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The Effects of Different Level Cluster Tip Reduction and Foliar Boric Acid Applications on Yield and Yield Components of Italia Grape Cultivar

A. Akin

***Abstract*—**This study was carried out on Italia grape variety (*Vitis vinifera* L.) in Konya province, Turkey in 2016. The cultivar is five years old and grown on 1103 Paulsen rootstock. It was determined the effects of applications of the Control (C), 1/3 Cluster Tip Reduction (1/3 CTR), 1/6 Cluster Tip Reduction (1/6 CTR), 1/9 Cluster Tip Reduction (1/9 CTR), 1/3 CTR+Boric Acid (BA), 1/6 CTR+BA, 1/9 CTR+BA, on yield and yield components of the Italia grape variety. The results were obtained as the highest fresh grape yield (4.74 g) with 1/9 CTR+BA application; the highest cluster weight (220.08 g) with 1/3 CTR application; the highest 100 berry weight (565.85 g) with 1/9 CTR+BA application; as the highest maturity index (49.28) with 1/9 CTR+BA application; as the highest must yield (685.33 ml/kg) with 1/3 CTR+BA and (685.33 ml/kg) with 1/9 CTR+BA applications. To increase the fresh grape yield, 100 berry weight and maturity index in the Italia grape variety, the 1/9 CTR+BA application can be recommended.

***Keywords*—**Italia grape variety, boric acid, cluster tip reduction, yield, yield components.

I. Introduction

VITICULTURE is at the forefront of the most important agricultural branches in Turkey. It is located between the latitude and longitude grades at which grape growing can be carried out appropriately. Some 74 million tons was produced from 7 million hectares around the world [1], while 4 million tons of grape from 435,227 hectares were produced in vineyards in Turkey [2].

To ensure that the world's population can be fed, the importance of applications for increased productivity and quality from the unit side is increasing day by day. Viticulture, which has an important place in the agriculture of Turkey, nowadays faces various problems such as production, aquaculture and marketing. Among these problems, those related to the yield and quality degradation are significant. Efficiency in viticulture is closely related to the number and size of the cluster and berry on the vine, as well as the number of vine in the unit area. However, these characteristics are influenced by various internal and external factors such as variety, rootstock, cultural practices and environmental conditions [3].

While some of the fertilization works to feed the vine from the soil, some applications aim to reinforce the nutrients needed by the vine from the leaves [4]. Some nutrient deficiencies can be seen in the vines. Boron is one of the most common micronutrient element deficiencies in vines. Boron deficiency, which is frequently seen in low pH soil and in areas exposed to abundant rainfall, reduces the berry set and increases seedless berries in vines [5]. Another feature of Boron is that it plays an active role in the production of growth hormones [6].

The effects of the boron nutrient application on the yield and quality of grapes were investigated by researchers and positive effects were determined [7]. Boron is involved in pollen tube formation and is needed for the necessary cell divisions in root, shoots and young leaves. At the same time, boron is needed in the transport of sugar. A rare characteristic of boron in plants is deficiency; the sufficiency and toxicity of the concentration limits are very close [8].

Aydin Akin is with the Selcuk University Agriculture Faculty and Department of Horticulture, Konya, 42075, Turkey (phone: 90 532 5014464; fax: 90 332 241 0108; e-mail: aakin@selcuk.edu.tr).

II. Review of Literature

Alphonse Lavallee grape variety was cultivated in Turkey. While the maximum maturity index was obtained with 1/9 cluster tip reduction application; the most grape juice yield was determined with 1/3 cluster tip reduction + boric acid application [9]. Alphonse Lavallee grape variety was determined to have the highest berry weight (5.23 g) with 1/9 cluster tip reduction + boric acid and (5.32 g) with 1/9 cluster tip reduction applications; as the highest maturity index (45.14) with 1/9 cluster tip reduction application; as the highest must yield with 1/6 cluster tip reduction + boric acid, with 1/9 cluster tip reduction + boric acid, with 1/3 cluster tip reduction + boric acid, with 1/6 cluster tip reduction and with 1/9 cluster tip reduction applications [10]. It was found that the highest fresh grape yield was (10.26 kg/vine) with 1/9 CTR, (10.14 kg/vine) with 1/3 CTR and (10.09 kg/vine) with 1/3 CTR+BA applications in the Tilki Kuyruğu grape variety [11]. Keshmeshi grape cultivar determined the application of nitrogen, boron and zinc (0.5%, 0.15% and 0.15%, respectively) had a positive effect on the fruit set [12]. The Syrah grape variety saw reduced grape yield per vine by around 40% with cluster thinning, whereas berry thinning reduced by around 20% [13].

