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PHYSICAL CHANGES OF SOME COLORED TABLE GRAPE VARIETIES DURING RIPENING

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Abstract: In this study, it was aimed to determine the physical changes of seven different colored table grape varieties in the samples taken at different periods until the ripening time. The cultivars used in the study are Alphonse Lavallée, Royal, Tekirdağ Çekirdeksizi, Michael Palieri, Karaerik, Bilecik İrikara and Horoz Karası. Grape samples were harvested for four weeks (20.08.2019, 27.08.2019, 02.09.2019 and 09.09.2019) every week for approximately one month until ripening. Cluster weight, bunch length and width, berry weight, berry width-length and berry hardness values were taken from the harvested grapes. Horoz Karası variety attracted attention with its cluster weight (550.86 g) and cluster width (15.01 cm) characteristics. The Michael Palieri variety stood out with its berry weight (8.92 g) and the Alphonse Lavallée variety with its berry hardness (0.94). Physical characteristics of all cultivars from fall to maturity differed according to both periods and cultivars. While the varieties and periods used in the study serve the literature, they are also an infrastructure for different studies with more varieties, different locations and different periods.

Keywords: Berry weight, Berry width, Berry hardness, Table grape

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1. Introduction

Considering the world agricultural activities, it can be stated that grape is the third most valuable product after tomato and potato with its economic value of 67.8 billion dollars in 2016 (Alston and Sambucci, 2019). According to the Food and Agriculture Organization of the United Naitons (FAO) data, viticulture reached a value of 167.90 billion dollars in 2018 and it is estimated that it will reach a value of 254.29 billion dollars by 2024. From the perspective of producers, viticulture activities are seen as an important source of income. Concentration of trade, increasing competitiveness in global markets has been an important goal for entrepreneurs and policy makers (Seccia et al., 2015).

Considering the statistics in recent years, it is seen that grape has increased despite the decrease in the vineyard areas. The reason for this is the positive effect of conscious cultural and chemical practices applied in viticulture on yield and quality per unit area. In particular, the development of technology and the reduction of vineyard areas have led to an increase in efforts to increase productivity. Various studies and researches are carried out on increasing productivity (Bahar et al., 2006; Sabır et al., 2010; Topuz, 2016).

Most of the grape in Turkey is used for table and raisin, and some for wine. The share of fresh grape production in our entire fruit production is % 50 (TUİK, 2019). The potential of table grape production should be recognized and factors such as domestic market, foreign market and producer requests should be taken into consideration (Kiracı et al., 2009; Söyler et al., 2019). In addition, grapes, which have an important place in human nutrition, have so many benefits for human health. Natural nutrition methods are recommended against increasing diseases in recent years. The fact that grapes are rich in antioxidant substances increases its importance even more. Therefore, it is necessary to increase the consumption of grapes (Cabaroğlu and Yılmaztekin, 2006).

One of the factors that determine the quality of grapes is ripening. If viticulture is to be carried out economically in a region, it is very important to know the optimum maturity of the variety to be grown. The ripening of grapes is affected by climatic conditions. Temperature, rains and sunshine duration for each variety to mature are variety specific (Winkler et al., 1974).

The climatic conditions of the Tokat province in Turkey; Being suitable for viticulture, it also enables the cultivation of commercially important table grapes. In the study, it was aimed to determine the physical changes that occur for 4 weeks until the harvest time in standard colored table grape varieties adapted to the conditions of Tokat province in Turkey.

2. Material and Methods

2.1. Material

This study was carried out in 2017 in the vineyard of Central Black Sea Transitional Zone Agricultural

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Research Institute (40° 32' 17.20" N, 36° 45' 09.53" E). The planting density of the vineyard is 3.0 x 1.75 m. A midwire cordon support system is used in the vineyard. Grape varieties used as material in the study were grafted onto 1103 paulsen American rootstock and were planted with a double-arm cultivation system with a stem height of 70 cm.

