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APPLICATION OF GOMAT ROST AS FOLIAR FERTILIZER UNDER MERLOT VARIETY GROWN WITHOUT IRRIGATION IN RHODOPE COLLAR REGION

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Abstract

The study was conducted at the Department of Viticulture and Fruit Growing. The aim is to find out how Gomat Rost affects the vegetative and reproductive manifestations of a variety 'Merlot'. The results of the experiment showed when applying with doses of 1 to 4 L/Ha, leads to a change in the growth dynamics of the different variants in the experiment. Treated in four different stages of the growing season, it has a positive effect on the vine plants included in the experiment compared to the control variant. The result of the application of higher doses has a positive effect on the growth and shoots maturation and increase the grapes mass. This is found despite the small amount of soil available and 35% atmospheric humidity. This is confirmed by the data on the yield and the sugar and acidity content in the grapes during harvest. In the variants treated with the highest dose of 4 L/Ha sugars and acids remain stable close to those for normal fermentation. This is very important for wine grape varieties in order not to dilute the grape must in order to compensate for the water that has evaporated during veraison. From a technological point of view, vines subjected to water stress causes problems in the fermentation process.

Key words*: Bulgaria, Gomat rost, Merlot variety, foliar feeding.*

INTRODUCTION

It is very difficult to distinguish the soil influence on grape yield and quality of wines obtained, as it is intertwined with the influence of variety, rootstock and the complex climate impact of a country. Another important element in the vine cultivation as a plant is related to nutrition.

Use of natural bio stimulants to improve the quality of grape production (Salvi, 2016). Studies was conducted during the 2015 growing season of *Vitis vinifera* 'Sangiovese' to investigate the effects of foliar fed bio stimulants on the vine, eco-physiological and productive characteristics, to improve quality in a vigorously growing vine. Similar results were obtained from Andraş-Sauca, 2018.

Tillage and foliar fertilizers include control variant, Ca-200 g/L, K-150 g/L, N-20 g/L g, Ca-30 g/L, K-20 g/L and Cu-5 mg/L. The results show that the application of soil and foliar fertilizers increases the quality and quantity of table grapes compared to the control treatment.

The highest berry diameter, weight and size of 100 berries are obtained when vines are treated with Ca 200 g/L. The highest cluster weight was obtained for vines that were treated with K 150 g/L using the soil application method. The highest berry hardness was obtained in vineyards treated with K 20 g/L using foliar application method.

The highest pH and TSS were obtained in vineyards treated with Cu 5 mg/L using also the foliar application method. The highest fruit yield was found in vineyards treated with K 150 g (M.R. Beibulatov, 2018).

It was found that treatment with the preparation "Mars-U" promotes the accumulation of starch 0.4% in variety 'Tempranillo' and up to 0.6% in the variety 'Syrah'. Potassium humate treatment is encouraging the starch accumulation in Tempranillo - from 0.2% up to 0.4% in 'Syrah'. Treatment with the "CryoMix" at a dose of 0.5 l/ha contributed to an increase in the starch content in 'Tempranillo' from 0.2% to 0.15% for 'Syrah'; with a dose of 1.0 l/ha by 0.2% for both varieties; with a dose of 1.5 l/ha from 0.4% for 'Tempranillo' to 0.2% on 'Syrah'.

As the analysis of the agro biological characteristics of the studied varieties showed, under the conditions of equal the foliar treatment with the tested substances had a significant influence on the number of developed shoots and the coefficient of fruiting. The use of Cryoprotectants ("CryoMix" at a dose of 0.5 l/ha and "Mars-U" 1.0 l/ha) before the onset of shoots helps to improve the maturation, which is associated with earlier achievement of optimal shoot length and stopping their growth. This improves the ripening, contributing to increasing the frost resistance of the vine.

The use of tested Cryoprotectants ensures better buds preservation of both grape varieties. Great safety is ensured by the preparations "Mars-U" and "CryoMix" in doses of 0.5 l/ha and 1.0 l/ha. Revealed this foliar treatment using tested Cryoprotectant: Mars-U, Potassium humate.

