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Oil content of grapevine seeds of intra- and interspecific genotypes

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Abstract
As a result of processing grapevines, the secondary derived products obtained constitute about 20% of the total processed mass. Grapevine seeds contain 9-20% oil. These oily substances contribute to strengthening the activity of the human body, which demonstrates that they can serve as raw material for obtaining and using these seed oils. The present study aimed to determine the comparative amount of oil in grapevine seeds of intra- and interspecific origin genotypes with green-yellowish and blue-violet berries. The seeds subject to the study were extracted from the berries until the start of the must fermentation process, using the nuclear magnetic resonance method. Determining the oil content in grapevine seeds of intraspecific genotypes with yellow-green berries, it was found that they contain about 13.8 % oil (Fetesca regală) and 13.7% oil (Sauvigon), while seeds of interspecific genotypes with yellow-green berries contain about 13.45-14.46% oil (Alexandrina, Sarmis, etc.). Grapevine seeds of intraspecific genotypes with blue-violet berries contain 13.5% oil (Feteasca neagră) and 16.6% oil (Merlot), while seeds of interspecific genotypes with blue-violet berries contain 11% oil (Ametist) and 15.35% oil (Sor). The amount of oil in the seeds depends on the genotype, as well as the climatic conditions of grapevine cultivation. Analyzing the climatic conditions in the area where grapevine genotypes grow, an increase in air temperature was found in relation to the calculated annual norm of 3.23 ^{0}C. When growing grapes in an arid climate, the oil content in the seeds is higher than when growing grapes in an area with moderate temperatures.

Keywords: genotype, seeds, oil, grapevine, relaxometery.

Introduction

Every year, winemaking enterprises accumulate impressive quantities of grape pomace, which, as a result of the separation of fractions, extract the seeds for further processing for various purposes. The secondary products, as a result of the processing of the vine grapes, constitute about 20% of the total mass processed, being made up of bunches, the skin of the berries, seeds and various sediments from the must and wine. This is the raw material for the production of grape seed oil, feed products, food products, abrasive materials, oenotannin, etc. As a result of the fermentation of grape juice, to obtain derived products (wine, divin), the deposited sediments allow the production of tartaric acid, as well as alcohol, biogas and organic fertilizers [4; 7; 9].

From an economic and technological point of view, a primary criterion for evaluating oil raw materials is the composition and quality of the oils. The oil obtained from grape seeds consists of saturated fats (palmitic and stearic) as well as unsaturated fatty acids. Grape seeds contain three times less oil compared to traditional oil crops, such as rapeseed, sunflower, etc. [5; 10].

The present study aimed to determine and quantitatively compare the oil content of seeds of intraspecific and interspecific grapevine genotypes.

Material and Method

The object of the study was the seeds collected from intraspecific grapevine genotypes from the *Vitis vinifera* L. ssp. *sativa* D.C. group, such as: Fetească neagră, Fetească regală, Merlot, Sauvignon, as well as rhizogenic interspecific grapevine genotypes *Vitis vinifera* L. ssp. *sativa* D.C. x *Muscadinia rotundifolia* Michx., such as: Ametist, Alexandrina, Tethys etc. [1; 3].

The seeds under study were extracted from the berry before the start of the fermentation process of the must.

Through the analyses carried out, according to existing standards, the following were determined: the amount of oil (%) and the weight of the seeds. The determination of oil content in grape seeds was carried out using the NMR (nuclear magnetic resonance) relaxometer method. The determination of oil by

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nuclear magnetic resonance is carried out by comparing the amplitude of the echo signal from the seeds with that from a set of calibration standards. The selection of standards is determined by the natural biochemical composition of the seeds [11].

Temperature and atmospheric precipitation were collected from weather stations, the data obtained were analyzed and statistically processed, based on which the necessary graphs were developed [6, 8, 12].

Results and Discussion

As a result of the studies undertaken, it was found that grapevine seed oil represents a biochemical compound very rich in antioxidants, especially vitamin E and essential fatty acids, such as linoleic acid, which contribute to maintaining the activity of the cardiovascular and immune systems. Of the total mass of grapevine seeds, 9.9-20.6% is represented by oils [9, 10].

The amount of oil in grapevine seeds depends on the genotype, as well as on the climatic conditions of grapevine cultivation. In the case of grapevine cultivation in a southern wine-growing area with an arid climate, the oil content in grapevine seeds will be higher than in the case of grapevine cultivation in an area located further north.