2.2. Methods

Grape samples were harvested approximately 1 month before the ripening time of the varieties, every week and for a total of four weeks (20.08.2019, 27.08.2019, 02.09.2019 and 09.09.2019). Necessary processes in the harvested grapes were carried out in the laboratories of Tokat Gaziosmanpaşa University, Faculty of Agriculture, Department of Horticulture in Turkey. Grape cultivars were harvested on 20 and 28 August, on 2 and 9 September, between 08:00 and 10:00 in the morning. In each harvest period, 10 clusters were taken from one replication and brought to the laboratory in ice containers. Analyzes of physical properties were made. The analyzes made are as follows;

2.2.1. Cluster weight

Samples of 3 clusters of each variety and replication harvested on the same days for four weeks were brought to the laboratory. The cluster weight was determined by weighing the samples with a precision balance (DENSI PC-100W model with 0.01 precision).

2.2.2. Cluster length and width (cm)

The length and width of the cluster, whose weight was taken, were measured with a ruler.

2.2.3. Physical properties of the berry

With 10 berry taken from each bunch (4-4-2), a total of 100 berry weight was taken. The width (mm) and length (mm) of 10 randomly selected berries from the granulated samples of each replication were measured with the help of caliper. The fruit flesh firmness of the same berries was measured with a precision scale (0.01 g) and a hardness meter (PCE. SLJ-B) with a 1.54 mm piercing tip.

2.2.4. Statistical analysis

The study was carried out according to the divided plot design with 3 replications and 6 vines in each replication. After the obtained data were subjected to analysis of variance, LSD (0.05) test was used to compare the means (Genç and Soysal, 2018). All the data of the cultivars during the harvest period were separately evaluated (random blocks) and analyzed.

3. Results and Discussion

When the varieties were examined among themselves, the differences in physical properties other than berry width and berry size were found to be statistically significant. The highest values in terms of cluster weight and cluster width were obtained in Horoz Karası (550.86 g; 15.01 cm) cultivar. The highest value in cluster length was obtained in Karaerik variety (22.61 cm). In terms of berry weight, Michele Palieri (8.92 g) stood out. Finally, when the berry hardness was examined, it was found that Alphonse Lavallée (0.94) had the highest value (Table 1).

When the physical properties were examined in terms of periods, the differences in all physical properties except berry width and berry weight were found to be statistically significant. When the characteristics that show differences are examined, the 4th period (438.68 g) comes to the fore in terms of cluster weight, while the 2nd period (398.96 g) follows it, and the 1st and 3rd periods (395.33; 376.20 g) are in the same group. In terms of cluster width, the 2nd and 3rd periods are in the same statistical group with the highest values (13.30; 13.19 cm) and the order changes as 4th period (12.62 cm) and 1st period (11.99 cm). In cluster length, the 4th period (21.04 cm) came to the fore, followed by the 2nd period (20.41 cm), the 1st period and the 3rd period (19.32; 18.83 cm) lastly took place in the same group. In terms of berry size, the 2nd, 3rd and 4th periods (23.38; 23.83; 23.78 mm) were in the same statistical group with the highest values. Berry hardness value was included in the same statistical group with the highest values in the 1st and 3rd periods (0.92; 0.85) (Table. 2).

Table 1. Cluster weight (g), cluster width (cm), berry width-length (mm), berry hardness values of the cultivars*