CryoMix at a dose of 1.5 l/ha contributes to better tissue differentiation, with a high dry matter content in the vines. The Syrah variety was found to have the highest water content, especially when treated with Cryoprotectants: "CryoMix" at a dose of 0.5 l/ha and "Potassium humate" with values of 23.9% and 23.4%. The main source of energy in the soil are plant residues, animal excrements and water-soluble organic compounds, from which "Gomat Rost" originates, it is also mineralized (decomposed) by soil microorganisms. After these processes, energy is released needed to stimulate growth and form quality grapes.

It is accepted that the grape quality is determined by the amount of sugars, organic acids and anthocyanin's contained in red varieties. All other indicators are correlated with the sugar content. Therefore, the quantity of sugars has established itself as one of the main criteria for assessing the grape quality.

MATERIALS AND METHODS

The 'Merlot' variety, planted in 2013 in the Department of Viticulture and Fruit Growing near the village of Brestnik, was used as the object of the study. The experiment was conducted in 2019-2020. The planting distances are 3.0/1.0 m, the vines are formed on a stem bilateral cordon and loaded with spurs. The variety is grafted on the rootstock Berlandieri x Riparia sel. Oppenheim4. The experiment was performed in the following scheme.

Figure 1. V_o - control;
V_1 - treated with "Gomat Rost" - 2 L/Ha

V_2 - treated with "Gomat Rost" - 3 L/Ha; V_3 - treated with "Gomat Rost" - 4 L/Ha

Treatment stages are:

1. Before flowering;
2. After flowering;
3. "Pea" berry size;
4. Two weeks after "Pea" berry size.

Also are included:

- Description of the soil and climate characteristics of the site (terroir).
- Dynamics in growth and shoots maturation.
- Study of the influence of the leaf treatment with "Gomat Rost" through different phenological stages.
- Study on the yield and quality of grapes.
- The indicators were studied in Laboratory complex at AU-Plovdiv. The grapes were picked and processed on 11th September, 2020. The yeast used is Excellence XP 20 g/hl.
- Sugars, %, Titratable acids, g/dm^3

The indicators were examined according to the methods described in the Exercise guide in winemaking (Бамбалов, 2009).

RESULTS AND DISCUSSIONS

Soil characteristic - this study presents the important soil ingredients and necessary factors for making good wine production. The studied area is situated in South Bulgaria, Plovdiv region. Studied area is near the north part of the place, named "Rhodope collar", covering area of 29.7 Ha. The viticulture data is gathering from territories, which are located in training and experimental base in Brestnik village, part of the Department of Viticulture of Agricultural University- Plovdiv. The experimental base is one of the 28th University cellars in the world. Here are located more than 400 different types of grapes. This is the most developed agricultural region for wine production in Bulgaria. The relief is plane to hilly and that makes the studied area most suitable land for different viticulture analyzes. The climate is transcontinental, characterized with a cold winter and a hot summer. The Figure 2 shows the studied area Brestnik, located in Plovdiv region. Blue colors show the water resources and the black lines are the roads in the area.

Figure 2. Studied area

The main soil types in the studied area are Solonchaks and small part of type Chernozems by World Reference Base (2006) Soil Groups. On the next Figure 3 is the soil distribution of these two soil types by pink and yellow colors.
The studied site belongs to the Upper Thracian region of distribution of Cinnamon forest soils and is located in its accumulative part. The profile is very poorly differentiated. The soil is defined as deluvial meadow, clayey - sandy to sandy-clayey. The content of digestible ammonium and nitrate nitrogen in an extract with 1% KCl, absorbable phosphorus according to Egner-Rhyme and digestible potassium with a flame photometer was studied.

