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Cluster and Must Characteristics of Boğazkere and Kalecik Karası Grape Cultivars Grown on Different Rootstocks

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Abstract: The study was carried out in the Kırşehir/Toklumen vineyards of Kavaklıdere Winery Inc. in 2017 and 2018. The changes in bunch, berry, must, pH, total acidity, total phenolic, flavonoid and anthocyanin contents of Boğazkere and Kalecik Karası grape cultivars on 3 different rootstocks (110 Richter, 1103 Paulsen and 140 Ruggeri) from mole to harvest were investigated. An increase in cluster and berry weights of Boğazkere and Kalecik Karası grape cultivars, and softening in berry hardness with maturation, were observed between the veraison and the harvest period. While the must and pH values of the cultivars increased from mole to ripening, the total acidity values decreased. While the total phenolic and flavonoid contents, which were high during the veraison period, decreased towards the harvest period, the anthocyanin contents increased with maturation in both the skin and pulp. The cluster and berry weights of the cultivars on 140 Ru rootstock were lower than the other two rootstocks. During the harvest period, Boğazkere stood out in terms of total phenolic and anthocyanin content, and Kalecik Karası in terms of flavonoid content. Cluster and berry weights, must, pH, total acidity, total phenolic substance, flavonoid and anthocyanin content varied according to cultivar, rootstock and year.

Farklı Anaçlar Üzerinde Yetiştirilen Boğazkere ve Kalecik Karası Üzüm Çeşitlerinin Salkım ve Şıra Özellikleri

Anahtar Kelimeler
Anaç, Antosiyanin, Flavonoid, Toplam fenolik, Şaraplık üzüm

Öz: Bu çalışma 2017 ve 2018 yıllarında Kavaklıdere Şarapları A.Ş'nin Kırşehir/Toklumen bağlarında gerçekleştirilmiştir. Çalışmada 3 farklı anaç (110 Richter, 1103 Paulsen ve 140 Ruggeri) üzerinde yetiştirilen Boğazkere ve Kalecik Karası üzüm çeşitlerinde ben düşmeden hasat dönemine kadar salkım, tane, şıra, pH, toplam asitlik, toplam fenolik, flavonoid ve antosiyanin içeriklerinin zamana bağlı olarak değişimleri incelenmiştir. Ben düşme ile hasat dönemi arasında her iki yılda Boğazkere ve Kalecik Karası üzüm çeşitlerinin salkım ve tane ağırlığında artış, tane sertliğinde ise olgunlaşma ile birlikte yumuşama görülmüştür. Çeşitlerin şıra ve pH değerleri ben düşmeden olgunlaşmaya doğru artarken, toplam asitlik değerleri azalmıştır. Ben düşme döneminde yüksek olan toplam fenolik ve flavonoid içerikleri hasat dönemine doğru azalırken, antosiyanin içerikleri hem kabukta hem de pulpta olgunlaşma ile birlikte artış göstermiştir. Her iki çeşit 110 R ve 1103 P anaçları bakımından değişkenlik gösterse de 140 Ru anacına göre salkım ve tane ağırlığı bakımından daha yüksek değerler vermiştir. İki yılın hasat döneminde toplam fenolik ve antosiyanin içeriği bakımından Boğazkere üzüm çeşidi, flavonoid içeriği bakımından ise Kalecik Karası üzüm çeşidi ön plana çıkmıştır. Çeşitlerin salkım ve tane ağırlıkları ile şıra, pH, toplam asitlik, toplam fenolik madde, flavonoid ve antosiyanin içerikleri çeşide, anaca ve yıla göre değişkenlik göstermiştir.

1. INTRODUCTION

The main reason for the use of rootstock in vineyards is phylloxera pest [1, 2, 3]. Today, there is still no permanent chemical solution against phylloxera. It has not been successful enough by underwater or disinfecting the vineyard soils. Many rootstocks are used in the world, which can adapt to different soil types, have different resistance to drought, lime, salinity, phylloxera and nematodes, as well as have different compatibility abilities with *Vitis vinifera* L. cultivars. Studies on grape rootstock selection are among the basic studies of modern viticulture [4].