Cultivar	Cluster weight (g)	Cluster width (cm)	Cluster length (cm)	Berry weight (g)	Berry width (mm)	Berry width (mm)	Berry harness
Alphonse Lavallée	352.42^{cd}	13.06^{b}	19.67^{bc}	7.52^{b}	22.22	22.84	0.94^{a}
Bilecik İrikara	389.70^{bc}	10.90^{c}	17.98^{cd}	3.95^{d}	17.6	18.37	0.85^{ab}
Horoz Karası	550.86^{a}	15.01^{a}	20.13^{b}	8.90^{a}	36.76	30.63	0.93^{a}
Karaerik	372.28^{cd}	12.18^{b}	22.61^{a}	5.48^{c}	19.47	21.64	0.74^{bc}
Michele Palieri	441.34^{b}	12.89^{b}	22.33^{a}	8.92^{a}	23.21	26.03	0.84^{ab}
Royal	381.32^{cd}	13.06^{b}	19.11^{bcd}	8.12^{b}	23.14	23.75	0.78^{bc}
TÇ	328.14^{d}	12.35^{b}	17.46^{d}	4.96^{c}	18.81	20.27	0.66^{c}
LSD	57.14	1.24	2.11	0.66	N.S	N.S	0.12

*Mean values with different superscripts in the same effects indicate a significant difference (P<0.05).

TÇ= Tekirdağ çekirdeksiz

Table 2. Cluster weight (g), cluster width (cm), berry width-length (mm), berry hardness values of the periods*

Period	Cluster weight (g)	Cluster width (cm)	Cluster length (cm)	Berry weight (g)	Berry width (mm)	Berry length (mm)	Berry hardness
1	376.20^{b}	11.99^{b}	19.32^{b}	6.66	20.55	22.45^{b}	0.92^{a}
2	398.96^{ab}	13.30^{a}	20.41^{ab}	6.75	20.72	23.38^{a}	0.75^{b}
3	395.33^{b}	13.19^{a}	18.83^{b}	7.15	20.86	23.83^{a}	0.85^{a}
4	438.68^{a}	12.62^{ab}	21.04^{a}	6.78	29.99	23.78^{a}	0.74^{b}
LSD	43.19	0.94	1.6	N.S	N.S	0.62	0.08

*Mean values with different superscripts in the same effects indicate a significant difference (P<0.05).

When the physical properties of the cluster and the berry were examined in terms of the interaction of the variety X period, only the differences in the cluster weight and cluster width were found to be statistically significant. The highest value in terms of cluster weight was obtained from the 2nd period of Horoz Karası (649.49 g), while the lowest value was obtained from the 4th period of Tekirdağ Çekirdeksiz (279.40 g). In terms of cluster width, Horoz Karası 2nd period stood out again (17.56 cm), while the lowest value was obtained in Bilecik İrikara 1st period (9.67 cm). The results of the cluster weight, cluster width and other physical properties are as in Table 3.

Grape is not a climacteric fruit and is consumed when it is harvested. In determining the maturity of table and wine grapes, physical properties such as appearance of the fruit, skin color, berry size, presence of firm and spilled berries, and stem rupture resistance are taken into account along with chemical properties (Kara and Gerçekcioğlu, 1993). The characteristics (shape, color, width, length) of the cluster, which is the structure formed by the combination of grape berries, are also physical criteria for grapes.

Table 3. Cluster weight (g), cluster width-length (cm), berry width-length (mm), berry hardness values of cultivar X period interaction*

