International Journal of Biological, Life and Agricultural Sciences
ISSN: 2415-6612
Vol:10, No:5, 2016

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

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***Abstract*—**This study was carried out to determine the effects 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 applications on yield and yield components of four years old Alphonse Lavallee grape variety (*Vitis vinifera* L.) grown on grafted 110 Paulsen rootstock in Konya province in Turkey in the vegetation period in 2015. According to the results, the highest maturity index 21.46 with 1/9 CTR application; the highest grape juice yields 736.67 ml with 1/3 CTR + BA application; the highest L* color value 32.07 with 1/9 CTR application; the highest a* color value 1.74 with 1/9 CTR application; the highest b* color value 3.72 with 1/9 CTR application were obtained. The effects of applications on grape fresh yield, cluster weight and berry weight were not found statistically significant.

***Keywords*—**Alphonse Lavallee grape cultivar, different cluster tip reduction (1/3, 1/6, 1/9), foliar boric acid application, yield, quality.

I. Introduction

VITICULTURE is a significant branch of agriculture in Turkey. Turkey is the most suitable location for viticulture. It is producing 73.524.262 tons of grapes from 7.155.187 hectares in the World [1]. Turkey has the 5th with 461.956 hectares of viticulture area, and the 6th with 3.650.000 tons of production in Turkey [2].

Micronutrients included the nonmetallic only plant nutrients for the absolute necessity [3]-[5]. The boron deficiency decreased the amounts of ascorbic acid and a non-protein compound. It also remarkably decreases the activity of glutathione reductase [6].

II. Review of Literature

Round seedless grape was treated with different applications. These applications were tip cutting of the cluster, girdling and applying both methods together at fruit set. When we compare all these applications with control, harvest dates were 5-7 days earlier. Cluster weight, cluster length, and number of berries per cluster increased more in girdling application than in tip cutting of cluster. The highest values of berry weight, berry volume and berry length, berry width and berry detachment index were obtained at the application of the girdling plus tip cutting of cluster at fruit set [7].

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 [8].

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 [9].

It was found that yield, cluster weight, berry weight and must had statistically significant effect on the rate, TSS and the total acidity of Humic acid application in Ercis grape variety. TSS ratio increased with the application of humic acid, and the total acidity ratio is determined to fall [10].

A study was carried out 150-50-50 g/vinestocks ($N_1P_1K_1$) by giving Boron as 11% Borax dosages; I. dose (Bo); 0 g, II. dose (B_1); 2,5 g, III. dose (B_2); 5 g, IV. dose (B_3); 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 [11].

Reducing the cluster number 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 [12]. Leaf collection and implementation of cluster thinning in Crimson seedless grape cultivar resulted in the increase of cluster weight, cluster size,

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berry size, berry color, ºBrix and fruit juice values and decreases in accelerating the maturation process and the acidity values [13].

It was carried out in 5 BB rootstock grafted on Horoz Karası and Gok grape varieties (*Vitis vinifera* L.) during the 2010 growth season. 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 [14].

Another study investigated the effects on grape yield and quality of control, 1/3 cluster tip reduction, repetitive applications of herbagreen (HG), humic acid (HA), combined foliar fertilizer (CFF), gibberellic acid (GA), gibberellic acid + combined foliar fertilizer (GA + CFF) and gibberellic acid + herbagreen (GA+HG) performed in the Muskule table grape variety. The longest cluster was obtained in control, the highest ^{0}Brix and L* color value were obtained in 1/3 cluster tip reduction, the highest grape yield was obtained in 1/3 cluster tip reduction + herbagreen, the highest berry length/berry width, and b* color value in 1/3 cluster tip reduction + humic acid, the highest maturity index were obtained in 1/3 cluster tip reduction + combined foliar fertilizer, the highest must yield and a* color value were obtained in 1/3 cluster tip reduction + gibberellic acid + herbagreen applications [15].

The effects on grape yield and quality of applications from foliar in the 5 BB rootstock grafted on Hasandede wine grape variety were investigated. While maturity index was increased, berry weight, ºBrix and titratable acidity values were decreased. Grape yield, cluster weight, cluster lenght and berry lenght/ berry width values were not significantly with 1/3 Cluster Tip Reduction and 1/3 Cluster Tip Reduction + humic acid applications [16]. Tartaric and malic acid values of Red Globe grape variety were mostly influenced by the cluster-berry thinning treatment [17].

