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**POTENTIAL AND POSSIBILITIES OF REBO – NEW GRAPEVINE VARIETY (*Vitis vinifera* L.)
IN GROWING CONDITIONS IN REPUBLIC OF NORTH MACEDONIA***Dushko Nedelkovski^{1*}; Klime Beleski¹; Goran Milanov¹; Venelin Roychev²; Violeta Dimovska³*¹*University Ss. Cyril and Methodius Institute of Agriculture- Skopje, Republic of North Macedonia*²*Agricultural University- Plovdiv, R. Bulgaria*³*Faculty of Agriculture, Goce Delcev University –Stip, Republic of North Macedonia**Corresponding author: duskosk8@yahoo.com**Abstract**

Rebo (Rigotti 107-3) is a vine variety that originates from Trentino, North Italy. It was selected by the researcher Rebo Rigotti by crossing the varieties Merlot x Terlodego at the agriculture and forest experimental station in S. Michele all' Adige. According to the literature the idea of the breeder was to produce new variety that would be similar to Merlot but more resistant to cold climate conditions. Our idea to plant Rebo in Macedonia was to grow this variety on sites with higher altitude locations that are difficult for growing Merlot. The vineyard for this study is located in the north part of Macedonia on the mountain German near the town of Kriva Palanka, area typical for growing frost resistant varieties. In this research paper we analyzed the mechanical structure of the grape cluster and berries, the quantity of sugar and titratable acids in the grapes. In the wine we analyzed the quantity of total phenols, total anthocyanins, wine colour (Cl;H), total flavan-3-ols and standard chemical analysis of the wine.

Key words: *Rebo, Rigotti 107-3, cold resistance***INTRODUCTION**

Republic of North Macedonia has centuries of tradition of growing vines and producing high quality wines. Located in the south part of Balkan peninsula, it's a country with very good viticultural conditions, dry and warm summers and not so cold winters, which are ideal conditions for the production of high quality red wines. As a result of the climate conditions the produced wines in general are characterized as high colored, full body, structured, well balanced wines with aromas of ripened and black fruit. The most planted is the local variety Vranec, but from the red varieties, Merlot, Cabernet Sauvignon, Cabernet franc, Syrah and Pinot noir are also grown.

The quality of a wine can be expressed as a balanced set of multiple components found in it. The phenolics substances are just one group that participated in the quality of the wine. The greater the quantity of this component is the more complex wine can be produced. There are numerous factors that influence the production

of this components in the grape berry: grape variety, climatic and soil condition, agricultural practice (Stockham, K. et al., 2013; Maria G. et al., 2015).

In some parts of the country there are high altitude terrains for viticulture with not ideal winter temperatures. Because Merlot is one of the varieties that are demanded on the wine market the idea was to search for a variety that is similar to Merlot but is more frost tolerant. Rebo is grape variety created by the researcher Rebo Rigotti by crossing the varieties Merlot x Terlodego in S. Michele all' Adige. This grape variety is cultivated in Trentino northern Italy mainly in San Michele all' Adige, Volano, Calavino, Cavedine and Padergnone. In Italy in 2000 there were 39ha according to agricultural census. (Ian D'Agata 2014; Jancis R. et al 2012). The aim of the research was to investigate the quality of the grapes and wine from Rebo, Italian variety that is related to Merlot and is more resistant to low winter temperatures grown in climate conditions

of N. Macedonia. By analytical methods and degustation tasting to determine if this variety can provide grapes with good yield and quality grapes with expected parameters for the production of high quality wine. To investigate the potential and possibilities of Rebo we

analysed the mechanical composition of the harvested grapes and chemical composition of the produced wine (alcohol, extract, titratable acids, pH, free and total SO_2 , total polyphenols, total anthocyanidins, total flavan-3-ol, Hue and wine intensity and colour).

MATERIALS AND METHODS

Field research

The vineyard is located in the north part of the country near the town Kriva Palanka in the mountain German. It is a young vineyard, the vines are four years old and it was its second harvest. The distance between the plants in the vineyard is 3.2,m x 1,2m. The pruning system is double guyot, leaving two spurs with 2 buds and two cane with 6-8 buds, which is 16 to 20 buds per grape vine in total. Standard agricultural practise was performed in the vineyard.

