

**DYNAMICS OF RIPENING OF AFUS-ALI TABLE GRAPE VARIETY**

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**Abstract**

The afus-ali variety, together with the muscat italia, cardinal, victoria, ribier, and palieri, is the most important table grape variety in the Republic of Macedonia. We studied the dynamics of ripening of the afus-ali table grape variety from two locations Kavadarci and Valandovo where this variety is most commonly cultivated in the Republic of Macedonia. To determine the timing of ripening, we examined the dynamics of ripening by randomised sampling in the period from early August to the ripening of the grapes in early September. Four samples with three repetitions for each sample were taken every 10 days. We analysed the mechanical and chemical composition and mechanical properties of the cluster and berries following the OIV (International Organisation of Vine and Wine) methods. We used statistical analysis of the completely randomised design. The changes that occur during ripening of the afus-ali variety are the indicator of its technological ripeness. The results can be applied in the planning of the vintage depending on the market placement and duration of refrigerator storage of grapes.

**Keywords:** table grape variety, afus-ali, dynamics, ripening.

**Introduction**

The afus-ali variety is the most common table grape variety in the Republic of Macedonia, mostly grown in the vicinity of Kavadarci, Valandovo, Gevgelija, and Strumica. Its maturation starts by the end of August and has prolonged harvesting period up to the end of October (Božinović 2010). After harvesting, it is most often placed on the markets in the region, mainly in Serbia and Kosovo. Storing in refrigerators, with the intention to be placed on the markets later in the period October – December, is not a very common practice. This variety yields high-quality table grapes. In the ecological conditions of Veles, the control, in relation to the applied variants, varied in the average cluster mass (387 and 445 g), cluster weight (4.92 – 5.96 g), sugar contents (4.7 – 5.1 g/dm<sup>3</sup>), skin firmness (1.81 – 2.23 kg/cm<sup>2</sup>) and pedicel detachment force (416 – 475 g) (Jevtimova 2000). The purpose of our investigation is to detect the mechanical composition, mechanical properties, and chemical composition of the grapes in the period from veraison to full maturity and to use the obtained results to determine the harvesting and the refrigerator storage time following the markets' needs.

**Material and methods**

Samples were collected in 4 periods from two locations, Valandovo and Kavadarci, which are the most important locations for table grape production in the Republic of Macedonia,. The first sampling period started on August 3 followed by the next three periods on every 10 days each. The sampling was completely randomised, without predetermination of the exact location and certain vines at that location. The must chemical composition was studied from the grapes of all groups by analyzing the content of sugars, total acids and pH following the standard methods of the OIV. Three groups of clusters, the largest, medium size, and the smallest, were analysed for their mechanical

properties. Each of the groups were analysed in three repetitions. Weight of the grapes, number of berries, participation of normal and small berries in a cluster, mechanical composition and mechanical properties of the berries were studied. We analysed the correlation coefficient between the days of maturation and each of the examined indicators.

### Results and discussion

Table 1 shows the afus-ali variety cluster weight. The average weight of the afus-ali cluster increased gradually from 517 g to 900 g and from 553 g to 783 g in Kavadarci and Valandovo respectively in the period from August 3 to September 4.

Table 1. Cluster weight (g)

Cluster size	3 August		14 August		25 August		4 September	
	Kav.	Val.	Kav.	Val.	Kav.	Val.	Kav.	Val.
Largest	766	695	860	740	816	948	1477	1105
Medium	508	586	535	620	542	779	753	825
Smallest	278	377	369	398	277	394	471	419
Average	517	553	588	586	545	707	900	783

Table 2 shows the grape weight of the afus-ali variety. The average weight increased gradually from 3.2 g to 6.2 g and from 3.3 g to 5.2 g in Kavadarci and Valandovo respectively between August 3 and September 3.

Table 2. Berry weight (g)

Berry size	3 August		14 August		25 August		4 September	
	Kav.	Val.	Kav.	Val.	Kav.	Val.	Kav.	Val.
Largest	3,6	3,2	4,5	5,1	5,0	4,9	6,0	5,6
Medium	3,8	2,9	3,7	4,1	4,4	4,9	5,7	5,1
Smallest	2,3	3,8	5,1	2,8	3,6	4,3	6,9	4,9
Average	3,2	3,3	4,4	4,0	4,3	4,7	6,2	5,2

Table 3 shows the reactive berry skin firmness of the afus-ali variety. The average skin firmness decreased gradually from 9,2 kg/cm<sup>2</sup> to 6,7 kg/cm<sup>2</sup> and from 5,6 kg/cm<sup>2</sup> to 5,3 kg/cm<sup>2</sup> in Kavadarci and Valandovo respectively between August 14 and September 3.