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 [18].

A research was conducted in Canakkale, Turkey aiming to study the effects of cluster tipping applications on the yield and quality of Uslu (*V. vinifera* L.) and Cardinal (*V. vinifera* L.) grape cultivars. 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 [19].

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 [20].

It was investigated Ismailoglu grape type (*Vitis vinifera* L.) in Turkey. In this research, it was investigated whether the applications on yield and yield components of Ismailoglu grape type. The results were obtained as the highest fresh grape yield (16.15 kg/vine) with TKI-HM (S), as the highest cluster weight (652.39 g) with 1/3 CTR + STR, as the highest 100 berry weight (419.07 g) with 1/3 CTR + STR + TKI-HM (F), as the highest maturity index (44.06) with 1/3 CTR, as the highest must yield (810.00 ml) with STR + TKI-HM (F), as the highest intensity of L* color (42.04) with TKI-HM (S + F), as the highest intensity of a* color (2.60) with 1/3 CTR + TKI-HM (S), as the highest intensity of b* color (7.16) with 1/3 CTR + TKI-HM (S) applications. To increase the fresh grape yield of Ismailoglu grape type was recommended TKI-HM (S) application [21].

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 [22].

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.

III. Methodology

This study was conducted in 1103 Paulsen rootstock grafted on five years old Alphonse Lavallee (*Vitis vinifera* L.) grape variety during the 2015 growth season in Konya province in Turkey. The cultivar is consumed as table grape, yellow-green skin, seedy, at the end of August and early September maturing. 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.

A. 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.

B. 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.

C. 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.

D. 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.

E. 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.

F. Cluster Weight (g)

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

G. Berry Weight (g)

It was calculated a berry weight 100 by dividing of 100 berries weight collected using the method [23].

H. Maturity Index (°Brix /TA)

It was determined with the division of °Brix to TA. °Brix (total soluble solid substance) (%) was determined by squeezing the grapes (berries) collected from the vines using the method [23] 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 [24].

I. Must Yield (ml/kg)

It was determined as the amount of juice obtained by squeezing the grapes that were picked.

J. Color Density

It was determined using a colorimeter device (CR-400 Minolta Co., Osaka, Japan). Color intensity values were provided as CIEL* (Commision Internationele de I'E Clairage) a* b* coordinates, which defined the color in a three-dimensional space. However, L* indicated lightness, while a* and b* were the chromaticity coordinates, green-red and blue-yellow coordinates, respectively. L* is an approximate measurement of luminosity, which is the property according to which each color can be considered as equivalent to a member of the gray scale, between black and white, taking values within the range of 0 to 100. Thus, a* takes positive values for reddish colors and negative values for the greenish ones, whereas b* takes positive values for yellowish colors and negative values for the bluish ones [25]. For the color measurement, 10 grapes per cluster were selected from two opposite sides of the cluster and at five different heights. In this way, the color datum was the mean of 10 grapes for each application. 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).

IV. Findings and Comments

The effects of all of the applications on maturity index, must yield, intensity of L* color, a* color and b* color in Alphonse Lavallee grape variety were found statistical significant.

A. Effects of Applications on Fresh Grape Yield

The effect of applications on fresh grape yield is not a statistical significant (Fig. 1). In similar studies, while Taris-ZF foliar fertilizer application did not increase fresh grape

yield of Hesap Ali and Eksi Kara varieties, it increased that of Ermenek grape variety [8]. It is showed that 1/3 CR + HA application increased grape yield of Horoz Karası grape variety and 1/3 CR application of Gok grape variety [11]. It was reported that the bunch reduction application decreased the grape yield [14]. 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 [18].

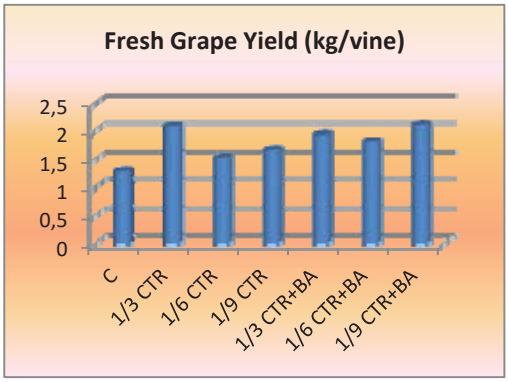

Fig. 1 Effects of applications on fresh grape yield

B. 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 [8].

C. Effects of Applications on Berry Weight

The effect of applications on berry weight is not a statistical significant (Fig. 3). 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 [8].

