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The Effects of Cluster Tip Reduction and Boric Acid Applications on Yield and Yield Components of Alphonse Lavallee Grape Cultivar

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Abstract

Viticulture is a very important agriculture branch in Turkey. This study was conducted on Alphonse Lavallee grape variety (*Vitis vinifera* L.) in Konya province in Turkey in 2016. The cultivar is 7 years old and grown on 110 R rootstock. In this research, it was investigated whether the applications of 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 Alphonse Lavallee grape variety. The results were obtained as the highest berry weight (5.23 g) with 1/9 CTR+BA and (5.32 g) with 1/9 CTR applications; as the highest maturity index (45.14) with 1/9 CTR application; as the highest must yield (673.33 ml/kg) with 1/6 CTR+BA, (686.67 ml/kg) with 1/9 CTR+BA, (693.33 ml/kg) with 1/3 CTR+BA, (703.33 ml/kg) with 1/6 CTR and (703.33 ml/kg) with 1/9 CTR applications. No significant effects were found statistically on fresh grape yield and cluster weight values. To increase berry weight and maturity index in Alphonse Lavallee grape variety can be recommended 1/9 CTR application.
Keywords: Alphonse Lavallee, boric acid, cluster tip reduction, yield, yield components

Öz

Alphonse Lavallee Üzüm Çeşidinde Salkım Ucu Kesme ve Borik Asit Uygulamalarının Verim ve Verim Unsurları Üzerine Etkileri

Bağcılık, Türkiye'de çok önemli bir tarım koludur. Bu çalışma, 2016 yılında Konya ilinde 110 R asma anacı üzerine aşılı 7 yaşındaki Alphonse Lavallee (*Vitis vinifera* L.) üzüm çeşidinde gerçekleştirilmiştir. Araştırmada, Kontrol (K), 1/3 Salkım Ucu Kesme (1/3 SUK), 1/6 Salkım Ucu Kesme (1/6 SUK), 1/9 Salkım Ucu Kesme (1/9 SUK), 1/3 SUK+Borik Asit (BA), 1/6 SUK+BA, 1/9 SUK+BA uygulamalarının Alphonse Lavallee üzüm çeşidinde verim ve verim unsurları üzerine etkileri incelenmiştir. En yüksek tane ağırlığı (5,23 g) 1/9 SUK+BA ve (5.32 g) 1/9 SUK uygulamaları ile; en yüksek olgunluk indisi (45,14) 1/9 SUK uygulaması ile; en yüksek şıra randımanı (673,33 ml/kg) 1/6 SUK+BA, (686,67 ml/kg) 1/9 SUK+BA, (693,33 ml/kg) 1/3 SUK+BA, (703,33 ml/kg) 1/6 SUK ve (703,33 ml/kg) 1/9 SUK uygulamaları ile elde edilmiştir. Uygulamaların üzüm verimi ve salkım ağırlığı değerleri üzerine etkisi istatistiki olarak önemli bulunmamıştır. Alphonse Lavallee üzüm çeşidinde, tane ağırlığı ve olgunluk indisi değerlerini artırmak için 1/9 SUK ve 1/9 SUK+BA uygulamaları, olgunluk indisi değerini artırmak için 1/9 SUK uygulaması tavsiye edilebilir.
Anahtar Kelimeler: Alphonse Lavallee, borik asit, salkım ucu kesme, verim, verim unsurları

Introduction

Turkey is a very important country in terms of viticulture in the World. It is producing 67.067.129 tons of grapes from 6.969.373 hectares in the World (FAO, 2016). Turkey has the 5th with 461.956 hectares of viticulture area, and the 6th with 3.650.000 tons of production in Turkey (TÜİK, 2016).

The boron deficiency decreases the amounts of ascorbic acid and a non–protein compound. It also remarkably decreases the activity of glutathione reductase (Cakmak and Romheld, 1997). TARIS–ZF foliar fertilizer was applied on leaves of Horoz Karası (Ermenek) grape cultivar, and fresh grape yield, cluster weight, 100 berry weight, berry stalk connection force, must yield and pruning waste weight values were increased. However, berry width, berry length, berry length/berry width ratio, total sugar, total acid, maturity index and the number of bud burst values were decreased (Akın, 2003).

The Fe deficiency was determined in consequence of studies performed at Alasehir location which had a large potential for vineyard in Aegean region. In the experiment which was carried out in the randomized complete block design with five replications, the foliar Fe applications in the form of Fetrilon 13 and at four different levels were performed in three different periods. In general, the Fe applications affected positively the content of nutrient elements in the leaf compared to control. It was

observed that the contents of total Fe and also the contents of active Fe of lamina also increased depending on the foliar Fe applications (Yağmur et al., 2005).