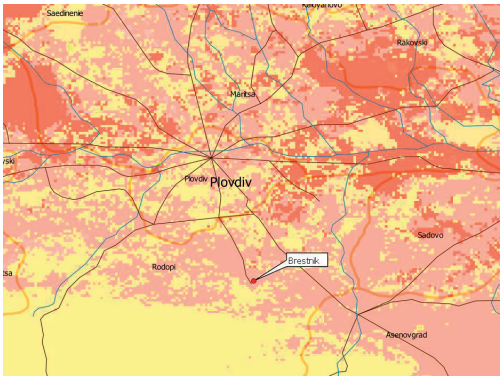

Figure 3. Soil distribution

The content of digestible ammonium nitrogen is relatively low and is a reason for the need to supplement the nitrogen deficiency in these plants. The content of easily digestible phosphorus is also below the norm of 10 m/ 100 g of soil and varies in the range of about 5.46 mg/100 g of soil. The stock of soils with absorbable potassium is good - 26.27 mg/100 g. The soil conditions for the experiment give a clearer picture of the impact of Gomat rost. It is effect on the vegetative and reproductive manifestations in the cultivation of the Merlot variety in a state of N and P_2O_5 deficiency (Table 1).

Table 1. Nitrogen, phosphorus and potassium content in the upper root soil layer

№ of the sample	pH	N mg/1000 g	P_2O_5 mg/100 g	K_2O mg/100 g
30-60 cm	8.0	Общ N- 8.55	5.46	26.27
Common carbonates	g/kg	-	-	62.27
Active carbonates	g/kg	-	-	15.00

Water regime - The average annual amount of precipitation for the period from December 2019 to the end of November 2020 in the area, has a total of 560.6 mm, which is close to the data for the average annual amount of precipitation in Bulgaria.
Research on the physiological condition of the vines include:
Phenological observations - The bud burst of the Merlot variety in the area during the

experimental period begin around middle of the third decade of March and ends in the first decade of April. The "flowering" stage takes place mainly in the first ten days of June, and the “pea” size berries in second half. The veraison starts in the middle of the third decade of July and ends within the third decade of August. Here we must note that the technological maturity of grapes reaches the first ten days of September. This is relatively close to the typical date for this phenological manifestation of this variety, which is around mid-September.

The vines from all variants treated with different concentrations, as well as the control variant, enter and leave the respective phase almost simultaneously. The data from the conducted phenological observations (Table 2) show that the only feature occurred is the reporting of an approximate period of "bud burst" and "flowering" took place for 14 days.

Table 2. Terms of the phenological stages of Merlot variety, in the Brestnik area in 2020

Variant	Bud burst			Appearance on the 1st leaf	Appearance of the1st inflorescense	Flowering			Pea size	Veraison			Technological ripeness
	tart	n masse	end			start	n masse	end		start	n masse	end	
control	24,03	31,03	7,04	18,04	23,04	29,05	6,06	12,06	20,06	25,07	8,08	23,08	11,09
2 L/Ha	24,03	31,03	7,04	18,04	23,04	29,05	6,06	12,06	20,06	25,07	8,08	23,08	11,09
3 L/Ha	24,03	31,03	7,04	18,04	23,04	29,05	6,06	12,06	20,06	25,07	8,08	23,08	11,09
4 L/Ha	24,03	31,03	7,04	18,04	23,04	29,05	6,06	12,06	20,06	25,07	8,08	23,08	11,09

Dynamics in shoot growth - The growth of the shoots begins with the bud burst, which is in 21st March, 2020. It can be seen that the strongest growth distinguishes the shoots from the variant treated with 4 L/Ha “Gomat Rost” in 2020, followed from variant with 3L/Ha, with no significant difference between them (Figure 4). In the next measurement there is a tendency for a gradual increase in the needs of the treated options.As the vegetation progresses, the growth increases, and by the end of May an increase of about 64 - 74 cm is already formed, in the different variants. On average per week it moves within about 15-20 cm. In June, with the increase of the average daily air temperatures, even greater activity in the growth processes is observed.Subsequent measurements made in June show a positive effect on treatment options in terms of "Gomat Rost" as all perform better than control variant. This trend continues in all variants in July.