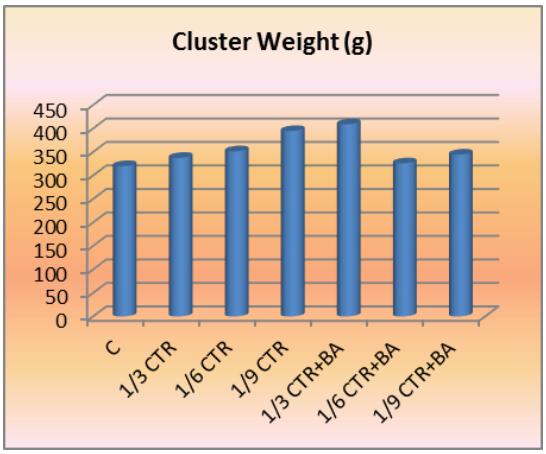

Fig. 2 Effects of applications on cluster weight

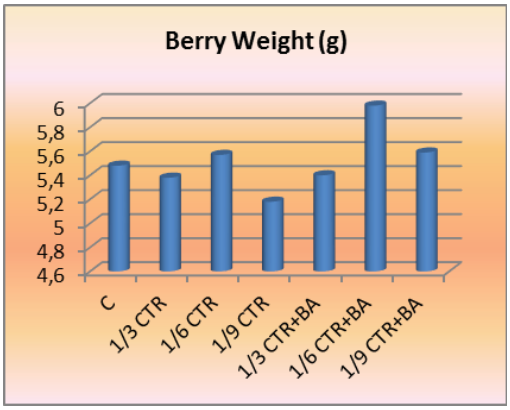

Fig. 3 Effects of applications on berry weight

D. Effects of Applications on Maturity Index

A different response according to applications in terms of maturity index was found (Fig. 4). The highest maturity index was taken with 21.46 from 1/9 CTR application in Alphonse Lavallee grape variety. The least maturity index was taken with 17.76 from 1/ CTR + BA, with 17.86 from 1/3 CTR + BA and 18.15 from 1/6 CTR + BA applications. 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 [8]. The maturity index value was increased on reducing cluster number application in Amasya and Cardinal grape cultivars [12].

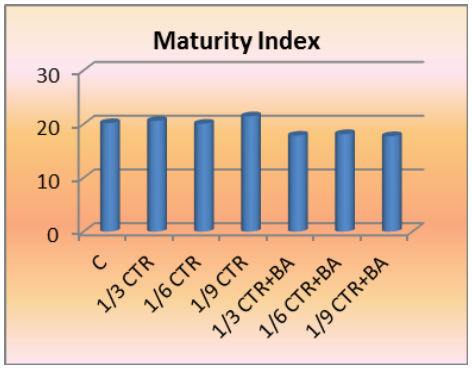

Fig. 4 Effects of applications on maturity index

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

The results showed a different response according to applications in terms of must yield (Fig. 5). The highest must yield was taken with 736.67 ml/kg from 1/3 CTR + BA application in Alphonse Lavallee grape variety. The least maturity index was taken with 606.67 ml/kg from 1/6 CTR, with 606.67 ml/kg from 1/9 CTR and with 600.00 ml/kg from C applications. 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 [8].

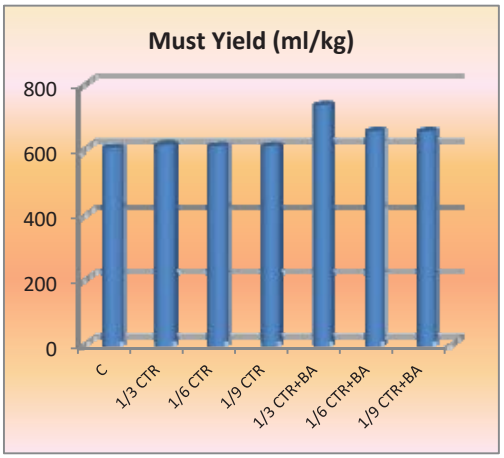

Fig. 5 Effects of applications on must yield

F. Effect of Applications on L Color Intensity*

The highest L* color intensity was obtained with 32.07 from 1/9 CTR application in Alphonse Lavallee grape variety. L* color intensity increased white (brightness) compared to control (42.59) with this application. The least L* color intensity was taken with 27.53 from 1/9 CTR + BA and with 27.88 from 1/6 CTR + BA applications (Fig. 6). In similar studies, the L* color intensity increased with 1/3 CTR application in Muskule table grape variety [18].

