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## Research Concerning the Correlation Between Crop Load, Leaf Area and Grape Yield in Few Grapevine Varieties

Alin DOBREI<sup>a\*</sup>, Alina DOBREI<sup>a</sup>, Gheorghe POSTA<sup>a</sup>, Marcel DANCI<sup>a</sup>,  
Eleonora NISTOR<sup>a</sup>, Dorin CAMEN<sup>a</sup>, Mihaela MĂLĂESCU<sup>a</sup>, Florin SALA<sup>a</sup>

<sup>a</sup>Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara

### Abstract

Several red grapevine varieties like Feteasca neagra, Cabernet Sauvignon, Pinot noir, Merlot, Burgund and Cadarca were investigated during 2014-2015 in the vineyard Minis-Maderat. Following research, correlations and mathematical models were made differentiated between crop load, leaf area and grapes quality (sugar content, titratable acidity, *sugar-acidity index* and anthocyanins). Optimal crop load varies from one variety to another, depending on each of them. The effect of four crop load (20, 30, 40 and 50 buds/vine) was study for their influence on yield and grape quality. The quality of production is an indicator that can be best optimized by proper pruning. From this point of view, Feteasca neagra and Merlot varieties had the best behaviour, while the Burgund and Cadarca recorded smaller qualitative differences between experimental variants. Correlations and mathematical methods vary from one variety to another; superior quality indices were recorded at different crop load, determined with precision by *statistical* and *mathematical* methods and *interpretation*. Although pruning is a technological stage extensively studied, it can be optimized for each variety according to the production destination, environmental conditions and vineyard management. Statistical analysis showed that the Cabernet Sauvignon variety perform the best concerning the grape quality parameters while Burgund and Merlot are varieties with week results in both experimental years. The aim of the study was to investigate the influence of crop load on grape quality, grape yield and photosynthetic efficiency.

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\* Corresponding author. Tel.: Tel.: +40256-277-289; Fax: +40256-277-263.

E-mail address: [alin1969tmro@yahoo.com](mailto:alin1969tmro@yahoo.com)

## 1. Introduction

The optimum crop load in order to achieve wine quality is still one of the most important management issues in viticulture. It is difficult to choose a proper number of buds/ vine which must be correlated with soil type, grapevine training on trellis or climatic conditions (Cus, 2004; McDonnell et al., 2008). The effect of crop load on grape quality depends on how a difference in crop load is achieved (Chapman et al., 2004). If too many buds are left at pruning will result too many shoots which leads to a dense canopy and alternatively, if too few buds left, then the remaining shoots may grow too vigorously which leads to shade in the fruiting zone (Kliewer and Dokoozlian, 2005). Crop load associated with climate variability (Pickering et al., 2014), weather differences among years, in addition to vineyard location are by far the strongest determinants of fruit composition (Santesteban and Royo, 2006; Visan et al., 2015). An increase of vine spacing is typically associated with a higher yield per vine, but vine size or leaf area per vine, also increases, so fruit composition and wine quality may be completely unaffected (Keller et al., 2008; Gonzalez-Alvarez et al., 2013). Canopy, vigour and productivity of the vine can be balanced through pruning; the vine needs to have moderate number of shoots and canes in order to maintain the uniform vigour for the entire life span and for the best grapes quality (Senthilkumar et al., 2015). The aim of the study was to investigate the effect of crop load on several red wine grape cultivars and on their productive performance in different climatic conditions.

## 2. Materials and methods

The research was carried out during 2014 - 2015 in a private plot with early full maturity vines, from Miniş-Maderat vineyard. Red wine varieties as: Feteasca Neagra, Cabernet Sauvignon, Pinot Noir, Merlot, Burgund and Cadarca grape quality was investigated. Vineyard is located on a sandy-loam soil with a medium fertility, with planting distance of 2.2 m between rows and 1 m between vines; pruning and training was Cazenave cordon system. Experimental variants had different crop loads: V1 - 20 buds/ vine; V2 - 30 buds/ vine; V3 - 40 buds/ vine; V4 - 50 buds/ vine. First was observed the pruning influence on: grapes quality (sugars, acidity, sugar/acidity index, and anthocyanins), leaf area, photosynthetic efficiency of vine and varieties. Therefore, it was aimed to correlate the crop load with leaf area required per kg of sugar accumulation, and per kilogram of yield.

Each year, samples were taken under different climatic conditions, with extremes influences on the vine, which made difficult to observe with accuracy the differences between the experimental variants in both years of growing. Zamboni et al. (1997), studying the leaf area stated that a high number of nodes lead to a larger total leaf area compared to the vines having lower nodes, but had the same 'total leaf area/fruit yield ratio'. All statistical analyses were performed using GraphPad Prism 6.07 software.

## 3. Results and discussions

Year 2014 was less favourable for grapevine growing, with excess rainfall; the annual average rainfall in the research area was of 780 mm, while solar radiation recorded was slightly inferior to the normal recorded consistently in this area. In 2014, the real amount of solar radiation among April 15 to October 30 was only of 1690 hours. 2015 was a dry year, one of the hottest year on record with annual rainfall of 532 mm, while solar radiation during April 15 to October 30 was 2115 hours. In 2014 grape yield was not of great quality, crop qualitative indices recording parameters below the varieties and growing area potential. In all varieties crop load obviously influenced the quality of production. Results obtained in the study are presented in Tables 1, 2, 3 and 4.

Feteasca neagra cultivar registered the highest sugar concentration, 196 g/l on average (Table 1). The highest sugar concentration was registered for 40 buds/ vine; the difference was statistically assured compare with the average of the experience. Both smaller crop load of 20 or 30 buds/ vine, and higher crop load of 50 bud/ vine, resulted in lower accumulation of sugars. 40 buds/ vine was found to be the most appropriate for other grape quality (sugars/ acidity index and anthocyanins), which recorded the best values for this crop load. Cus, (2004) found the highest crop yield at 40 buds/ vine. Cabernet Sauvignon was found to be less sensitive to crop load fluctuations in the limits of experience, the differences between the experimental variants being smaller and not statistically significant; the other qualitative indices meet the same conditions. Latest researches suggest that for Cabernet varieties a crop load with a small number of buds/ vine becomes detrimental like over-cropping (Lasko, 2013).

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