Grape rootstocks can affect the phenological stages, vegetative growing, bud shoot rate, ripening time, quality, cluster weight, must, acidity, leaf area and mineral nutrient content in the leaves of grape cultivars [5, 6, 7, 8, 9, 10, 11, 12, 13]. However, it is not possible to find all the desired characteristics in terms of yield and quality parameters in a single rootstock. It is difficult to clearly determine the interaction effects between rootstock and cultivar. As a matter of fact, vine rootstocks can have a primary or secondary effect on cultivars. It is stated that the primary effect affects the pruning weight (kg / vine) and the secondary effect affects the green parts of the vine[14].

The same grape cultivars can be grafted onto different American vine rootstocks for different reasons (soil, earliness, lateness, resistance to diseases and pests, adaptation, etc.). There are many research results showing that rootstocks affect the yield and quality of the grape cultivar grafted on.

The Central Anatolia region of our country is an important center in terms of viticulture potential. In this region, the provinces of Ankara, Çankırı, Yozgat, Kırıkkale, Kırşehir and Nevşehir come into prominence. While viticulture has an important social and economic place in this region, it has regressed over time due to reasons such as phylloxera damage, migrations, not giving the necessary importance to adaptation studies of new cultivars, and not doing the maintenance and cultural processes applied in viticulture according to the technique [15].

With this work; It was aimed to determine the effects of some wine grape cultivars (Boğazkere and Kalecik Karası) grafted on Berlandieri x Rupestris (110 R, 1103 P, 140 Ru) rootstocks on cluster, must and berry characteristics in Kırşehir (Toklumen) conditions.

2. MATERIAL AND METHOD

Research; It was carried out for two years in a producer's vineyard in Kırşehir in 2017 and 2018. Within the scope of the study, Boğazkere (grafted on 110 R, 1103 P and 140 Ru rootstocks) grape cultivar and Kalecik Karası (140 Ru, 1103 P and own roots) grape cultivar were used. The vines are 11-12 years old, the planting density is 2.0 m x 1.0 m and the training system is wall. After the veraison period, cluster samples were taken and brought to the laboratory in the cold chain environment and the following analyzes were made. Clusters weight; were measured by weighing on a digital scale (0.01 precision). Cluster length and width (cm) were measured with the help of a ruler. In bunch for berry measurement all the berries were plucked and placed in a bowl. Berry width and berry length (mm) were measured with a caliper by taking 25 randomly from this bowl. Berries hardness (Newton) were measured with a 1.54 mm penetrating hardness testing machine (PCE, SLJ-B). Amount of must (%) by refractometer (Atago Master-93H); acidity (g l^{-1}) According to Cemeroğlu [16]; The pH in the must was determined with a ph-measuring equipment (WTW Inolab pH 7310). While determining the phenolic, flavonoid and anthocyanin contents in the berry, sample preparation was done according to Bino et al. [17]. Total amount of phenolic substance Velioğlu et al. [18], the total amount of flavonoids Zhishen et al. [19] and the total amount of anthocyanin was determined according to Di Stefano and Cravero [20].

2.1. Statistical Analyses

Data; The analysis of variance was performed in a randomized block design with 3 replications and 18 vine per replication. Each cultivar was evaluated in itself. LSD ($p \leq 0.05$) test was used to compare the means, and the data of each week were analyzed separately.

3. RESULTS AND DISCUSSION

Two-year cluster and must data of Boğazkere grape cultivar grafted on different rootstocks are given in Table 1 and Table 2.

According to the data obtained, the berry weight and pH values of Boğazkere grape cultivar were found to be statistically significant during the harvest period ($p \leq 0.05$). In terms of cluster weight, some variation was observed between 110 R and 1103 P rootstocks. In the first year of the harvest period, the highest cluster (184.4 g) and berry weight (2.00 g) was 110 R, and the highest pH (3.44) 140 Ru combination. It can be said that the 1103 P combination stands out in terms of cluster weight (375.0 g) in the 2nd year harvest period.