G. Effect of Applications on a Color Intensity*

The highest a* color intensity was obtained with 1.74 from 1/9 CTR application in Alphonse Lavallee grape variety. a* color intensity increased compared to control (0.35) with this application. That is the increased reddish color of berries. The least a* color intensity was taken with 0.34 from 1/3 CTR, with 0.35 from C and 0.42 from 1/6 CTR applications (Fig. 6). In similar studies, a* color intensity value increased with the berry thinning application in Syrah grape variety [18].

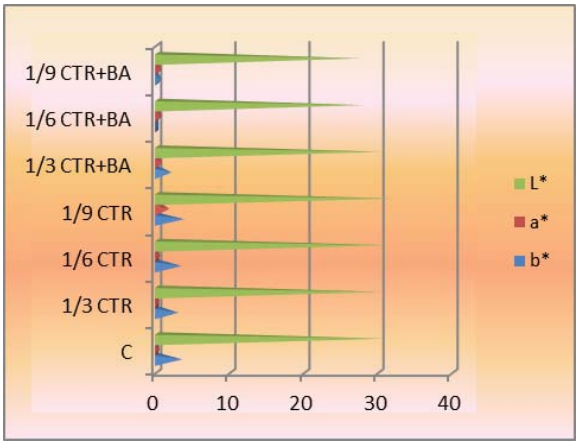

Fig. 6 Effects of applications on color intensity

H. Effect of Applications on b Color Intensity*

The highest b* color intensity was obtained with 3.72 from 1/9 CTR application in Alphonse Lavallee grape variety. b* color intensity increased compared to control (3.43) with this application. That is the increased yellowish color of berries. The least b* color intensity was taken with 0.15 from 1/6 CTR + BA application (Fig. 6). In similar studies, b* color intensity increased with cluster thinning and berry thinning applications in Syrah grape variety [18].

V. Conclusion

Consequently, we can recommend to improve maturity index with 1/9 CTR; to improve must yield with 1/3 CTR + BA; to improve L* (black) color intensity with 1/6 CTR + BA or 1/9 CTR + BA; to improve a* (reddish) color intensity with 1/9 CTR applications.

Acknowledgments

This study was supported by Selcuk University Scientific Research Project (Selcuk University-BAP, Konya-Turkey, Project Number: 15401061). The authors wish to thank BAP Staffs.