Grapevine berries contain from one to four seeds, so that one thousand berries will contain on average about 2,000 seeds. From one kilogram of grapes, approximately 30 grams of seeds with a dry matter content of 72% of the total mass will be obtained [2, 7, 9, 10].

Determining the oil content of grapevine seeds of intraspecific grapevine genotypes from the *Vitis vinifera* L. ssp. *sativa* D.C. group with yellow-green berries, it was found that they contain approximately 13.8% oil (Feteasca regală) - 13.7% oil (Sauvigon), while the interspecific grapevine genotypes *Vitis vinifera* L. ssp. *sativa* D.C. x *Muscadinia rotundifolia* Michx. with yellow-green berries contain approximately 13.45% (Alexandrina) - 14.46% oil (Sarmis) (tab. 1.).

Grapevine seeds of intraspecific genotypes from the *Vitis vinifera* L. ssp. *sativa* D.C. group with blue-violet berries contain 13.5% oil (Fetească neagră) and 16.6% oil (Merlot), while the seeds of the interspecific genotypes *Vitis vinifera* L. ssp. *sativa* D.C. x *Muscadinia rotundifolia* Michx. with blue-violet berries contain 11% oil (Ametist) - 15.35% oil (Sor) (tab. 1.).

Taking into account the average weight of the grapevine seeds included in the study, we find that grapevine seeds of intraspecific origin weigh on average 30.4 mg, and the average amount of oil is 14.4%. Grapevine seeds of interspecific origin weigh on average 33 mg, and the average amount of oil is 13.9% (tab. 1.).

Taking into account the color of the berries of the grapevine genotypes included in the study, it was found that grapevine seeds of genotypes with yellowish-green berries contain an average of 14.4% oil, and seeds of grapevine genotypes with blue-violet berries contain an average of 13.54% oil.

Based on the results of the studies carried out, it was found that grape seeds obtained from fermented pomace have an oil content of approximately 9-12% [7; 9].

Based on the results presented in that study, it can be noted that grapevine seeds of genotypes from the *Vitis vinifera* L. ssp. *sativa* D.C. group contain on average 14.4% oil, while grapevine seeds of the interspecific genotypes *Vitis vinifera* L. ssp. *sativa* D.C. x *Muscadinia rotundifolia* Michx. contain on average 13.7% oil.

Analyzing the climatic conditions where the grapevine genotypes from which the seeds were harvested are cultivated, we find that the average annual temperature, the calculated norm, for the respective area is 9.73 ^{0}C, and the average annual temperature during 2024 was 12.96 ^{0}C. Based on the measurements and calculations performed, an increase in relation to the calculated annual norm of 3.23 ^{0}C is noted (fig. 1.).

The annual amount of precipitation, the norm calculated for the respective area is 527 mm, and during the year 2024 there were a total of 715 mm of atmospheric precipitation. Based on the calculations performed, we note an increase in relation to the calculated annual precipitation norm by 188 mm. Analyzing the daily amount of precipitation during the year 2024, we observe a non-uniformity of atmospheric precipitation (fig. 2.).

Table 1. Oil content and weight of grapevine seeds

Genotype	Oil, (%)	Seed weight, (mg)
Intraspecific genotypes (Vitis vinifera L. ssp. sativa D.C.):		
- yellow-green berry		

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Feteasca regala	13,8	27
Sauvignon	13,7	38,9
- blue-purple berry		
Feteasca neagră	13,5	28,4
Merlot	16,6	27,3
Interspecific genotypes (Vitis vinifera L. ssp. sativa D.C. x Muscadinia rotundifolia Michx.)		
- yellow-green berry		
Alexandrina	14	32,6
Tethys	13,45	29,8
Sarmis	13,7	38,9
BC_3-536	14,46	35,8
- blue-purple berry		
Ametist	11	32,85
Sor	15,35	28,4