As this is most clearly seen in the variants treated with 3 to 4 L/Ha. This is evident after the third application of the fertilizer during the “Pea” size stage. The following conclusion can be drawn from the positive result reported when monitoring the growth dynamics in fruit-bearing vineyards. Applied in a young vineyard "Gomat Rost" can have a positive effect on the formation and growth processes, as well as contribute to the faster establishment and entry to fruiting.

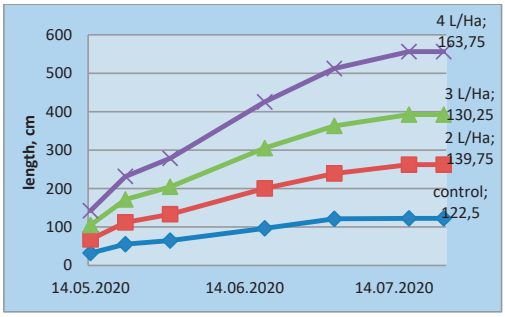

Figure 4. Dynamics in shoot growth

Dynamics of shoots maturation - Maturation is of great practical importance. It is associated with low temperatures resistance, as well as that of buds. The ripening process begins more noticeably in the first ten days of August. This occurs at a relatively high temperature and a minimum rainfall of 46.7 mm/m^2, lasting 4 weeks in all variants. The process is relatively intense, with the individual length of the mature part being about 20-30 cm per week (Figure 5). The dynamics of shoot maturation is directly dependent on climate conditions, as in the growth of shoots.

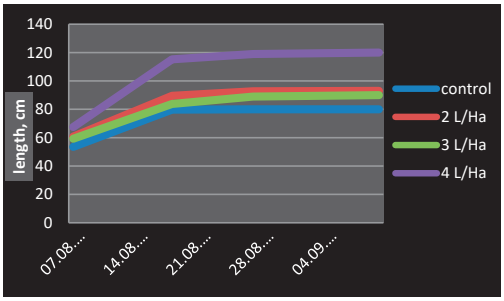

Figure 5. Dynamics in shoot maturation

Research on grape yield - Grape yield is one of the indicators determining the economic

efficiency of the applied agro-technical measures (Table 3).

Table 3. Quantitative changes in the yield of Merlot grapes

Period	Variants	Average yield per vine, kg	Average yield per Ha, kg
2020	контрола	2.950	8850.00
2020	2 L/Ha	2.965	8895.00
2020	3 L/Ha	3.100	9300.00
2020	4 L/Ha	3.600	10800.00

The yield of grapes in variants ranges from 2.950 kg to 3.600 kg per vine. The highest yield was in the variant treated with 4 L/Ha, followed by the variant treated with 3 L/Ha, and in relation to this indicator it can be seen that no significant difference was observed between the control variant and the variant treated with 2 L/Ha. The application of "Gomat Rost", with rates of 3 to 4 L/Ha in the indicated stages in the methodology of the experiment a yield of about 900 to 1000 kg can be established.

The average mass of the clusters changes in the same sequence. The bunches have the highest mass again from the variant treated with 4 L/Ha, followed by the variant treated with 3 L/Ha "Gomat Rost". With regard to this indicator, it can be seen again the formation of a group dynamics between the control and the variant treated with 2 L/Ha (Figure 6).

