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*Dejan DULETIĆ and Slavko MIJOVIĆ¹***YIELD AND QUALITY OF GRAPES OF THE CARDINAL VARIETY
DEPENDING ON DIFFERENT FOLIAR FERTILIZERS****SUMMARY**

Since contemporary viticulture system sees an increasing use of foliar fertilizers, the main purpose of this research is to determine which of the liquid foliar fertilizers applied will create the best effect on agro-biological and technological properties, that is, on the quantity and quality of grape yield of the Cardinal variety. The research was done in 2013, on the trial plot of the Biotechnical Faculty, which lasted for one year. The trial was set using the randomized block design method. Planting distance is 2.5x1.2 m. The training system is two-folded cordon formed at the height of 60 cm. Mixed pruning. Five types of foliar fertilizers were applied: Folifertil B11, Wuxal Super, Wuxal Magnesium, Wuxal Ferro and Slavol. The biggest effect on the yield of grapes of the Cardinal variety manifested in foliar fertilizers Wuxal Super, Folifertil B11 and Slavol. The highest yield per vine plant was achieved in the variant 2 (Wuxal Super), amounting to 4.5 kg, while the lowest yield (2.9 kg/vine plant) was recorded in the control. The highest sugar content in grape juice (18.65%) was measured in the variant treated with Folifertil B11 (variant 1). Application of different types of foliar fertilizers did not have a significant effect on total acid contents in the grape juice of the Cardinal variety. On the control variant it was identified the highest content of total acid.

Keywords: Cardinal variety, foliar fertilizers, agro-biological and technological properties

INTRODUCTION

In contemporary viticulture fertilizing is among the most important agro-technical measures, which significantly effect at increasing yield, the quality of grapes and wine and improving the physico-chemical and biological properties of the soil. Fertilizing is imposed as a necessary measure since every year, yield, and green and ripens mass of vine plant take large quantities of mineral substances. Each by these deficiencies can be significantly reduced by foliar nutrients of the grape vine. Feeding of grape vine via leaf is done with liquid, easily soluble fertilizers, and intended are exclusively for supplemental foliar feeding of grape vine with macro and micro elements, primarily with nutrients such as boron (B), zinc (Zn) and iron (Fe) which deficiency mostly occur in viticulture soils.

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The elements needed from the soil are often inaccessible to plants. Intake of nutrients through roots requires mobilization on daily basis of inaccessible forms of elements in soil into accessible ones, in quantities sufficient to provide the plant with the daily nutrients quantity needed. Accessibility of elements in soil is influenced by cold weather, soil type, pH reaction of the soil, as well as water content. Foliar feeding gives the producer assurance that the plant will absorb nutrients within a short period and be provided with them in the exact development pheno-phase when they are needed most.

According to Milosavljević (1998) Cardinal is one of leading table varieties in USA, Italy, Serbia and Montenegro. It is an early variety whose grapes are crunchy and have mild hardly noticeable Muscat aroma, very pleasant for consumption, with colorless juice of a pleasant aroma and taste (Avramov, 1991).

The object of this research was to determine which variants of foliar nourishment of grape vine applied would achieve the best results in terms of the quantity and quality of grapes yield of the Cardinal variety.

MATERIALS AND METHOD

The research was done in the course of 2013, in a trial plot of the Biotechnical Faculty, in „Podgorica“. The trial was set by a randomized block design method. The planting distance is 2.5 x 1.2 m. The training system is the two-folded cordon formed at the height of 60 cm. Mixed pruning. Trellis was made of concrete and wire. Each variant had 15 vine plants distributed in 3 replications of 5 plants each. The research was done on the Cardinal variety, grafted on the rootstock Kober 5BB. Five variants of foliar fertilizers were applied:

- 1.FOLIFERTIL B11 (Foliar liquid fertilizer containing one element B-11%);
- 2.WUXAL SUPER (Foliar complex liquid fertilizer with balanced micro and macro elements. Composition: N-8%, P₂O-8%, K₂O-6%, B-0.01%, Cu-0.04%, Fe-0.02%, Mn-0.012%, Mo-0.01%, Zn-0.001%);
- 3.WUXAL MAGNESIUM (foliar liquid fertilizer with increased magnesium content. Composition: N-3.6%, MgO-12%, SO₃-10%, B-0.3%, Mn- 1%, Zn-0.7%);
- 4.WUXAL FERRO (foliar liquid fertilizer with increased iron content. Composition: Fe-5 %, N-5%);
- 5.SLAVOL (microbiological liquid fertilizer. Slavol is a bio-organic fertilizer, containing bacteria and natural vitamins, enzymes and growth stimulators);
- 6.CONTROL (no foliar fertilizer).