Table 1. Cluster and must characteristics of Boğazkere grape cultivar on different rootstocks (2017)

Sample date	Rootstocks	Cluster weight (g)	Berry weight (g)	Berry hardness (NW)	Must (%)	pH	Acidity (g l^{-1})
August 15	110 R	66.9 a	0.60	1.53	6.5 a	2.72	38.02
	1103 P	51.2 b	0.66	1.77	5.4 b	2.83	38.50
	140 Ru	54.0 b	0.64	1.97	6.2 ab	2.68	42.02
LSD $_{(0.05)}$		11.4	ns	ns	ns	ns	ns
August 22	110 R	60.3 a	0.64	1.06	7.1	2.77	32.36
	1103 P	71.9 a	0.79	1.28	7.0	2.87	35.26
	140 Ru	57.7ab	0.75	1.28	7.5	2.73	29.69
LSD $_{(0.05)}$		9.0	ns	ns	ns	ns	ns
August 29	110 R	68.7 b	0.84 a	0.76	10.5	2.84 b	20.43
	1103 P	110.5 a	0.77 a	1.10	11.2	3.04 a	22.00
	140 Ru	60.6 b	0.59 b	1.14	9.4	2.81 b	20.83
LSD $_{(0.05)}$		36.8	0.10	ns	ns	0.17	ns
September 5	110 R	129.1 ab	1.06	0.55	14.1	2.93	16.47
	1103 P	164.5 a	1.05	0.59	14.5	3.09	17.84
	140 Ru	94.2 b	0.77	0.53	14.5	3.03	17.84
LSD $_{(0.05)}$		67.8	ns	ns	ns	ns	ns
September 12	110 R	141.5	1.40	0.53	16.8 b	3.14	10.61 b
	1103 P	191.1	1.57	0.57	18.2 a	3.19	9.93 b
	140 Ru	136.0	1.26	0.44	14.9 c	3.09	15.05 a
LSD $_{(0.05)}$		ns	ns	ns	ns	ns	2.33
September 18	110 R	167.5	1.52	0.48 b	17.9	3.18	8.41
	1103 P	138.4	1.36	0.55 b	18.7	3.22	8.51
	140 Ru	158.3	1.43	0.91 a	16.2	3.28	7.95
LSD $_{(0.05)}$		ns	ns	0.22	0.22	ns	ns
Harvest	110 R	184.4	2.00 a	0.44	20.7	3.23 c	7.54
	1103 P	182.6	1.67 b	0.52	20.4	3.32 b	7.11
	140 Ru	167.3	1.40 b	0.54	20.7	3.44 a	7.11
LSD $_{(0.05)}$		ns	0,28	ns	ns	0,07	ns

Table 2. Cluster and must characteristics of Boğazkere grape cultivar on different rootstocks (2018)

Sample date	Rootstocks	Cluster weight (g)	Berry weight (g)	Berry hardness (NW)	Must (%)	pH	Acidity (g l^{-1})
August 10	110 R	169.2 a	1.35	0.67 ab	13.2	2.92	13.09 b
	1103 P	104.0 b	1.69	0.48 b	12.6	2.94	20.23 a
	140 Ru	152.7 a	0.89	0.82 a	11.3	2.87	18.70 a
LSD $_{(0.05)}$		ns	ns	0.19	0.19	ns	4.96
August 17	110 R	216.3	1.77	0.36	13.6	3.00	12.02
	1103 P	171.8	1.72	0.42	14.7	2.98	16.28
	140 Ru	158.1	1.48	0.47	12.1	2.93	17.13
LSD $_{(0.05)}$		ns	ns	ns	ns	ns	ns
August 31	110 R	237.2	2.21 a	0.30	17.3	3.05	9.07
	1103 P	278.7	2.23 a	0.34	16.4	3.01	10.71
	140 Ru	228.9	1.70 b	0.31	16.5	3.04	8.33
LSD $_{(0.05)}$		ns	0.32	ns	ns	ns	ns
September 14	110 R	274.3	2.35	0.27	19.6	3.24	7.07
	1103 P	325.5	2.27	0.28	19.3	3.25	6.87
	140 Ru	300.4	1.93	0.23	21.0	3.27	7.24
LSD $_{(0.05)}$		ns	ns	ns	ns	ns	ns
Harvest	110 R	318.3	2.49	0.20	21.8 b	3.32	6.07
	1103 P	375.0	2.42	0.22	21.1 b	3.30	4.84
	140 Ru	314.0	2.72	0.21	23.1 a	3.29	5.88
LSD $_{(0.05)}$		ns	ns	ns	ns	ns	ns

