

The Effect of Irrigation by Flooding and of the NPK Fertiliser Application on the Yield, Quality and Vegetative Potential of the Vranac Variety in Agroecological Conditions of Podgorica

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Abstract: In the 1985-1989 period, the yield and quality of grapes and vegetative potential of the Vranac variety were examined in the conditions of irrigation by flooding with the application of two manners of soil maintenance, shallow cultivation and overgrowing with grass, with and without the application of the NPK fertilisers.

On the basis of the obtained results, we can state that the yield of grapes and vegetative potential (rankness of vine) were higher in the conditions of applying the NPK fertilisers notwithstanding the manner of soil maintenance. Otherwise these parameters had higher values on the plots maintained by more frequent shallow cultivation.

The content of sugar and acids in the must was almost the same regardless of the way of soil maintenance and the application of the NPK fertilisers.

Key words: irrigation, manner of soil maintenance, fertilisation, yield, sugar, acids, vegetative potential.

Introduction

The use of shallow soils for intensive agricultural production is related to a number of problems, especially in the conditions of Mediterranean climate which prevails in agroecological conditions of Podgorica.

Considering the unfavourable distribution of rainfall in our environment, it is impossible to imagine successful vineyard growing without irrigation, while classical cultivation of land in vineyard has been substituted more and more with the maintenance of the very soil surface by applying herbicides or overgrowing

with grass. The aim of this paper was to determine yield and quality of grapes and vegetative potential of the autochthonous wine grape variety Vranac in the conditions of irrigation by flooding, and soil maintenance in two ways (more frequent shallow cultivation and overgrowing with grass) with and without the application of the NPK fertilisers.

Material and Method of Work

The researches were conducted on the experimental plantation owned by the Agricultural Institute in Podgorica-Montenegro. Experimental vineyard was established with the variety Vranac on the rootstock Kober 5 BB. The spacing between vines was 2.5 x 1 m. The stem was shaped with two sprouts spreading horizontally on the spalire, 60 cm high. Mixed pruning was applied.

The trial including different manners of soil maintenance, irrigation and fertilisation of vineyards was put under split-split-plot system. The basic plot covered 100 m². It included: three ways of soil maintenance, two ways of irrigation and five combinations of fertilisation (total of 300 trial plots).

The experimental vineyard was established on the cement-brown Mediterranean soil which was created on quaternary fluvial-glacial stony pebbly sediments of various composition and great mightiness. An average depth of the profile was about 60 cm. The soil contained 35-60% of skeleton and there was up to 50% of sand in the fine soil. The soil without carbonate was with acid to low acid reaction. In the surface layer there was enough quantity of humus (3-4%), and average quantity of potassium (15-20 mg K₂O), while it was very poor in easily approachable phosphorus (1-2 mg P₂O₅).

The climate was characterised by: relatively high average air temperatures (15.5 C), hot summers and mild winters, a great amount of rainfall (1650 mm) with very unfavourable distribution over the year. In the period June-August 10% of annual quantity of rain falls, so that there is always lack of water for the vines at that time.

This paper shows the results of studying yields, quality of grapes and vegetative potential of the Vranac variety in the conditions of irrigation by flooding with or without the application of the NPK fertilisers.

Irrigation by flooding was applied 2-3 times depending on the year, and the quantity of irrigation water was determined according to the retention capacity of soil. The irrigaton was applied when the moisture in the soil would drop to 18% (point of fading is about 12.5%).

Shallow cultivation was carried out by a milling machine and a cultivator, 3-4 times a year, depending on the weed growth and with manual supplementary cultivation of the surface below the vines which couldn't be reached by the machine. Overgrowing with grass was carried out by sawing grass growing in the parks (*Trifolium repens*, *Lolium perene*, *Fesenta rubra*, *poa pretense*), but later on spontaneous vegetation prevailed, so that the composition of grass was identical to those growing on natural surfaces overgrown with grass. The grass was cut 2-3 times a year and left in mulch.

Fertilisation was applied every year in early spring by its distribution on the surface in the following quantities: 75 kg of N, 75 kg of P, 75 kg of K (active substance).

Within the research period (1984-89) the data were gathered and registered by standard methods. The yield of grapes taken from 6 experimental vines of each repetition was determined by weighing. The sugar content was determined by the must meter and total acids were determined by titration with NaOH n/4. The green mass was obtained by pruning of 6 trail vines of each repetition. Two-factor trail was put in the conditions of irrigation, where the manner of soil maintenance was the first factor and the application of fertiliser the second.

Results and Discussion

Yield of grapes. On the basis of the results obtained over a 5-year-long period and presented in Table 1, an average yield of grape per vine was 2.83 kg on the plots where more frequent shallow cultivation was applied without the application of fertilisers i.e. 3.85 on the plots where the NPK fertilisers were applied.

Table 1. Average yield of grapes (kg/vine) for the period 1985/1989.

Ord./numb.	Irrigation	Manner of soil maintenance	Fertilisation	
			O*	NPK
1.	Flooding	Shallow cultivation	2.83	3.89
2.		Overgrowing with grass	2.48	3.26
			2.65	3.57

O* - without NPK fertilisers

On the plots overgrown with grass without the application of fertilisers, an average yield of grapes per vine was 2.48 kg, i.e. 3.26 kg with the application of the NPK fertilisers. Generally speaking, regardless of the way of soil maintenance, on the plots where the NPK fertilisers were applied, the yields of grapes per vine were: 2.65 kg without the NPK fertilisers and 3.57 with the application of the NPK fertilisers.