The first application of the fertilizer was done before flowering, the second after flowering and the third in the veraison phase. All sprayings were done in mostly dry and cloudy weather, with no precipitation, in early morning hours.

The soil where the trial vineyard was set up is formed on quaternary fluvial-glacial rocky-gravel sediments of different composition and great power. It belongs to the type of cement brown Mediterranean soils. It is poorly provided with easily accessible potassium and in particular phosphorous, while the humus content, particularly in the surface layer is satisfactory. The climate is characterized by relatively high average air temperatures (15.5°C), with hot summers and mild winters with no snow. In addition to the standard treatment, fertilizing, protection and care the plantation of grape vine regularly was irrigated with system drop by drop.

During the one-year trial, the following were analysed: grape yield (kg/vine plant), cluster weight (g), sugar content in must (%) and total acid content in must (g/l).

Average cluster weight was determined in a representative sample by dividing the measure grape weight with number of clusters in it.

Average yield of grapes per vine plant represents the average yield of 5 vine plants.

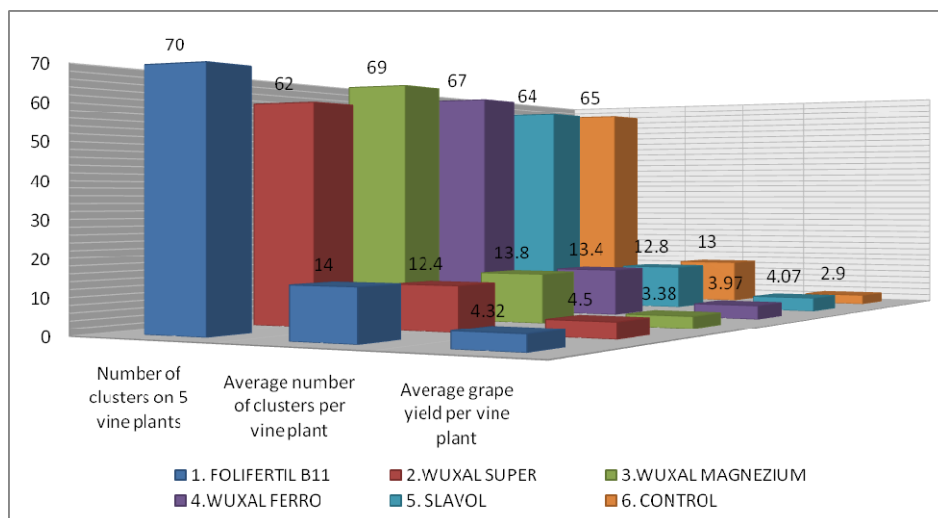
Sugar content in grape juice was determined using Oechsle must meter. The total must acidity is determined by direct titration with the sodium hydroxide (NaOH) solution.

RESULTS AND DISCUSSION

The results of the research show that the grape yields were satisfactory and characteristic of the Cardinal variety in the viticulture area of Podgorica. As it can be seen from the data presented in the Graph 1 below, the lowest grape yield (2.9 kg/vine plant) was recorded in control variant. In the variant with Wuxal Magnesium applied it was recorded a somewhat higher and it was 3.38 kg/vine plant. A significantly higher yield compared to the control, was recorded also in the variant 4 - Wuxal Ferro (3.97 kg/vine plant). Significantly higher yield where measured in the variant 5 and 1 (in both variants the grape yield was above 4 kg/vine plant). The highest yield of grapes in this research was recorded in the area treated with Wuxal Super (4.50 kg/vine plant).

The results obtained are showed that foliar fertilizers have a positive effect on grape yield which is consistent with the results of Mijović (1992), Lović (1973), Milosavljević (1998), Mitović (1980). Ulićević et al. (1976) established in their research that the average yield of grapes in the Cardinal variety amounts to 3.41 kg per vine plant, which is approximately the same as results obtained in this research.

Average number of clusters per vine plant in the variants foliar fertilizers applied ranged from 12.4 in variant 2 to 14 in variant 1, as in control was 13. The above results show that there were no significant differences in number of clusters studied variants.