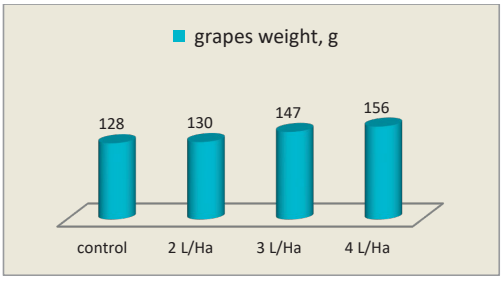

Figure 6. Average bunch mass in Merlot variety

In variants to which higher doses of "Gomat Rost" are applied, a positive trend in the mass of grapes is established. This is because again it has to be underlined thickly that the experiment is under non-irrigated conditions and this cause stress. The length of the bunches is in the range from 16.76 to 18.00 cm, and at the width 8.35 to 9.41 cm. The application of "Gomat Rost" did not have a significant effect on the inflorescences in the different variants. Because according to ampelographic characteristics the average size of a bunch is 17 cm length and 11.1 cm wide (Table 4).

Table 4. Quantitative change in the size of bunches in the Merlot variety treated with different amounts of "Gomat Rost"

Period	Variants	Bunch sizes	
		Length (cm)	Width (cm)
2020	контрола	16.76	8.35
2020	2 L/Ha	17.21	9.41
2020	3 L/Ha	17.80	8.79
2020	4 L/Ha	18.00	8.43

The grapes ripen around mid-September. From a practical point of view, this would lead to earlier planning and implementation of the grape harvest campaign. This is very important because the climate conditions are monitored during the harvest. If rains, that can create conditions for not being able to carry out the grape harvest. Figure 7 presents the results of the application of "Gomat Rost".

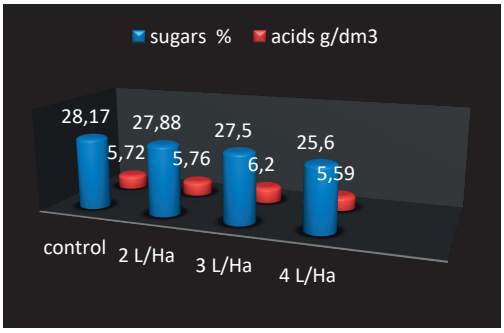

Figure 7. Dynamics of sugars and acidity content

The year 2020 was extreme in terms. The lack of rainfall required for vine growth and grape ripening was significant. It is important for the practice to emphasize that application of "Gomat Rost", in its highest dose, creates a condition for the vine plant to overcome the stress of the low soil and atmospheric humidity and to form yield, mass and shape of grapes typical for the 'Merlot' variety. From a technological point of view, the treated vines with the highest dose used lead to the preservation of relatively balanced sugars and acids.

They are directly correlated between both the rapid and the silent fermentation of the grape must. It can be clearly said from the results obtained so far that "Gomat Rost" has abilities that positively affect the presence of stress caused by drought during the growing season.

CONCLUSIONS

There is a positive effect of "Gomat Rost" on the development of the vine plant, regardless of the nitrogen deficiency. The content of easily digestible phosphorus is also below the norm of 10 mg/100 g of soil and varies in the range of about 5.46 mg/100 g. Here we must also note the fact that precipitation is not evenly distributed regardless of their total amount, which is 560.60 mm close to the national average.

Leaf application of "Gomat Rost" do not have a significant impact on the timing and duration of the individual phenological stages.

The strongest growth is characterized by the shoots from the variant treated with 4 L/Ha " Gomat Rost " followed by the variant treated early with 3 L/Ha. Applied in a young vineyard "Gomat Rost" can have a positive effect on the formation and growth processes, as well as contribute to the faster formation during establishing and entry into fruiting.

Despite the low rainfall during the growing season, ripening of the vines treated with the highest dose of 4 L/Ha is established and the process itself is proceeding at a faster pace.

A yield of about 9000 to 10000 kg/Ha can be formed using the application of "Gomat Rost", with rates of 3 to 4 L/Ha. In variants to which higher doses of "Gomat Rost" are applied, a positive trend in the mass of grapes is established. This is because again it has to be underlined thickly that the experiment is under non-irrigated conditions and this puts stress on the vine. From a technological point of view, the treated vines with the highest dose of fertilizer lead to the preservation of relatively balanced sugars and acids.

Gomat Rost has abilities to positively affect the presence of stress caused by drought during the growing season.

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