Mechanical composition of the grapes

The grape was harvested in September and has relatively high amount of sugar 24,5 Brix. The yield and the mechanical analysis of the grape clusters and the grape berries were performed in the experimental laboratory in the Institute of Agriculture, using standard methods (Avramov, 1991).



Figure 1. Left- grape cluster of Rebo; Right – young vine of Rebo with visible grape clusters.

Vinification

Processing of grape was performed in the microvinification cellar, according to the standard procedure for red wines production. The grapes were hand-picked in plastic cases from 13 kg at technological maturity, at ripeness of 24.5 Brix. The grapes were immediately destemmed and crushed on a small electric crusher and 30mg/l SO_2 was added in order to prevent oxidation and to obtain microbiological protection. Lallemand

EXV enzyme for maceration was added during the processing of the grapes and yeast culture Lalvin D254 with dosage of 25g/hl was used for the alcoholic fermentation. The grape mash was fermented in 225liters capacity stainless steel tanks. The temperature regime during the AF was $24\pm 3^{\circ}C$. Yeast nutrient, Fermaid E (recommended dosage of 25 g/hL) was added during fermentation.

Spectrophotometric analyses of grape berries and wine

The analysed wine samples were performed by direct measurements or using appropriate dilution of wine in distilled water if it's necessary.

Total phenols content were assessed by the reduction method with Folin-Ciocalteu reagent. The results obtained are expressed as mg/L gallic acid equivalent (GAE/L).

Total flavan-3-ols were determined using DMCA (p-dimethylaminocinnamaldehyde) method. Quantity of 0.1 mL of the wine sample was transferred in a 10 mL flask, than few drops of glycerol and 5 mL DMCA solution were added

and made up to the mark with methanol. The absorbance was measured at 640 nm against methanol as blank. The obtained results are expressed as mg/l catechine hidrate.

Determination of total anthocyanins in wine. Wine dilution (1:100) was added in 10 ml flask and made up to volume with a solution of ethanol: water: hydrochloric acid (70:30:1). The absorbance measured at 536 to 540 nm against ethanol chloride as blank was used for calculation the concentration of total anthocyanins (TA) in wines using the equation:

$$TA_{540nm} \text{ (mg/L)} = A_{540nm} \cdot 16.7d,$$

where "A_{540nm}" is the absorbance at 540 nm and "d" is the dilution factor

Wine intensity, Hue and colour were analysed according to Ivanova V. (2013).

Degustation rating of the wine was performed by UC Davis 20 point system.

RESULTS AND DISCUSSION

The results for the quantity of the harvested grape per vine are given in Table 1. From it we can see that that the yield of this variety is similar compared to Merlot. The average yield produced of Rebo is 2700 g/vine and the average cluster weight is 194.3g. From the measurements of cluster weight and weight of 100 berries in table 1 we can establish that Rebo has small grape clusters and small berry size,

similar to Merlot. One of the most important parameters for the quality of the grapes and wine are the content of sugar and titratable acids and their mutual ratio. From the analysis of the grapes we measured high content of total soluble solids of 24,5° Brix and high content of titratable acids 7.5g/L. The level of Malic acid was also high 1,8 g/L.

Table 1. Mechanical analysis of Rebo grapes.

Parameter	Rebo
Yield (g/vine)	2700
Cluster weight (g)	194,3
Grape stem weight (g)	5
Weight of 100 berries (g)	86
Seed number/100 berries	202
Seed weight/100 seeds (g)	3,14
pH	3,23
Titratable acids (g/L)	7,5
Malic acid (g/L)	1,8
Total souluble solids (°Brix)	24,5

The obtained results in Table 2 for the general analysis of the wines (pH, alcohol content, total acidity, volatile acidity) demonstrated that the samples are in the expected range for red wines of this type of wine. Additionally, they showed that the wine from Rebo have high alcohol level which shows

that this variety is capable to produce high level of sugar and still have a good level of total acidity in the grapes and in the wine. The ratio between these two parameters makes this variety very good for production of young fresh wines and wines that can have long shelf life which can be also confirmed from the obtained high level of

total extract (33.20 g/L). The high value for this parameter also indicates that from this variety structural, full body wines can be produced. The level of volatile acidity is 0.51g/L and the free and total SO₂ have good ratio which indicates that there was no problem during the alcoholic

fermentation. According to the degustation rating the wine had 18 points that showed that the produced wine from Rebo have very good potential for production high quality wines. These results are similar with the results from the research performed by Sartor et al. (2017).