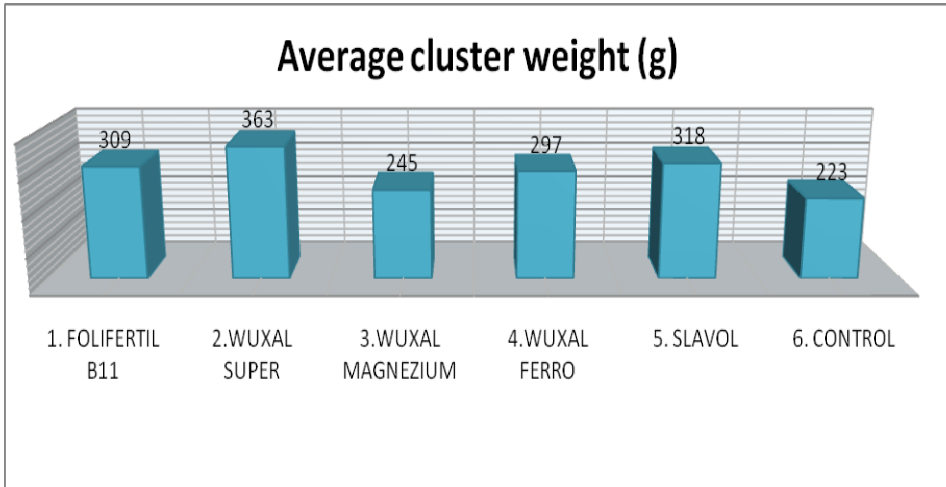
Graph 1. Cardinal variety grape yield (kg/vine plant)

Vukadinović (2007), in her three-year trial in the same location came to conclusion that a stronger effect of foliar products can be expected only in the third year of foliar application.

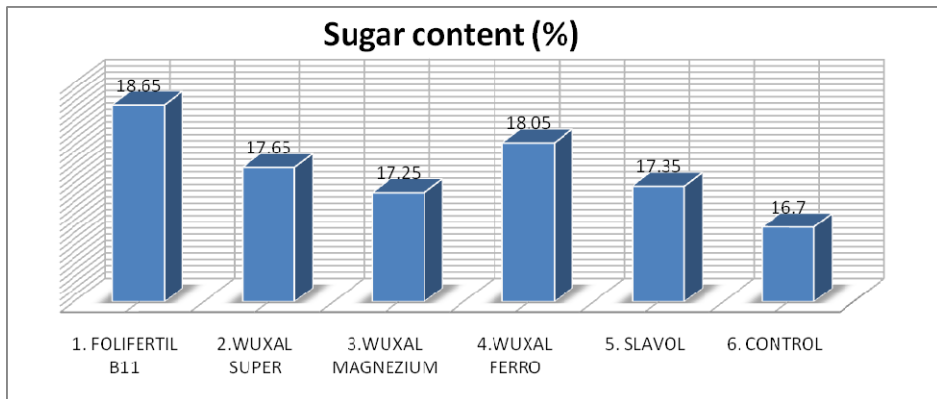
Cluster weight is another important indicator of the quality of a table variety. Variation of this property depending on the foliar fertilizer type is presented in Graph 2 below. Analysis of the average cluster weight of the Cardinal variety shows that it was the highest in variant 2 (363g), treated with Wuxal Super. A somewhat lower grape yield was observed in variant 5 (318g), variant 1 (309g) and variant 4 (297 g). In the area treated with Wuxal Magnesium, average grape weight was 245 g, which is by only 21 g higher than the control. Results of the research are in the high correlation with researches of Avramov (1991), Žunić (2000) and Cindrić et al. (2000).

One of main indicators of grape quality is the sugar content in grape juice. The total sugar content in must varies significantly depending on the variety, weather conditions during the grapes ripening and agro-technical measures applied. Foliar feeding is among other significant factors having a direct effect on achieving higher sugar content in grapes. Based on the data recorded (Graph 3) we can state that the highest sugar content in grape juice was recorded in the variant 1(18.65%). In variant 4, treated with Wuxal Ferro, the sugar content was recorded in the level on 18.05%, as in the other variants it was below 18%. The lowest sugar content was measured in control and it was 16.7%.