Cultivar	Period	Berry weight (g)	Berry width (mm)	Berry length (mm)	Berry harness	Cluster weight (g)	Cluster width (cm)	Cluster length (cm)
Alphonse Lavallée	1	7.14	21.81	21.98	0.91	403.42^{e-I}	12.78^{b-F}	20.67
Alphonse Lavallée	2	7.95	22.49	23.44	0.82	347.89^{g-K}	13.06^{b-F}	20.67
Alphonse Lavallée	3	7.67	22.35	23.09	0.89	334.11^{h-K}	13.67^{b-E}	17.22
Alphonse Lavallée	4	7.33	22.24	22.85	1.14	324.27^{h-K}	12.72^{b-F}	20.11
Bilecik İrikara	1	3.00	16.16	16.75	1.00	283.94^{j-K}	9.67^{h}	15.17
Bilecik İrikara	2	4.22	18.03	18.60	0.77	368.47^{e-K}	10.89^{f-G-H}	17.44
Bilecik İrikara	3	4.44	17.85	19.03	0.84	472.69^{c-F}	12.22^{d-G}	19.89
Bilecik İrikara	4	4.13	18.34	19.09	0.77	433.69^{d-H}	10.80^{f-G-H}	19.42
Horoz Karası	1	9.01	21.51	29.85	0.95	470.78^{c-F}	12.47^{c-F}	18.39
Horoz Karası	2	9.06	20.95	30.78	0.77	649.49^{a}	17.56^{a}	22.67
Horoz Karası	3	8.61	20.49	30.47	1.11	476.80^{c-D-E}	14.89^{b-C}	18.78
Horoz Karası	4	8.91	84.08	31.41	0.90	606.36^{a-B}	15.11^{a-B}	20.67
Karaerik	1	4.75	18.29	20.08	0.88	308.20^{i-J-K}	10.78^{f-G-H}	22.33
Karaerik	2	5.37	19.38	21.42	0.79	382.47^{e-K}	13.28^{b-F}	23.67
Karaerik	3	5.71	19.73	22.20	0.67	455.24^{c-G}	13.22^{b-F}	20.56
Karaerik	4	6.10	20.47	22.84	0.62	343.20^{g-K}	11.44^{e-H}	23.89
Michele Palieri	1	9.27	23.88	25.07	0.99	432.09^{d-H}	11.61^{e-H}	20.78
Michele Palieri	2	7.64	22.15	25.40	0.69	376.51^{e-K}	13.11^{b-F}	22.33
Michele Palieri	3	9.61	22.94	26.87	0.87	394.02^{e-J}	12.45^{c-G}	20.00
Michele Palieri	4	9.15	23.87	26.79	0.79	562.73^{a-B-C}	14.39^{b-D}	26.22
Royal	1	8.24	23.10	23.39	0.91	359.44^{f-K}	12.83^{b-F}	19.00
Royal	2	8.13	23.32	24.15	0.81	319.73^{h-K}	13.00^{b-F}	18.33
Royal	3	8.53	23.31	23.90	0.87	324.99^{h-K}	12.44^{c-G}	18.00
Royal	4	7.56	22.82	23.58	0.52	521.13^{b-C-D}	13.94^{b-E}	21.11
TÇ	1	5.21	19.10	20.01	0.79	375.52^{e-K}	13.78^{b-E}	18.89
TÇ	2	4.84	18.70	19.90	0.62	348.15^{g-K}	12.22^{d-G}	17.78
TÇ	3	5.49	19.36	21.26	0.74	309.49^{i-J-K}	13.44^{b-E}	17.33
TÇ	4	4.31	18.10	19.93	0.48	279.40^{k}	9.94^{g-H}	15.83
	LSD	N.S	N.S	N.S	N.S	114.31	2.51	N.S

*Mean values with different superscripts in the same effects indicate a significant difference (P<0.05).
TÇ= Tekirdağ çekirdeksiz

Parameters such as cluster weight and cluster size vary according to grape varieties. It is not only the variety that affects the cluster structure and properties, but also; Many factors such as ecological conditions, presence of buds and its condition on the shoot, cultural processes applied to the vine also come into play as influencing factors (Çelik et al., 1998; Çelik, 2011; Kamiloğlu and Üstün, 2014).

There is an increase in weight and volume in the period from berry setting to ripening. Although this increase varies according to cultivar characteristics, just like in cluster characteristics, it is also closely related to factors such as pruning, precipitation, sun exposure, light, soil characteristics, spraying, and plant growth regulators (Ağaoğlu, 2002).