The 2017 and 2018 cluster and must characteristics of Kalecik Karası grape cultivar, which is another combination subject to the study, are given in Table 3 and Table 4. During the harvest period, values total acidity in Kalecik Karası grape cultivar in the 1st year and must in the 2nd year were found to be statistically significant ($p \leq 0.05$). In the harvest period of the first year, 1103 P combinations came to the fore in terms of cluster (236.6 g) and berry weight (1.42 g). In the harvest period of the second year, the combination of Kalecik Karası grape cultivar grown in its own roots stood out in terms of cluster (208.6 g) and berry weight (2.18 g) (Table 3 and Table 4). There are many studies on rootstock and cultivar combinations in viticulture in our country [5, 9, 11, 12, 22, 23, 24, 25, 26, 27]. From these studies; It can be concluded that rootstocks may have different effects on the phenolic stages, vegetative growing, cluster and berry characteristics of the cultivars and chemical parameters (such as must, pH, acidity) and this effect may vary from year to year with climate and cultural practices. 1103 P and Kalecik Karası grape cultivar/own root combinations came into prominence. In terms of cluster and berry weight, 140 Ru rootstock gave lower values in both cultivars compared to other combinations. Considering the data obtained, it is not seen that there is a single rootstock that has all the desired characteristics in terms of quality in viticulture, similar to other fruit species [21].

Table 3. Cluster and must characteristics of Kalecik Karası grape cultivar on different rootstocks (2017)

Sample date	Rootstocks	Cluster weight (g)	Berry weight (g)	Berry hardness (NW)	Must (%)	pH	Acidity (g l^{-1})
August 15	1103 P	121.8	0.99	1.08	14.1	2.84	15.49 b
	140 Ru	91.8	0.76	1.03	14.7	2.84	22.42 a
	Vinifera	135.2	1.08	0.82	14.9	2.99	13.25 b
LSD $_{(0.05)}$		ns	ns	ns	ns	ns	5.93
August 22	1103 P	151.2	1.20	0.62 b	17.1	3.08 b	13.20
	140 Ru	114.9	0.90	0.94 a	15.6	3.03 c	19.23
	Vinifera	134.0	1.13	0.56 b	15.7	3.20 a	12.52
LSD $_{(0.05)}$		ns	ns	0.24	0.24	0.05	ns
August 29	1103 P	181.6 a	1.37	0.60	19.9	3.11	9.23 b
	140 Ru	123.1 b	1.03	0.56	20.0	3.13	10.56 a
	Vinifera	158.0 ab	1.13	0.52	18.9	3.22	8.74 b
LSD $_{(0.05)}$		44.2	ns	ns	ns	ns	1.44
September 5	1103 P	200.3	1.36	0.36	21.3	3.20	8.47
	140 Ru	148.9	1.12	0.47	20.9	3.19	9.99
	Vinifera	166.9	1.16	0.40	22.2	3.35	8.08
LSD $_{(0.05)}$		ns	ns	ns	ns	ns	ns
September 12	1103 P	230.5 a	1.38	0.31	23.7	3.40 b	6.45
	140 Ru	126.7 b	1.13	0.42	23.2	3.46 b	8.16
	Vinifera	165.9 ab	1.20	0.33	23.0	3.58 a	6.96
LSD $_{(0.05)}$		73.3	ns	ns	ns	0.06	ns
Harvest	1103 P	236.6	1.42	0.70	24.3	3.48	6.08 b
	140 Ru	144.2	1.27	0.45	25.7	3.54	7.45 a
	Vinifera	172.1	1.28	0.44	25.9	3.46	7.57 a
LSD $_{(0.05)}$		ns	ns	ns	ns	ns	0.50