Table 2. General analysis of the analysed wines.

Parameter	Rebo
Sp. Gravity, 20/20	0,99
Alcohol, vol%	14,32
Total extract, g/l	33,20
Titrateable Acid, g/l	6,8
Volatile Acid, g/l	0,51
Free SO ₂ , mg/l	32,00
Total SO ₂ , mg/l	62,72
Degustation rating	18,00

The phenolic components are one of the most important components in the wine. Their production is as a response of stress conditions and their accumulation is influenced by agricultural practise, climate condition and the grape variety (Fernandez-Mar, M et al. 2012). During the wine making process they are transferred from the solid parts of the grapes to the must (Monagas et al. 2003). They are the components responsible for the organoleptic properties of the wine, astringency, bitterness, wine colour and the healthy effect. The anthocyanine through co-pigmentation with flavonols stabilised and increased the wine colour. In our study the level of total anthocyanine

was 588.24 mg/L for Rebo which indicates that the obtained wine has a very nice dark colour and that is supported with the obtained value for color intensity, 7.25. During winemaking (crushing, maceration, and fermentation), flavonoids, anthocyanins, flavonols, flavan-3-ols, and procyanidins are transferred from the solid parts of the grape (the skin, seed, and stem) to the must (Monagas et al., 2003). The experimental wines have high level of total polyphenols (2920.95 mg/L) components and total flavan-3-ols (614.66 mg/L). The high level of these components suggests that the wine produced from this grape variety is suitable for ageing.

Table 3. Analysis of phenolic components Hue CI in wine.

Parameter	Rebo
Total polyphenols (mg/L)	2920,59
Total flavan-3-ols (mg/L)	614,66
Total Anthocyanins (mg/L)	588,24
Hue	0,2397
Colour Intensity	7,25
Yellow, %	9,70
Red, %	40,45
Blue, %	49,86

CONCLUDING REMARKS

The grape variety Rebo is perspective wine variety for Republic of North Macedonia. Its higher frost resistance compared to Merlot makes it more suitable for vine growing terrains with higher altitude. From the mechanical

analysis it can be seen that this variety has small grape clusters and medium level yield per vine. The variety can produce high amount of sugar and titrateable acidity which makes it good variety for producing quality wines. The

wines produced from this variety are complex, with deeply ruby red color and high content of anthocyanins. The taste of the wine is berry fruited, with light herbaceous and spicy notes,

full body. The young wine has slightly higher level of tannins which makes it suitable for ageing.

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ПОТЕНЦИЈАЛ И МОЖНОСТИ НА РЕБО - НОВА ВИНСКА СОРТА (*Vitis vinifera* L.) ОДГЛЕДУВАНА ВО УСЛОВИ НА РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА

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Резиме

Ребо (риготи 107-3) е сорта на винова лоза која потекнува од Трентино, северна Италија. Селекционирана е од страна на истражувачот Ребо Риготи со вкрстување на сортите Merlot x Terlodego на експерименталната станица за земјоделство и шумарство во С. Мишел Алто Адице. Според литературните податоци идејата на селекционерот била да произведе нова сорта која би била слична со мерло, но поотпорна на ладни климатски услови. Нашата идеја да засадиме ребо во Македонија беше со цел оваа сорта да се одгледува на локации со повисоки надморска височина кои не се погодни за одгледување на мерло. Лозовиот насад за оваа студија е лоциран

во северниот дел на Македонија на планината Герман, во близина на градот Крива Паланка, област која е типична за одгледување на сорти отпорни на измрзнување. Во овој истражувачки труд беа анализирани механичката структура на гроздот и зрното, количеството на шеќер и вкупни киселини во грозјето. Во виното беше анализирано количеството на вкупни феноли, вкупните антоцијани, бојата на виното (Cl; H), вкупни флана-3-оли и стандардна хемиска анализа на вино.

Клучни зборови: *ребо, риготи 107-3, отпорна на ладни климатски услови.*