The purpose of this study was to identify the effects on yield and quality of different level cluster tip reduction and foliar boric acid applications in Italia grape cultivar.

III. Methodology

This study was carried out in Italia grape variety in Turkey

in 2016. The cultivar is evaluated as a table grape. Yield and development is a good standard grape variety, matures in the middle of the season, with large clusters, yellowish colors and big berries, seedy, sweet and musky fragrance, suitable for short pruning. The study was used 63 vines in total.

Trial plan: 1) Control (C), 2) 1/3 Cluster Tip Reduction (1/3 CTR) 3) 1/6 Cluster Tip Reduction (1/6 CTR), 4) 1/9 Cluster Tip Reduction (1/9 CTR), 5) 1/3 CTR + Boric Acid (BA), 6) 1/6 CTR + BA, 7) 1/9 CTR + BA [9]. Effects on yield and yield components of these applications in the Italia grape cultivar were determined.

A. Application of Cluster Tip Reductions

- 1/3 Cluster Tip Reduction (1/3 CTR): The 1/3 cluster tip reduction (berry thinning) was applied by cutting the tips of one third of the cluster length, while the 1/3 cluster reduction of all clusters outside the control in the berry set period was conducted [9].
- *1/6 Cluster Tip Reduction (1/6 CTR):* The 1/6 cluster tip reduction was applied by cutting the tips of the cluster at the point of one sixth of the cluster length, while the 1/6 cluster reduction of all clusters outside the control in the berry set period was conducted.
- *1/9 Cluster Tip Reduction (1/9 CTR):* The 1/9 cluster tip reduction was applied by cutting the tips of the cluster at the point of one in nine of the cluster length, while the 1/9 cluster reduction of all clusters outside the control in the berry set period was conducted.

B. Application in Boric Acid Form to Foliar

The first boric acid application was used one week prior to flowering, while the second boric acid application was during the berry set period. The application of 1000 ppm boric acid was sprayed to leaves in the cooler evening hours. Maturing of the grapes after harvest and the data were obtained based on the following criteria [9].

C. Fresh Grape Yield (kg/vine)

Samples from all the clusters on each of the vines were collected and counted, and the total cluster of each vine and weight was determined. Fresh grape yield is obtained by dividing the total cluster number by the total cluster weight.

D. Cluster Weight (g)

It was found by dividing the total grape yield with the number of grape clusters obtained from each parcel.

E. 100 Berry Weight (g)

It collected 100 berries according to the Amerine and Cruess method [14] from 10 clusters. That is, berries are taken from the top, middle and tip of the clusters.

F. Must Yield (ml/kg)

With squeezing of 1 kg from the grapes collected at random, and given in ml/kg.

G. Maturity Index (°Bx /TA)

It was determined with the division of °Bx (degrees Brix) to TA (titratable acidity). The °Bx (total soluble solid substance) (%) was determined by squeezing the grapes (berries) collected from the vines using the method proposed by [14], and keeping the grape juice at 20°C in a digital refractometer device (Atago RX-7000 (alpha)). The TA (g/l) was calculated by using the titration method in [15] from the juice squeezed from the same grapes. A sample consisting of 5 ml the grape juice and 45 ml pure water were subjected to titration with 0.1 N NaOH.

The research was planned in a completely randomized block plan as a simple factorial experiment, and variance analyses and multiple comparison tests were done using the JUMP statistic package program (version 7.0; SAS Institute, Cary, NC, USA).

IV. Findings and Comments

A. Effects of Applications on Fresh Grape Yield

Fresh grape yield was found statistically significant from the applications (Fig. 1). While the highest fresh grape yield was determined at 4.74 kg/vine from 1/9 CTR+BA application, the least fresh grape yield was found to be 4.42 kg/vine from 1/6 CTR application in the Italia grape variety. In similar studies, fresh grape yield was conducted with 1/9 CTR, with 1/3 CTR and with 1/3 CTR+BA applications to the Tilki Kuyruğu grape variety [11].