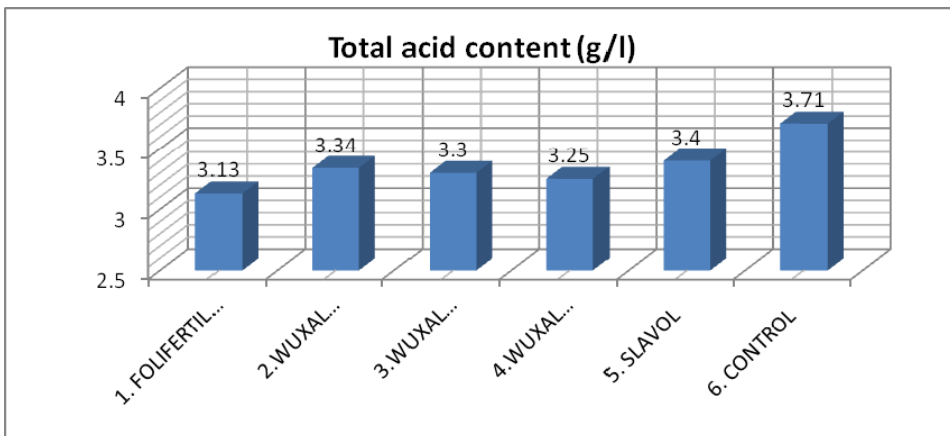
The results show that sugar content in must was within the limits of values stated for this variety by Blasé (2006), Cindrić (1990) and Žunić et al. (2002). The positive effect of foliar fertilisers applied on sugar content in the grape juice notes Mijović (1992) too.



Graph 2. Average cluster weight for the Cardinal variety (g)



Graph 3. Sugar content in grape juice (%)



Graph 4. Total acid content (g/l)

The total acid content in grape juice is an important indicator of the quality of grapes that the harmonious taste of grapes depends on. Acidity to grape juice is given by free acids and their salts present in it and to a smaller extent some other acidic substances. The total content of acids (Graph 4.) did not vary significantly with the type of foliar fertilizer. The highest total acid content was recorded in the control (3.71g/l), while the lowest content was recorded in the variant 1.

CONCLUSION

On the basis of one-year research, it can be concluded:

- Foliar feeding had a positive effect on yield and quality of grapes of the Cardinal variety.
- The highest yield (4.5 kg/vine plant) and cluster weight(363g) was in the variant 2 (Wuxal Super)
- The highest sugar content (18.65%) in the grape juice was recorded in the variant 1(Folifertil B11)
- Application of different types of foliar fertilizers did not have a significant effect on total acid content in the grape juice of the Cardinal variety. The highest acid content was measured in the control variant.

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PRINOS I KVALITET GROŽĐA SORTE KARDINAL U ZAVISNOSTI OD RAZLIČITIH VRSTA FOLIJARNIH ĐUBRIVA

SAŽETAK

Obzirom da su danas u savremenom sistemu uzgoja vinove loze sve više u upotrebi folijarna đubriva, osnovni cilj ovog istraživanja je da se utvrdi koje od primjenjenih tečnih folijarnih đubriva će pokazati najbolje djelovanje na agrobiološke i tehnološke karakteristike, odnosno na visinu i kvalitet prinosa grožđa sorte kardinal. Istraživanja su sprovedena 2013. godine na Oglednom imanju Biotehničkog fakulteta i trajala su godinu dana. Ogled je postavljen metodom slučajnog blok sistema. Rastojanje sadnje je 2.5 x 1.2 m. Uzgojni oblik je dvokraka horizontalna kordunica formirana na 60 cm visine. Rezidba je mješovita. Proučavano je pet varijanti folijarnih đubriva: Folifertil B11, Wuxal Super, Wuxal Magnezium, Wuxal Ferro i Slavol. Najveći uticaj na prinos grožđa sorte cardinal ispoljila su folijarna đubriva Wuxal Super, Folifertil B11 i Slavol. Prinos grožđa po čokotu je bio najveći kod varijante 2 (Wuxal Super) i iznosio je 4.5 kg, dok je ja najmanji prinos zabilježen kod kontrole (2.9 kg/čok). Najveći sadržaj šećera u grožđanom souk (18.65%) izmjereno je kod varijante tretirane sa Folifertil B11 (varijanta 1). Primjena različitih vrsta folijarnih đubriva nije značajno uticala na sadržaj ukupnih kiselina u grožđanom soku sorte Kardinal. Na kontrolnoj varijanti evidentiran je najveći sadržaj ukupnih kiselina.

Ključne riječi: sorta Kardinal, folijarna đubriva, agrobiološke i tehnološke karakteristike