and elongated berries.

ACKNOWLEDGEMENT

This research was supported by a grant from the College of Agriculture of Shiraz University.

LITERATURE CITED

1. Barritt, B.H. 1970. Fruit set in seedless grapes treated with growth regulators, alar and gibberellin. J. Amer. Soc. Hort. Sci. 95: 58-61.
2. Christodoulou, A.J., R.J. Weaver, and R.M. Pool. 1968. Relation of gibberellin treatment to fruit set, development and cluster compactness in *Vitis vinifera* grapes. Proc. Amer. Soc. Hort. Sci. 92: 301-310.
3. Denne, E.B., and R.J. Weaver. 1972. Effect of potassium gibberellate on growth and development of 'Black Corinth' grapes. J. Amer. Soc. Hort. Sci. 97: 659-662.

4. Duncan, D.B. 1955. Multiple range and multiple F test. Biometrics 11: 1-42.
5. Feinstein, B., S.P. Moselise, and R. Goren. 1975. Studies on the reduction of seed number in mandarins. HortScience 10: 385-386.
6. Jacob, H.E. 1928. Some response of seedless varieties of *Vitis vinifera* to girdling. Proc. Amer. Soc. Hort. Sci. 25: 223-229.
7. Kuykendall, J.R., G.C. Sharpless, J.M. Nelson, L.F. True, and H.F. Tate. 1970. Berry set response of 'Thompson Seedless' grapes to pre-bloom and post-bloom gibberellic acid treatment. J. Amer. Soc. Hort. Sci. 95: 697-699.
8. Meynhardt, J.T., and L. Ginsburg. 1964. The use of plant growth regulators on grapes. Deciduous Fruit Grower 14: 227-280.
9. Tafazoli, E. 1978. Increasing fruit set in *Vitis vinifera* grapes. Sci. Hort. 6: 121-124.
10. Tafazoli, E., and D. Vince Prue. 1979. Fruit growth and development in strawberries *Fragaria ananassa* Duch. Ann. Bot. 43: 125-134.
11. Weaver, R.J. 1956. Plant regulators in grape production. Calif. Agric. Expt. Sta. Bull. No. 752, 26p.
12. Weaver, R.J., and S.B. McCune. 1960. Further studies with gibberellin in *Vitis vinifera* grapes. Bot. Gaz. 121: 155-162.
13. Weaver, R.J., and R.M. Pool. 1966. Effect of kinins on fruit set and development in *Vitis vinifera*. Hilgardia 37: 181-201.