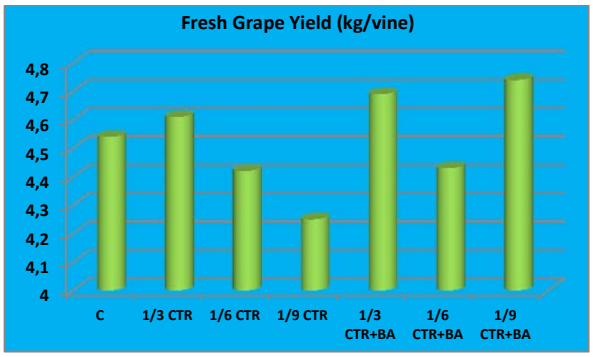

Fig. 1 Effects of applications on fresh grape yield

B. Effects of Applications on Cluster Weight

It was found statistically significant, the effect on the cluster weight of applications (Fig. 2). While the highest cluster weight was taken at 220.08 g from 1/3 CTR application, the least cluster weight was determined at 209.03 g from 1/6 CTR+BA, with 210.42 g from 1/6 CTR and with 210.64 g 1/9 CTR+BA applications in the Italia grape variety.

C. Effects of Applications on 100 Berry Weight

The 100 berry weight was determined statistically significant from the applications (Fig. 3). While the highest berry weight was found with 565.85 g from 1/9 CTR+BA application, the least 100 berry weight was shown with 547.39 g from 1/9 CTR application (Fig. 3). In another study, it was shown that berry weight was increased with 1/9 cluster tip reduction + boric acid and with 1/9 cluster tip reduction applications in the Alphonse Lavallee grape variety [10].

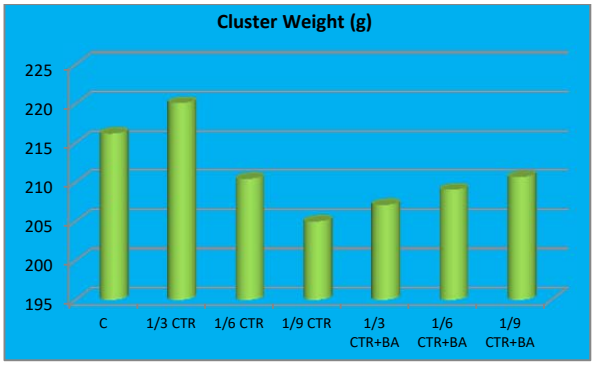

Fig. 2 Effects of applications on cluster weight

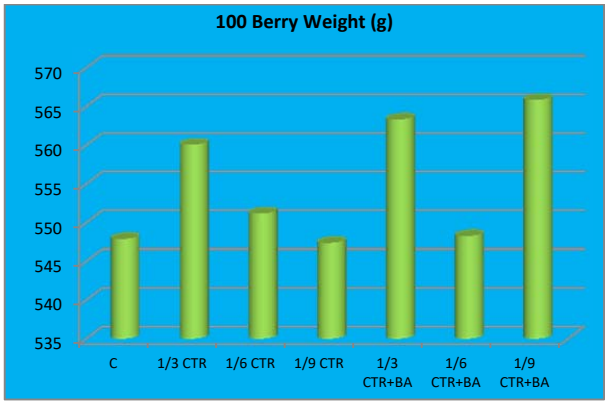

Fig. 3 Effects of applications on 100 berry weight

D. Effects of Applications on Maturity Index

The effect on maturity index of applications was found to be statistically significant (Fig. 4). While the highest maturity index was determined at 49.28 from 1/9 CTR+BA application, the least maturity index was seen with 42.67 from C application in the Italia grape variety (Fig. 4). In similar studies, the maturity index value was increased with 1/9 cluster tip reduction application in the Alphonse Lavallee grape variety [9]. The maturity index was increased with 1/9 cluster tip reduction application in the Alphonse Lavallee grape variety [10].

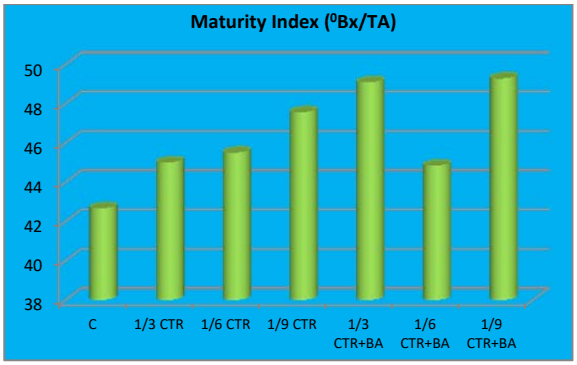

Fig. 4 Effects of applications on maturity index

E. Effect of Applications on Must Yield (Grape Juice)

It was found statistically significant, the effect on the amount of grape juice of the applications (Fig. 5). While the highest maturity index was determined with 685.33 ml/kg from 1/3 CTR+BA and with 685.33 ml/kg from 1/9 CTR+BA applications, the least maturity index was seen with 660.33 ml/kg from C application. In similar studies, the must yield value was increased with 1/3 cluster tip reduction + boric acid application in the Alphonse Lavallee grape variety [9]. Must yield was increased with 1/9 CTR+BA application in the Tilki Kuyruğu grape variety [11]