In the earlier researches conducted by Ulicevic et al. (1972,1987) it was stated that yields of grapes on the plots which have been under the grass cover permanently through the years, in the conditions of irrigation and fertilisation with the NPK fertilisers, did not importantly vary neither compared to those on the barren uncultivated plots nor to those which were either shallow or normally cultivated.

Also, according to the researches conducted by Ancel (cited upon Agulhon 1985), permanent overgrowing with grass did not have a depressive impact on either yield or quality of grapes.

The content of sugar and acids in the must. In the conditions of irrigation by flooding in both variants of soil maintenance in the vineyard (shallow cultivation and overgrowing with grass), on the plots without the application of fertilisers, a somewhat higher content of sugar in the must was noted down (18.65% and 19.04%) compared to the plots where the NPK fertilisers were applied (18.10% and 17.90%).

Table 2. Average content of sugar in the must (%) in the period 1985/89

Ord./numb.	Irrigation	Manner of soil maintenance	Fertilisation	
			O*	NPK
1.	Flooding	shallow cultivation	18.65	18.10
2.		Overgrowing with grass	19.04	17.90
			18.85	18.00

O* - without the application of NPK fertilisers

The above showed that soil maintenance in vineyard did not have an important influence on the content of sugar in the must. Soyer et al. (1984) obtained similar results.

However, Scienza et Valenti (1984) stated that in the Italian environment, there was a depressive impact of overgrowing with grass on the content of sugar in the must of Italian reasling.

The content of acids (Table 3) in the must on the surfaces maintained by more frequent shallow cultivation in the conditions without the application of fertilisers amounted to 6.15 g/l while on the plots where the NPK fertilisers were applied it amounted to 6.23 g/l.

Table 3. Average content of acids in the must (g/l) for the period 1985/89

Ord./numb.	Irrigation	Manner of soil maintenance	Fertilisation	
			O*	NPK
1.	Flooding	Shallow cutlivation	6.15	6.23
2.		Oveergrowing with grass	6.30	6.21
			6.22	6.22

O* - without the application of NPK fertiliser

On the plots overgrown with grass, in the conditions without the application of fertilisers, the content of acids, amounted to 6.30 g/l, and in the conditions of the application of the NPK fertilisers it amounted to 6.21 g/l. On the basis of data on the content of sugar and acids in the must on the plots with and without the application of NPK, we can state that these parameters varied negligibly regardless of the way of soil cultivation.

Vegetative potential (average green mass pruned from the vine). From the data shown in the table 4. it comes out that the green mass taken off the vine by pruning was bigger on the plots on which NPK was applied regardless of the way of soil maintenance.

Table 4. An average mass pruned from the vine (g) for the period 1985/89

Ord./numb.	Irrigation	Manner of soil maintenance	Fertilisation	
			O*	NPK
1.	Flooding	Shallow cultivation	565	711
2.		Overgrowing with grass	587	707
			576	709

O* - without the application of the NPK fertilisers

Generally speaking, the vine rankness was bigger on the plots with shallow soil cultivation in the conditions with and without the application of the NPK fertilisers compared to the same conditions on the plots being overgrown with grass. Nikov (1972), Rangelov (1972, Ulicevic) et al. (1983,1987) obtained similar results.

Conclusion

On the basis of the obtained results, the following conclusions can be drawn:

Under conditions of irrigation by flooding, a somewhat higher yield of grapes per vine was achieved on the shallow cultivated plots fertilised by the NPK fertilisers compared to the plots overgrown with grass.

An average content of sugar and acids in the must on shallow cultivated non-fertilised plots, was somewhat lower than on the plots overgrown with grass, while on those fertilised by the NPK fertiliser it was higher.

The vegetative potential i.e. green mass pruned from the vine was bigger on shallow cultivated plots with and without the application of the NPK fertilisers compared to the plots overgrown with grass.

Generally speaking, the yield of grapes as well as the vegetative potential (vine vigor) was higher in the conditions of irrigation and the application of the NPK fertilisers regardless of the way of soil maintenance. Otherwise, these parameters had higher values on the plots maintained by more frequent shallow cultivation.

The content of sugar and acids in the must was nearly equal regardless of the way of soil maintenance and the application of the NPK fertilisers.

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UTICAJ NAVODNJAVANJA PLAVLJENJEM I PRIMJENE NPK ĐUBRIVA NA PRINOS, KVALITET I VEGETATIVNI POTENCIJAL SORTE VRANAC U AGROEKOLOŠKIM USLOVIMA PODGORICE

-originalni naučni rad-

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Rezime

U periodu od 1985-1989. godine, prinos, kvalitet i vegetativni potencijal sorte Vranac su proučavani u uslovima navodjavanja plavljenjem uz primjenu dva načina održavanja zemljišta: plitke obrade i zatravljivanja, sa i bez primjene NPK đubriva.

Na osnovu dobijenih rezultata možemo konstatovati da su prinos i vegetativni potencijal sorte Vranac (kvalitet groždja) bili viši u uslovima primijenjena NPK đubriva bez obzira na način održavanja zemljišta. Ovi parametri su imali više vrijednosti na zemljištu gdje je primijenjena plitka obrada.

Sadržaj šećera i kiselina u širi je bio skoro isti bez obzira na način održavanja zemljišta i primjenu NPK đubriva.