The effects foliar application of nitrogen, boron and zinc on fruit set and some quatitative and qualitative characteristics of Thampson seedless grape (Keshmeshi cultivar) was conducted. Treatments were urea (0, 0.5 and 1%) zinc sulphate (0 and 0.15%), boric acid (0 and 0.13%) and their combinations that applied at seven days before full bloom and fruit set formation. Generally, application of nitrogen, boron and zinc (0.5, 0.15 and 0.15%, respectively) had a positive effect on fruit set, but the role of zinc was much more than the effects of the other two elements (Baneh and Taheri, 2009).

A study was carried out 150–50–50 g/vinestocks (N1P1K1) by giving Boron as 11% Borax dosages; I. dose (Bo); 0 g, II. dose (B1); 2,5 g, III. dose (B2); 5 g, IV. dose (B3); 10 g Boron/vinestock. The Boron application: I. Boron application was on vinestock drop–lines by mixing it (20–30 cm deep) 15 days before blooming, II. Application started 15 days before blooming and repeated at 15 day intervals. One fourth of boron was applied by spraying on the leaves four times. The yield increased at the range of 13.50% – 70.45% with the increase of boron level as compared to the control (Er et al., 2011).

In Amasya and Cardinal grape varities, cluster thinning wase conducted. Cluster thinning application in Amasya and Cardinal grape cultivars decreased the amount of titratable acid and fresh grape yield per vine, while it increased the index of maturity value (Dardeniz and Kısmalı, 2002).

Horoz Karası and Gok grape varieties (*Vitis vinifera* L.) were carried out in 2010. Effects of 1/3 cluster reduction (CR), 1/3 CR + herbagreen (HG) and 1/3 CR + humic acid (HA) applications on grape yield and quality of cultivars were examined. The results showed that 1/3 CR + HA application increased grape yield, berry weight, berry red and blue color intensity values of Horoz Karası grape variety and 1/3 CR application increased grape yield and maturity index values of Gök grape variety (Akın, 2011). Tartaric and malic acid values of Red Globe grape variety were mostly influenced by the cluster–berry thinning treatment (Keskin et al., 2013).

The influences of two treatments for reducing grape yield, cluster thinning and berry thinning on red wine composition and quality were studied in a *Vitis vinifera* cv Syrah vineyard in AOC Penedès (Spain). Cluster thinning reduced grape yield per vine by around 40% whereas berry thinning only reduced it by around 20%. Cluster thinning and berry thinning grapes had higher titratable acidity content and b color intensity than control grapes. Berry thinning grapes had higher color intensity than control grapes (Gil et al., 2013).

Uslu (*V. vinifera* L.) and Cardinal (*V. vinifera* L.) grape cultivars were conducted in Canakkale in Turkey. When the berries were 5–7 mm, the clusters were tipped at 1/3rd, 1/6th and 1/12th of the cluster length. In Uslu, cluster length (cm), cluster width (cm), cluster compactness (1–9), number of berries/cluster (n), berry weight (g) and titratable acidity (TA) (%) parameters were affected by the applications. In Cardinal, cluster length (cm), cluster compactness (1–9), number of berries/cluster (n), berry weight (g), total soluble solid (TSS) (%), titratable acidity (TA) (%) and maturity index parameters were affected by the applications. Yield was not affected by cluster tipping in Uslu and Cardinal grape cultivars. It was concluded that the cluster tipping applied to Uslu in a proportion of one–third and to the Cardinal in a proportion of one–sixth of the cluster length would be positively sufficient in terms of increasing the grape quality (Dardeniz, 2014).

The foliar application of Boron and Zinc for increasing quality and yield in grapevines was conducted. The experiment was done in a factorial completely randomized design with two factors and three replications. Factors of the experiment included two levels of combination of Zn and B from of $ZnSO_4.H_2O$ and H_3BO_3 (0 and 2 g/l). Second factor involved seven Turkmenistan cultivars (No.1, 3, 4, 5, 6, 7 and 8) and one ‘Rotabi Zarghan’ local cultivar. The foliar application was applied at three different stages including pre– and post–flowering and veraison. The results of variance analysis showed that using different levels of fertilization significantly increased berry (number, length and weight), cluster (length and weight) and seed (number and size) characteristics and TSS. Based on results the most fruit set index (berry number per cluster) observed in Turkmenistan No.7, 4, and 3 cultivars respectively, although it was not significant among cultivars. Also, effect of different cultivars was different significantly on chemical (TSS, TA and pH) and physical (length and weight berry, length and weight cluster and seed number and size) characters. Generally, different cultivars respond differently to the application of B and Zn (Nikkhah et al., 2013).