In a study conducted by Cangi et al. (2011) with wine varieties in Kazova region, the averages of cluster weights of Gewürztraminer, Pinot Noir, Syrah and Narince varieties differed between 2007 and 2008. This difference was attributed to the difference between cultivars and years. The fact that the findings of the cluster weights in the study made a statistical difference between both cultivars and periods shows parallelism with this study. In another study, the weights of clusters in different parts of the vine were examined in Cardinal and Amasya grape varieties in Çanakkale ecology, and as a result of the research, it was concluded that the averages of the two varieties varied according to the places. In this case, it is a proof that not only the variety but also the cluster characteristics can vary even in the same vine. Verigo, Horoz Karası, Altoni Red, Ergin Çekirdeksizi, Perlette and Italia cultivars were used in another study in which three-year (2004, 2005, 2007) data were obtained on some table varieties in KKTC ecological conditions. Different varieties have come to the fore every year in terms of cluster weight. This shows that the period (year) difference is effective in cluster weight as in our study. While the Horoz Karası variety appeared as the variety with the highest cluster weight average (50.86 g) in the study, this study also showed a parallel value with the study, with an average weight of 468-736 g (Tangolar et al., 2007). In the study carried out with Boğazkere, Chardonay, Emir, Merlot, Narince, Öküzgözü, Riesling varieties in Kazova region, it was reported that the berry size increased until the harvest period and this varied according to the cultivars (Şen, 2008). In the study, similar to this study, the differences in berry weight were important in terms of varieties.

In a study conducted by Aydın (2015) on the determination of some chemical contents of grape varieties grown in Amasya at different maturity periods, the averages of 100-berry weights taken in three different periods (one week before the harvest, one week before the harvest and one week after the harvest), respectively; It has been reported that it is in the red pointed fragrant grape variety with 774. 56 g, 838. 44 g and 861. 63 g and it varies according to the varieties in parallel with the study.

4. Conclusion

Considering the effect of sampling periods in the study on cluster characteristics, cluster weights increased towards maturation. Cluster width reached its highest values in the 2nd and 3rd periods. The highest value of cluster length is the fourth period. Considering the effects of the periods on the grain properties, the effects of grain weight and grain width were found to be insignificant. Berry size value found its highest value in the 2nd, 3rd and 4th periods. Berry hardness changed according to the periods and the highest values were determined in the 1st and 3rd periods.

In the study, the physical properties of all cultivars from mole to ripening differed according to both periods and cultivars. In recent years, it is known that people's perception of the food they consume focuses on quality rather than quantity. We can minimize quality losses by harvesting the best quality grapes at the right time. While the varieties and periods used in the study serve the literature, they are also an infrastructure for different studies with more varieties, different locations and different periods.

Author Contributions

All authors have equal contribution and all authors reviewed and approved the manuscript.

Conflict of Interest

The authors declared that there is no conflict of interest.

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References

Ağaoğlu YS. 2002. Bilimsel ve uygulamalı bağcılık (Asma Fizyolojisi- 1). Kavaklıdere Eğitim Yayınları, Ankara, Turkey, pp. 444.

Alston JM, Sambucci O. 2019. Grapes in the world economy. In: Cantu D., Walker M. (eds) The Grape Genome. Compendium of Plant Genomes. Springer, Switzerland, pp. 24.

Aydın M. 2015. Amasya'da yetiştirilen üzüm çeşitlerinin farklı olgunluk dönemlerindeki bazı kimyasal içeriklerinin belirlenmesi. Yüksek Lisans Tezi. Tokat Gaziosmanpaşa Üniversitesi, Fen Bilimleri Enstitüsü, Bahçe Bitkileri Anabilimdalı, Tokat, Turkey, pp. 52.

Bahar E, Korkutal İ, Kök D. 2006. Türkiye bağcılığının son yıllardaki gelişiminde görülen başlıca sorunlar ve çözüm önerileri. Trakya Üniv Fen Bil Derg, 7(1): 65-69.

Cabaroğlu T, Yılmaztekin M. 2006. Üzümün bileşimi ve insan sağlığı açısından önemi. Buldan Sempozyumu. 24–26 Kasım 2006, Denizli, Turkey, pp. 999-1004.