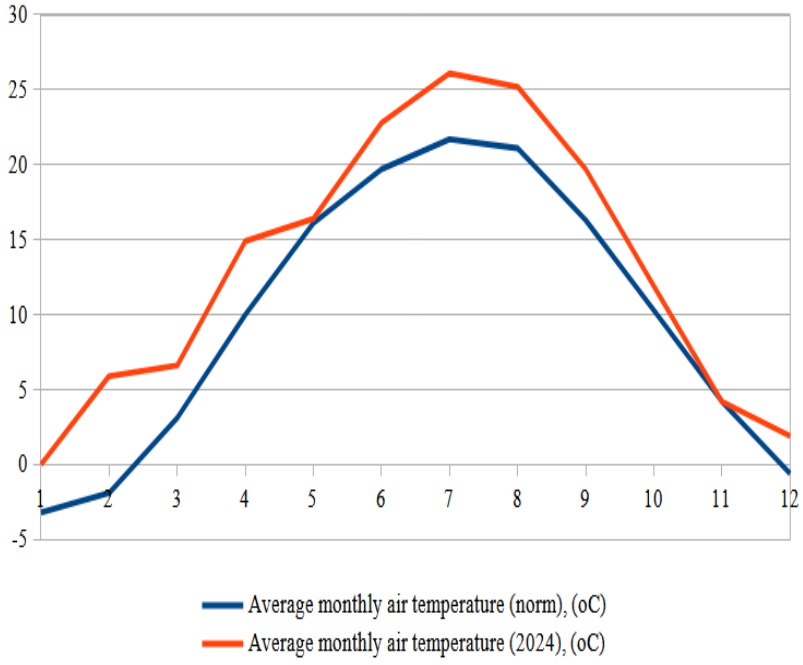


Figure1. Average monthly temperature during 2024 compared to the monthly norm (Chisinau).

As a result of the assessments carried out, it was found that the annual amount of atmospheric precipitation manifests itself in an uneven manner. Based on the monthly indices of atmospheric precipitation, it is observed that there are long periods (2-3 months) over large territories where atmospheric precipitation is absent. It was also found that atmospheric precipitation is also of a local type on fairly small areas, both in moderate and abundant amounts [1-3].

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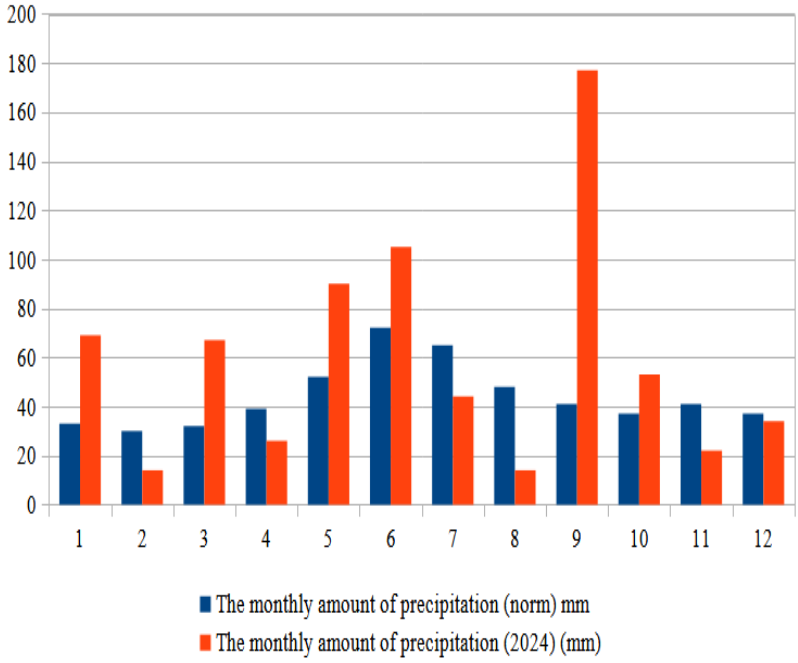


Figure 2. Amount of monthly atmospheric precipitation during 2024 compared to the norm. (Chisinau)

Conclusions

Grapevine seeds, taking into account the fact that they contain valuable derivatives of oily substances, so necessary to maintain the activity of the human body, demonstrate that they can serve as raw material for obtaining and using these seed oils. Grapevine seeds of intraspecific genotypes (*Vitis vinifera* L. ssp. *sativa* D.C.) with:
- yellow-green berries contain 13.8 % oil (Feteasca regală) - 13.7% oil (Sauvigon);
- blue-violet berries contain 13.5% oil (Feteasca neagră) - 16.6% oil (Merlot).

Grapevine seeds of interspecific genotypes (*Vitis vinifera* L. ssp. *sativa* D.C. x *Muscadinia rotundifolia* Michx.) with:
- yellow-green berries contain 13.45 % oil (Alexandrina) - 14.46% oil (Sarmis);
- blue-violet berries contain 11% oil (Ametist) - 15.35% oil (Sor).

Based on the color of the berries of the studied grapevine genotypes, it was found that grapevine seeds of genotypes with yellowish-green berries contain an average of 14.4% oil, and seeds of grapevine genotypes with blue-violet berries contain an average of 13.54% oil.

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