Boron (B) deficiency could impact the production and quality of grapevine (*Vitis vinifera* L. cv. Karaerik). A field experiment was conducted for determining the optimum economic B rate (OEBR), critical soil test, and tissue B values for yield and quality response of grapevine to B fertilizer application method (foliar and soil) at 5 doses (0, 1, 3, 9, and 12 kg B/ha) for two years. OEBR of foliar and soil application ranged from 6.4 to 8.5 kg B/ha with an average yield of 20.2–12.8 t/ha, respectively. The average soil B content at the OEBR was 0.32–2.52 mg/kg. Leaf tissue B content amounted to 98.9 and 64.4 mg/kg, and berry B content amounted to 21.4 and 12.9 mg/kg for foliar and soil application methods, respectively. Independently of application method, B application increased tissue N, Ca, Mg, P, K, and Zn, yet decreased Fe, Mn, and Cu content. We concluded that a B addition of 6.4 kg/ha for foliar application and 8.5 kg/ha for soil application are sufficient to elevate the soil B to the nondeficient levels (Güneş et al., 2015).

The objective of this study was to determine the effects on grape yield and its quality of Control, 1/3, 1/6, 1/9 Cluster Tip Reductions, Boric Acid from foliar and combined applications in Alphonse Lavallee grape variety.

Materials and Methods

This study was conducted in 110 R rootstock grafted on 7 years old Alphonse Lavallee (*Vitis vinifera* L.) grape variety in Konya province in Turkey in 2016. The cultivar consumed as table grape has yellow–green skin, seed, and matures at the end of August and early September. The present study was conducted with three different applications as three replications.

Experimental design;

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.

The effects on yield and yield components of this application in Alphonse Lavallee grape variety were determined. In this study, three vine plots in each replication including 21 in the vine 63 vines were used in total.

1/3 Cluster Tip Reduction (1/3 CTR): The 1/3 cluster tip reduction (berry thinning) was applied by cutting the tips of the cluster at the point 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.

1/6 Cluster Tip Reduction (1/6 CTR): The 1/6 cluster tip reduction (berry thinning) 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 (berry thinning) 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.

Application in Boric Acid Form to Foliar (BA): The first boric acid application: a week before flowering, the second application was used including berry period. Applications; 100 liters of water, 100 g boric acid, 500 g urea to be prepared was sprayed onto the cool evening hours. Maturing of the grapes after harvest and the data were obtained according to the following criteria.

Fresh Grape Yield (kg/vine): It was calculated by weighing all the yields from the vines in the parcels and dividing it with the number of vines.

Cluster Weight (g): It was found by dividing the total grape yield with the number of grape cluster obtained from each parcel.

Berry Weight (g): It was calculated a berry weight by dividing to100 of 100 berries weight collected using the method (Amerine and Cruess, 1960).

Must Yield (ml/kg:) With squeezing of 1 kg from the grapes collected by chance, given in ml/kg.

Maturity Index (°Brix /TA): It was determined with the division of °Brix to TA. ^{o}Brix (total soluble solid substance) (%) was determined by squeezing the grapes (berries) collected from the vines using the method (Amerine and Cruess, 1960) and keeping the resulting juice at 20 °C in a digital refractometer device (Atago RX 7000 Alpha). TA (titratable acidity) (g/l) was calculated by using the titration method from the juice squeezed from the same grapes. Pipette 5 ml of the grape juice and 50 ml of pure water in the beaker taken to be completed were subjected to titration with 0.1 N NaOH (Nelson, 1985).

The research was planned in a completely randomized block design as a simple factorial experiment, and variance analyses and multiple comparison tests were done by JMP statistical package program (version 7.0; SAS Institute, Cary, NC, USA).

Results and Discussion

The effects of all of the applications on berry weight, must yield and maturity index in Alphonse Lavallee grape variety were found statistical significant.

Effects of Applications on Fresh Grape Yield

The effect of applications on fresh grape yield is not a statistical significant (Fig. 1). But, the highest fresh grape yield was obtained with 1/9 CTR (6.18 kg/vine) application compared to C (4.99 kg/vine) as numerically. In similar studies, It was reported that the bunch reduction application decreased the grape yield (Akın, 2011). Cluster thinning reduced the grape yield per vine by around 40%, whereas berry thinning only reduced it by around 20% in *Vitis vinifera* cv Syrah (Gil et al., 2013).

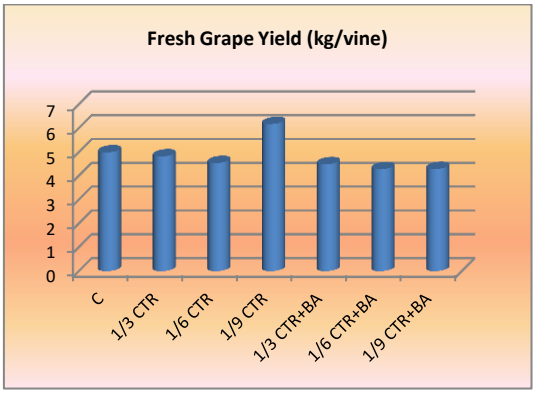

Figure 1. Effects of applications on fresh grape yield

Effects of Applications on Cluster Weight

The result of applications on cluster weight is not a statistical significant (Fig. 2). In similar studies, while Taris–ZF foliar fertilizer application did not increase the cluster weight of Hesap Ali and Eksi Kara varieties, it increased in Ermenek variety (Akın, 2011).