Cangi R, Saraçoğlu O, Uluocak E, Kılıç D. 2011. Kazova (Tokat) yöresinde yetiştirilen bazı şaraplık üzüm çeşitlerinde olgunlaşma sırasında meydana gelen kimyasal değişmeler. Iğdır Üniv Fen Bil Enst Derg, 1(3): 9-14.

Çelik H, Ağaoğlu YS, Fidan Y, Marasalı, B. 1998. Genel bağcılık. Sunfidan A.Ş. Mesleki Kitaplar Serisi I, Ankara, Turkey, pp. 253.

Çelik S. 2011. Asmanın morfolojisi ve anatomisi. Bağcılık (Ampeloji), Cilt:1. Avcı Ofset, İstanbul, Turkey, pp: 130.

Genç S, Soysal İM. 2018. Parametric and nonparametric post hoc tests. BSJ Eng Sci, 1(1): 18-27.

Kamiloğlu Ö, Üstün D. 2014. Bazı şaraplık üzüm çeşitlerinin hasat sonrası kalite özellikleri. Türk Tarım ve Doğa Bil Derg, 1(3): 361-368.

Kara Z, Gerçekçioğlu R. 1993. 12 farklı amerikan asma anacına aşılanmış narince üzüm çeşidinin bazı olgunluk karakteristikleri üzerine bir araştırma. Selçuk Üniv Ziraat Fak Derg, 3(5): 5-17.

Kiracı M, Sağlam M, Boz Y, Aydın S. 2009. Türkiye sofralık üzüm pazarlamasında iç ve dış pazar araştırmaları. 7. Bağcılık ve Teknolojileri Sempozyumu, 5-9 Ekim 2009, Manisa, Turkey, pp. 190-200.

Sabır A, Bilir H, Tangolar S. 2010. Bazı yaz budaması uygulamalarının çekirdeksiz üzümlerde verim ve kalite üzerine etkileri. Selcuk J Agri Food Sci, 24(3): 4-8.

Seccia A, Santeramo FG, Nardone G. 2015. Trade competitiveness in table grapes: aglobal view. Outlook on Agri, 44(2): 127-134.

Şen A. 2008. Kazova (Tokat) ekolojisinde yetiştirilen bazı üzüm çeşitlerinde etkili sıcaklık toplamlarının ve optimum hasat zamanının belirlenmesi. Yüksek Lisans Tezi, Tokat Gaziosmanpaşa Üniversitesi, Fen Bilimleri Enstitüsü, Bahçe Bitkileri Anabilimdalı, Tokat, Turkey, pp. 79.

Söyler K, Altındişli A, İşçi B, Boyacı M. 2019. Mevlana üzüm çeşidi yetiştiren üretici ve işletmelerin bazı özellikleri ve sorunları üzerine bir inceleme. Ege Üniv Ziraat Fak Derg, 56(4): 487-495.

Tangolar S, Özdemir G, Ekbiç H, Tangolar S, Rehber Y. 2011. Bazı sofralık üzüm çeşitlerinin açıkta K.K.T.C ekolojik koşullarına adaptasyonları. Türkiye VI. Ulusal Bahçe Bitkileri Kongresi. 4-8 Ekim 2011, Şanlıurfa, Turkey, pp. 47-54.

Topuz T. 2016. Damla sulama ile sulanan bağda farklı sulama uygulamalarının verim ve bazı kalite özelliklerine etkisi. Yüksek Lisans Tezi. Adnan Menderes Üniversitesi, Fen Bilimleri Enstitüsü, Aydın, Turkey, pp. 63.

TUİK. 2019. URL: https://www.tuik.gov.tr/ (access date: January 05, 2022).

Winkler AJ, Cook JA, Kliewer WM, Lider LA. 1974. General viticulture. Univ Of California, Berkeley, US, pp. 663.