References

[1] http://faostat.fao.org. Rome: FAO "Statistical Database" Retrieved February 01, 2016.
[2] http://tuikapp.tuik.gov.tr/bitkiselapp/bitkisel.zul Tuik, Crop Production Statistics, Retrieved February 01, 2016.
[3] K. Warington, "The Effect of boric acid and borax on the broad bean and certain other plants''. Ann. Bot., 37, 629-672, 1923.
[4] S. Goldberg, "Reaction of boron with soils. In Plant and Soil. Proceedings Eds". R.W. Bell and B. Rerkasem, Kluwer Academic Publishers, Dordrecth, the Netherlands pp. 193, 35-48, 1997.
[5] R. Keren, F.T. Bingham, and J.D. Rhoades, "Effect of clay content in soil on boron uptake and yield of wheat. Soil Sci. Soc. Am. J., 49, 1466-1470, 1975.
[6] I. Cakmak, and V. Romheld, "Boron-deficiency induced impairments of cellular functions in plants''. In: Boron in Soils and Plants: Reviews. Eds. B. Dell, P.H. Brown and R.W. Bell. Kluwer Academic Publishers, Dordrecht, The Netherlands. pp. 71-83, 1997.
[7] H. Coban, "Investigations on the effects of some cultural applications to increase table grape quality. Anadolu, J. of AARI 11 (2): 76 – 88, 2001.
[8] A. Akın, "Investigation on effects of different crop loading and leaf fertilizer application on the growth, grape yield and quality in some table grape varieties''. Selcuk University. Graduate School of Natural Sciences. Soil Department (PhD Thesis), pp: 311, Konya, 2003.
[9] B. Yagmur, S. Aydın, and H. Coban, "The effect of foliar iron (fe) applications on the mineral elements content of vineyard leafs. Ege Univ. Journal of Agricultural Faculty, 42(3):135-145, 2005.
[10] H. Yaşar, "The effect of humic acid applications on yield, fruit characteristics and nutrient uptake ercis grape cultivar''. Yüzüncüyıl University. Graduate School of Natural Sciences. Horticulture Department (Master Thesis), 22 page, Van, 2005.
[11] F. Er, A. Akın, and M. Kara, "The effect of different ways and dosages of boron application on Black Dimrit (*Vitis Vinifera* L.) grape's yield and quality. Bulg. J. Agric. Sci., 17: 544-550, 2011.
[12] A. Dardeniz, and I. Kısmalı, "The researches on the effects of different crop load on pruning weight, yield and quality of Amasya and Cardinal grape cultivars. Ege Üniv. Agriculture Faculty Publications. 39: 9-16. Bornova-İzmir. (In Turkish), 2002.
[13] E. Abd El-Razek, D. Treutter, M.M.S. Saleh, M. El-Shammaa, A.A. Fouad, N. Abdel-Hamid, and M. Abou-Rawash, "Effect of defoliation and fruit thinning on fruit quality of 'crimson seedless' grape''. Research Journal of Agriculture and Biological Sciences. 6(3): 289-295, 2010.
[14] A. Akın, "Effects of cluster reduction, herbagreen and humic acid applications on grape yield and quality of Horoz Karasi and Gök üzüm grape cultivars''. African Journal of Biotechnology. 10 (29): 5593-5600, 2011a.

[15] A. Akın, "Effects of cluster tip reduction and some growth regulating applications on grape yield and quality of the Müşküle grape variety''. YYU J AGR SCI, 21(2):134-139,2011b.
[16] A. Akın, and A. Sarıkaya, "Effects of cluster tip reduction and humic acid applications on grape yield and quality of Hasandede grape variety''. Sakarya University, Journal of Arts and Sciences, 14 (1): 267-274, 2012.
[17] N. Keskin, B. İsci, and Z. Gokbayrak, "Effects of cane-girdling and cluster and berry thinning on berry organic acids of four *Vitis vinifera* L. table grape cultivars''. Acta Sci. Pol., Hortorum Cultus 12(6) 2013, 115-125, 2013.
[18] M. Gil, M. Esteruelas, E. González, N. Kontoudakis, J. Jiménez, F. Fort, J. M. Canals, I. Hermosín-Gutiérrez, and F. Zamora, "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.
[19] A. Dardeniz, "Effects of cluster tipping on yield and quality of Uslu and Cardinal table grape cultivars''. ÇOMÜ Agricultural Faculty Journal, 2 (1): 21–26, Çanakkale (In Turkish), 2014.
[20] R. Nikkhah, H. Nafar, S. Rastgoo, and M. Dorostkar, "Effect of foliar application of boron and zinc on qualitative and quantitative fruit characteristics of grapevine (*Vitis vinifera* L.)''. International Journal of Agriculture and Crop Sciences. 6(9): 485-492, 2013.
[21] Y. Önal, and A. Akın, "The effects of yield and yield components of some quality increase applications on İsmailoglu grape type in Turkey. World Academy of Science, Engineering and Technology International Journal of Biological, Veterinary, Agricultural and Food Engineering. 875International Scholarly and Scientific Research & Innovation. 8(8): 874-878, 2014.
[22] A. Guneş, C. Kose, and M. Turan, "Yield and mineral composition of grapevine (*Vitis vinifera* L. cv. Karaerik) as affected by boron management. Turk J Agric for (2015) 39: 742-752, 2015.
[23] 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.
[24] K.E. Nelson, "Harvesting and handling california table grapes for market''. Bull. 1913, Univ. California, DANR Publication, Oakland, CA, 1985.
[25] Minolta, "Precise color communication''. color control from feeling to instrumentation. Minolta, Co. Ltd., Osaka (Japan), 1994.