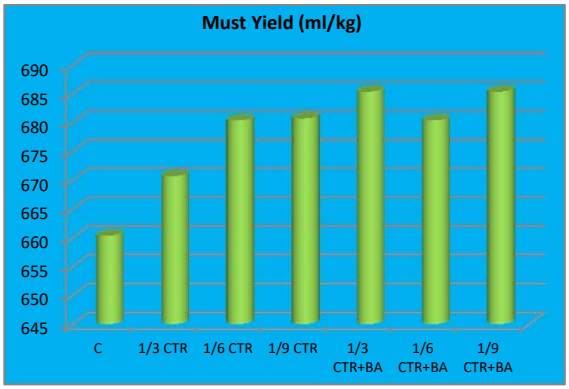

Fig. 5 Effects of applications on must yield

V. Conclusion

Consequently, it can be recommended to increase fresh grape yield, 100 berry weight and maturity index with 1/9 CTR+BA application in the Italia grape variety.

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References

[1] http://faostat.fao.org. Rome: FAO ''Statistical Database''. (Date of access. 10.01.2016), 2014.
[2] http://tuikapp.tuik.gov.tr/bitkiselapp/bitkisel.zul Tuik,''Crop Production Statistics, (Date of access. 10.01.2016), 2015.
[3] Y. S. Ağaoğlu, ''The effect of the depression period on flower formation''. Tübitak V. Science Congress, İzmir, 1975.
[4] B. Yağmur, Ş. Aydın, and H. Çoban, ''The effect of foliar iron (fe) applications on the mineral elements content of vineyard leafs''. Ege University, Journal of Agriculture Faculty, 42 (3): 135-145, 2005.
[5] I. Uzun, ''Viticulture handbook''. Hasad Publishing, İstanbul, 155 pages, 2011.
[6] Y. Kasap, ''Viticultur and fertilizer''. Ravza Publishing, İstanbul, 232 pages, 2012.
[7] C. Williams, N. Maier, and L. Bartlett, ''Effect of molybdenum foliar sprays on yield, berry size, seed formation, and petiolar nutrient composition of "Merlot" grapevines''. Journal of Plant Nutrition, 27 (11): 1891-1916, 2005.
[8] H. Karataş, and Y.S. Ağaoğlu, ''Fruitfullness in grapevines''. Alatarım. 4 (1): 13-22, 2005.
[9] A. Akın, and H. Çoban, ''The Effects on Yield and Yield Components of Different Level Cluster Tip Reduction and Foliar Boric Acid Applications on Alphonse Lavallee Grape Cultivar''. World Academy of Science, Engineering and Technology International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering. 10: 208-213, 2016.
[10] Y. Gayretli, and A. Akın, '' The effects of cluster tip reduction and boric

acid applications on yield and yield components of Alphonse Lavallee grape cultivar''. Çanakkale Onsekiz Mart University. Journal of Agriculture Faculty. (Impress).

[11] M. Karaçocuk, and A. Akın, ''The effects of cluster tip reduction and boric acid applications on yield and yield components of Tilki Kuyruğu grape cultivar''. Çanakkale Onsekiz Mart University. Journal of Agriculture Faculty. (Impress).

[12] H. D. Baneh, and M. Taheri, ''Effects of foliar application of nutrient elements on fruit set and quantitative and qualitative traits of Keshmeshi grape cultivar''. Seed and Plant Production Journal, 25 (1), 103-115, 2009.

[13] M. Gil, M. Esteruelas, Z. E. Gonzále, N. Kontoudakis, J. Jiménez, F. Fort, J. M. Canals, I. Hermosín-Gutiérrez,and F. Zamora, F, ''Effect of two different treatments for reducing grape yield in *Vitis vinifera* cv syrah on wine composition and quality: berry thinning versus cluster thinning''. J. Agric. Food Chem, 61: (4968−4978), 2013.

[14] M. A. Amerine, and M. V. Cruess, "The technology of wine making''. The Avi Publishing Comp., Inc. Westport, Connecticut, U.S.A., 709 pp, 1960.

[15] K.E. Nelson,''Harvesting and handling california table grapes for market''. Bull. 1913, Univ. California, DANR Publication, Oakland, CA, 1985.