Table 3. Skin firmness (kg/cm<sup>2</sup>)

Berry size	14 August		25 August		4 September	
	Kav.	Val.	Kav.	Val.	Kav.	Val.
Largest	10,2	6,0	7,1	6,4	7,8	5,3
Medium	8,5	5,3	6,7	4,9	5,6	5,6
Smallest	8,5	5,3	7,8	4,6	7,1	5,3
Average	9,2	5,6	7,1	5,3	6,7	5,3

Table 4. Pedicel detachment force (g)

Berry size	14 August		25 August		4 September	
	Kav.	Val.	Kav.	Val.	Kav.	Val.
Largest	314	354	180	358	406	402
Medium	126	178	142	124	270	158
Smallest	100	74	106	68	124	73
Average	180	202	143	183	267	211

Table 4 shows the pedicel detachment force of the afus-ali variety. The average pedicel detachment force increased gradually from 180 g to 267 g, and from 202 g to 211 g in Kavadarci and Valandovo respectively between August 14 and September 3.

Table 5 shows the chemical composition of the must of the afus-ali variety. The average sugar content in the must increased gradually from 128 g/dm<sup>3</sup> to 233 g/dm<sup>3</sup> and from 129 g/dm<sup>3</sup> to 204 g/dm<sup>3</sup> in Kavadarci and Valandovo respectively in the period from August 3 to September 4. Total acids decreased from 5.1 g/dm<sup>3</sup> to 3.0 g/dm<sup>3</sup> and from 7.7 g/dm<sup>3</sup> to 2.7 g/dm<sup>3</sup>, while pH increased from 3.47 to 3.97 and from 3.27 to 3.94 in Kavadarci and Valandovo respectively.

Table 5. Chemical composition of must

Must properties	3 August		14 August		25 August		4 September	
	Kav.	Val.	Kav.	Val.	Kav.	Val.	Kav.	Val.
Sugar g/dm <sup>3</sup>	128	129	135	126	174	182	233	204
Tot.acids g/dm <sup>3</sup>	5,1	7,7	3,4	3,2	3,2	2,8	3,0	2,7
pH	3,47	3,27	3,53	3,52	3,60	3,61	3,97	3,94

Table 6 shows the mechanical composition of the must of the afus-ali variety. The average contents of the flesh did not change significantly in Kavadarci (91.4% – 91.7%) but it increased in Valandovo (89.6% – 90.5%). The percentage of skin increased from 6.6% to 8.3% and from 7.7% to 8.3% in Kavadarci and Valandovo respectively. The percentage of seeds decreased from 2.0% to 1.4% in Kavadarci and from 2.8% to 1.1% in Valandovo.

Table 6. Mechanical composition of berry

Berry components	3 August		14 August		25 August		4 September	
	Kav.	Val.	Kav.	Val.	Kav.	Val.	Kav.	Val.
Flash %	91,4	89,6	93,0	92,9	92,8	91,6	91,7	90,5
Skin %	6,6	7,7	5,1	5,0	5,1	6,5	8,9	8,3
Seeds %	2,0	2,8	1,8	2,1	2,1	1,9	1,4	1,1

Table 7 shows the correlation coefficients (r) between the dynamics of ripening of the afus-ali variety, expressed in days, and the grape characteristics. The dynamics of ripening of the grapes has a positive correlation with a high coefficient (r) pertaining to the cluster weight, r=0.91; grape weight, r=0.97; sugar content and pH, r=-0.9; and total acids, r=-0.85. The dynamics of ripening is not correlated with the percentage of flesh and skin of the berry.

Table 7. Coefficient of correlation (r)

	Cluster weight	Berry weight	Skin firmness	Pedicele detachment force	Sugar	Total acids	pH	Flesh %	Skin %	Seeds %
Days	0,91	0,97	-0,92	0,62	0,95	-0,85	0,95	0,14	0,40	-

### Conclusions

The mechanical composition, mechanical properties, and chemical composition of the grapes of the afus-ali variety change in the period from veraison to full maturity. In both locations, Kavadarci and Valandovo, the average cluster and berry weight, pedicel detachment force, sugar contents and pH in the must increased significantly. At the same time, the skin firmness and total acid content decreased. Regarding the mechanical composition of the berry, the skin content increased while the seed content decreased. The value of these indicators will determine the use value of the grapes – whether to sell it on the market or store it in refrigerators.

**References**

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