Table 4. Cluster and must characteristics of Kalecik Karası grape cultivar on different rootstocks (2018)

Sample date	Rootstocks	Cluster weight (g)	Berry weight (g)	Berry hardness (NW)	Must (%)	pH	Acidity (g l^{-1})
August 10	1103 P	190.0 a	1.84 a	0.28 b	18.4	3.19	8.90
	140 Ru	127.8 b	1.48 b	0.44 a	21.5	3.20	11.08
	Vinifera	155.0 b	1.76 a	0.32 b	17.3	3.39	12.17
LSD $_{(0.05)}$		31.2	0.16	0.08	ns	ns	ns
August 17	1103 P	197.5	1.96 a	0.29	20.9	3.21 b	9.22
	140 Ru	189.7	1.41 b	0.40	19.1	3.28 b	8.64
	Vinifera	170.4	1.88 a	0.26	22.5	3.45 a	8.87
LSD $_{(0.05)}$		ns	0.28	ns	ns	0.08	ns
Harvest	1103 P	198.2	2.17	0.26	23.7 b	3.34	7.60
	140 Ru	196.0	1.70	0.28	25.6 a	3.36	7.07
	Vinifera	208.6	2.18	0.21	26.3 a	3.62	7.33
LSD $_{(0.05)}$		ns	ns	ns	1.8	ns	ns

Other parameters in the study are total phenolic, flavonoid and anthocyanin contents. Data for Boğazkere grape cultivar grafted on different rootstocks are given in Table 5 and Table 6, and data for Kalecik Karası grape cultivar are given in Table 7 and Table 8. In Boğazkere grape cultivar, the highest flavonoid content (3.12 mgQUE g^{-1} in pulp) in the 1st year was detected in the 1103 P combination. The highest total phenolic substance (95.14 mg GAE 100 g^{-1}) and the highest anthocyanin content (17.31 mg g^{-1} bark and 0.83 mg g^{-1} pulp) were determined on 140 Ru rootstock in the same cultivar in the second year. The highest flavonoid content (54.38 mgQUE g^{-1} in the skin) was determined in the 110 R combination (Table 5 and Table 6).

Table 5. Phenolic, flavonoid and anthocyanin contents of Boğazkere grape cultivar grafted on different rootstocks (2017)

Sample date	Rootstocks	Anthocyanin (mg g^{-1})		Flavonoid (mg QUE g^{-1})		Total phenolic (mg GAE 100 g^{-1})
		Pulp	Skin	Pulp	Skin	
August 22	110 R	0.10 a	0.88 a	26.00	384.00 a	760.24 b
	1103 P	0.01 b	0.20 b	20.36	342.81 ab	791.68 ab
	140 Ru	0.08 a	0.71 a	24.93	310.39 b	857.19 a
LSD (0.05)		0.03	0.34	ns	41.4	71.4
August 29	110 R	0.15	1.53	15.92 b	208.21 a	589.78 c
	1103 P	0.12	1.09	17.70 a	186.38 b	697.76 b
	140 Ru	0.18	1.45	18.08 a	157.33 c	748.78 a
LSD (0.05)		ns	ns	1.2	10.7	39.8
September 5	110 R	0.26	3.39	14.37	84.19	362.52
	1103 P	0.20	2.50	15.10	113.74	270.59
	140 Ru	0.26	1.55	16.44	115.73	265.21
LSD (0.05)		ns	ns	ns	ns	ns
September 12	110 R	0.30	3.39	12.57	83.00	223.56
	1103 P	0.25	3.64	13.49	82.50	281.40
	140 Ru	0.32	2.79	13.55	76.50	362.21
LSD (0.05)		ns	ns	ns	ns	ns
September 18	110 R	0.61 a	4.41	7.37 b	55.05 c	285.31 a
	1103 P	0.46 b	4.83	9.54 a	60.74 b	265.94 a
	140 Ru	0.44 b	4.23	9.05 a	72.67 a	234.10 b
LSD (0.05)		0.04	ns	1.20	3.80	28.90
Harvest	110 R	0.81 a	6.50	2.95 b	15.11	161.26
	1103 P	0.52 b	6.07	3.12 a	18.72	188.55
	140 Ru	0.44 b	5.80	3.05 ab	18.13	171.72
LSD (0.05)		0.15	ns	0.11	ns	ns