Figure 2. Effects of applications on cluster weight

Effects of Applications on Berry Weight

The effect of applications on berry weight is determined as a statistical significant (Fig. 3). The highest berry weight were obtained with 1/9 CTR (5.32 g) and with 1/9 CTR+BA (5.23 g) applications compared to C (4.53 g) application. In similar studies, while Taris–ZF foliar fertilizer application increased berry weight of Eksi Kara and Ermenek varieties, the increase in Hesap Ali variety was not found to be significant (Akın, 2011).

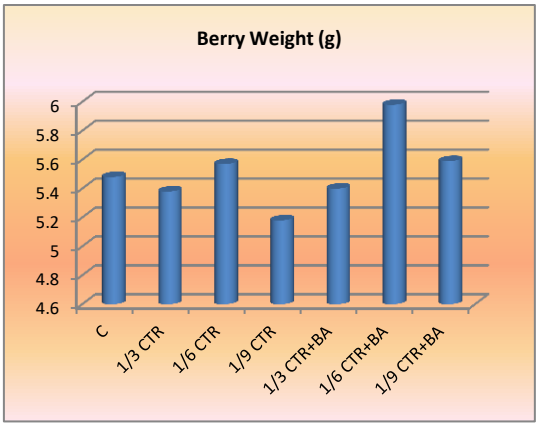

Figure 3. Effects of applications on berry weight

Effect of Applications on Must Yield (Grape Juice)

The result of applications on must yield is determined as a statistical significant (Fig. 4). The highest must yield were taken with 1/6 CTR (703.33 ml/kg), with 1/9 CTR (703.33 ml/kg), with 1/3 CTR+BA (693.33 ml/kg), with 1/6 CTR+BA (673.33 ml/kg) and with 1/9 CTR+BA (686.67 ml/kg) applications compared to C (562.67 ml/kg). In similar studies, as Taris–ZF foliar fertilizer application increased the must yield of Eksi Kara and Ermenek varieties, the increase in Hesap Ali was not found to be significant (Akın, 2011).

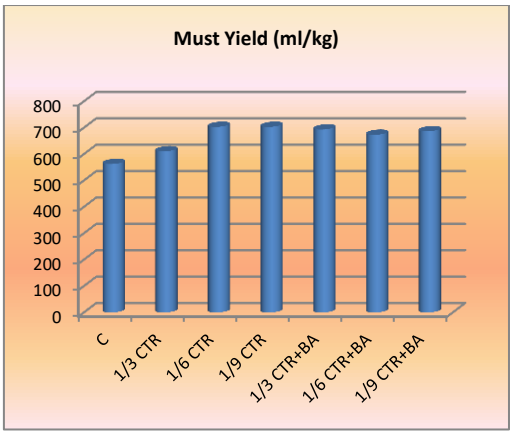

Figure 4. Effects of applications on must yield

Effects of Applications on Maturity Index

A different response according to applications in terms of maturity index was found statiscal significant (Fig. 5). The maturity index obtained with 1/9 CTR (45.14) application was higher than C (21.28) when compared . In similar studies, while Taris–ZF foliar fertilizer application increased the maturity index of Hesap Ali and Eksi Kara varieties, the increase in Ermenek grape variety was not found to be significant (Akın, 2011). The maturity index value was increased on reducing cluster number application in Amasya and Cardinal grape cultivars (Dardeniz and Kısmalı, 2002).

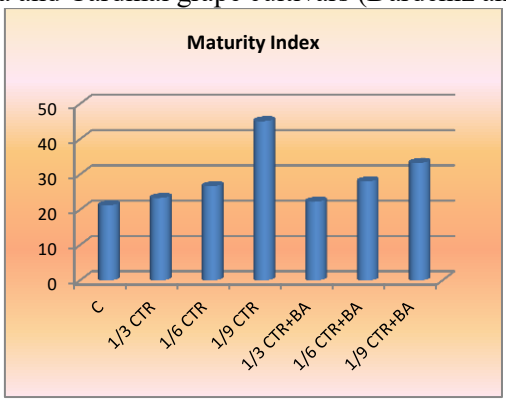

Figure 5. Effects of applications on maturity index

Conclusion

Consequently, we can recommend 1/9 CTR application to improve berry weight and maturity index. However, the work should be repeated in a few years more in Alphonse Lavallee grape cultivar.

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