Table 6. Phenolic, flavonoid and anthocyanin contents of Boğazkere grape cultivar grafted on different rootstocks (2018)

Sample date	Rootstocks	Anthocyanin (mg g^{-1})		Flavonoid (mg QUE g^{-1})		Total phenolic (mg GAE 100 g^{-1})
		Pulp	Skin	Pulp	Skin	
August 10	110 R	0.09	0.56 b	10.82 b	156.40	332.29 b
	1103 P	0.09	0.90 b	10.63 b	157.18	510.21 a
	140 Ru	0.09	1.62 a	11.12 a	153.85	441.79 b
LSD (0.05)		ns	0.69	0.23	ns	76.29
August 17	110 R	0.10 b	0.72 b	7.64	122.44 a	374.07
	1103 P	0.12 b	1.05 b	8.10	122.26 a	346.71
	140 Ru	0.38 a	2.15 a	7.86	117.98 b	315.14
LSD (0.05)		0.22	0.61	ns	2.11	ns
August 31	110 R	0.19 b	5.51	5.40	104.15	253.14
	1103 P	0.14 b	6.27	5.61	101.45	278.21
	140 Ru	0.56 a	5.96	5.69	98.77	276.79
LSD (0.05)		0.06	ns	ns	ns	ns
September 14	110 R	0.30 b	11.79	4.36 a	81.31	305.21
	1103 P	0.49 ab	12.55	4.26 b	80.12	254.79
	140 Ru	0.81 a	12.08	4.43 a	82.93	172.50
LSD (0.05)		0.34	ns	0.11	ns	ns
Harvest	110 R	0.37 b	13.56 b	3.56	54.38 a	79.36 b
	1103 P	0.63 ab	16.78 a	3.53	53.70 ab	75.64 b
	140 Ru	0.83 a	17.31 a	3.47	53.07 b	95.14 a
LSD (0.05)		0.27	2.79	ns	0.77	14.04

In Kalecik Karası grape cultivar, the highest total phenolic substance (202.85 mg GAE 100 g^{-1}) 140 Ru, the highest flavonoid (89.75 mgQUE g^{-1} in skin) and anthocyanin (4.59 mg g^{-1} in skin) in 2017 harvest period contents were determined in the 1103 P combination (Table 7).

Table 7. Phenolic, flavonoid and anthocyanin contents of Kalecik Karası grape cultivar grafted on different rootstocks (2017)

Sample date	Rootstocks	Anthocyanin (mg g^{-1})		Flavonoid (mg QUE g^{-1})		Total phenolic (mg GAE 100 g^{-1})
		Pulp	Skin	Pulp	Skin	
August 22	1103 P	0.13	1.33	33.57	442.50 c	533.21 a
	140 Ru	0.08	1.15	33.72	736.25 a	465.26 b
	Vinifera	0.09	0.95	34.22	508.35 b	392.88 c
LSD (0.05)		ns	ns	ns	32.60	60.30
August 29	1103 P	0.15	1.59 b	18.07 b	261.90	376.83
	140 Ru	0.21	2.19 a	18.93 a	287.49	402.53
	Vinifera	0.15	1.16 b	19.36 a	259.55	379.43
LSD (0.05)		ns	0.58	0.55	ns	ns
September 5	1103 P	0.19	2.15	15.08 c	239.81 a	270.43
	140 Ru	0.32	2.82	16.46 b	222.70 a	323.32
	Vinifera	0.21	3.10	17.01 a	139.82 b	238.53
LSD (0.05)		ns	ns	0.19	26.6	ns
September 12	1103 P	0.29 c	3.22	14.82 a	144.74 a	185.15
	140 Ru	0.50 a	3.33	7.56 b	107.50 b	193.67
	Vinifera	0.35 b	3.46	6.35 c	75.67 c	205.20
LSD (0.05)		0.04	ns	1.16	14.7	ns
Harvest	1103 P	0.61	4.59 a	6.42	89.75 a	161.65 ab
	140 Ru	0.71	3.93 b	6.41	82.25 b	202.85 a
	Vinifera	0.66	3.92 b	6.45	71.75 c	120.10 b
LSD (0.05)		ns	0.16	ns	0.63	41.50

The highest flavonoid content (4.59 mgQUE g-1 in pulp) of the cultivars were determined in the 140 Ru combination in the 2018 harvest period, while other parameters were statistically insignificant ($p \leq 0.05$) during the harvest period (Table 8).

Table 8. Phenolic, flavonoid and anthocyanin contents of Kalecik Karası grape cultivar grafted on different rootstocks (2018)

Sample date	Rootstocks	Anthocyanin (mg g^{-1})		Flavonoid (mg QUE g^{-1})		Total phenolic (mg GAE 100 g^{-1})
		Pulp	Skin	Pulp	Skin	
August 10	1103 P	0.10 b	0.54	9.89 a	155.63	463.71 a
	140 Ru	0.07 c	0.59	9.28 b	154.27	429.14 a
	Vinifera	0.11 a	0.75	9.62 a	156.43	303.93 b
LSD (0.05)		0.01	ns	0.29	ns	114.42
August 17	1103 P	0.14	3.22 a	7.34	125.47 a	251.79
	140 Ru	0.11	2.82 b	7.84	116.64 b	384.14
	Vinifera	0.13	2.46 c	7.75	126.45 a	299.71
LSD (0.05)		ns	0.18	ns	2.15	ns
Harvest	1103 P	0.16	9.04	4.39 c	72.83	55.93
	140 Ru	0.18	8.18	4.59 a	71.64	51.79
	Vinifera	0.11	7.34	4.51 b	74.11	50.79
LSD (0.05)		ns	ns	0.06	ns	ns

According to the harvest period of both years, Boğazkere grape cultivar stands out in total phenolic and anthocyanin content, and Kalecik Karası grape cultivar in flavonoid content. The total phenolic and flavonoid contents, which were high during the veraison period in all combinations, decreased towards the harvest period. The anthocyanin contents of the cultivars, on the other hand, showed an increase towards the harvest from veraison on both the skin and the pulp.

Many researchers stated that the total phenolic content decreases towards maturity and varies on the basis of cultivar and year during the harvest period. [28, 29, 30, 31]. In our study, the amount of phenolic substances of cultivars on the same rootstocks and of the same cultivars on different rootstocks seems to be compatible with the literature. The amount of flavonoids; It decreases towards ripening in grapes and has higher values in black cultivars compared to white cultivars. [32, 33]. The flavonoid content was higher in the skin than in the pulp. Towards ripening, the amount of flavonoids decreased in both the skin and pulp. Cultivars were differend in flavonoid content. Anthocyanins, on the other hand, are generally found in the grape skin and their amount increases from the veraison period. They reach the maximum level during the ripening period and provide the unique color of the grape cultivars [34]. In the study findings, it was determined that anthocyanin content increased towards

maturity according to the cultivars and rootstocks. Anthocyanin content in the skin was found to be higher than in the pulp. The anthocyanin content of the cultivars are different from each other. This difference may vary from year to year [35].

4. CONCLUSION

Considering the cluster and berry weights of Kalecik Karası and Boğazkere grape cultivars, it can be said that in general, 1103 P and 110 R rootstocks stand out compared to 140 Ru rootstocks. Although the total phenolic and flavonoid content of the cultivars varied on the basis of rootstocks, 140 Ru combinations came into prominence in general. On the basis of cultivars, Boğazkere grape cultivar in terms of total phenolic and anthocyanin content and Kalecik Karası grape cultivar in terms of flavonoid content came to the fore. In both years, the total phenolic and flavonoid contents of the cultivars, which were high in the veraison period, decreased towards the harvest period. Anthocyanin contents increased towards harvest, from veraison both the skin and pulp. Anthocyanin content in the skin was found to be higher than in the pulp. In the study, cluster and berry weights of the cultivars and must, pH, total acidity, total phenolic substance, flavonoid and anthocyanin contents varied according to cultivar, rootstock and year.

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