ABSTRACT

Key words: Fetească neagră, Cotnari vineyard, fitotechnical measures, culture technology

Cotnari vineyard is a *s*eptentrional vineyard whose setting towards the Northern limit of vine culture, makes the possibility of cultivating grapes for red wines quite questionable. Even so, lately, one notices an increase of the viticultural area and a diversification of the cultivated assortment in favour of grape varieties that are resistant to climatic stress. Global warming could lead to big changes in the viticultural map of the world, vineyards could extend in septentrional areas of Europe. Recent studies have shown that the favourable area for vine growing in Romania has extended up to the North, at the same time with improvement of the grapes' quality. The global climate changes have determined the apparition of some small changes in Romania, as well. Global warming could have a remarkable influence on the vineyards that produce high quality wines. For the Northern vineyards, the change in climate will be beneficial, while for the Southern vine growers, this phenomenon will bring disadvantages, as, because of the too hot climate, negative effects will appear on the viticultural products.

The aim of this thesis is the establishing of the cultural technology of Fetească neagră grape variety, in the conditions of the Cotnari viticultural ecosystem, by applying a complex of fitotechnical measures, in order to diversify the grape varieties assortment of the vineyard.

Applying green measures and works is one of the technological steps that respond to: finalising the fruit load for the current year; shaping and directing the growth and fruiting processes in a harmonious equilibrium; shaping the fruiting elements for the following year; creating and improving useful ratios between the quantity and quality of the harvest.

The thesis is structured in 8 chapters, it has 228 pages, with 66 tables, 44 figures and coloured photographs and 165 bibliographical titles. The first part of the study

refers to the actual state of the art knowledge of the studied theme, while the second part presents the personal contributions within seven chapters, including the final conclusions and used bibliography.

The first chapter entitled "*The importance of cultivation grape varieties for red wines*" presents the importance of grapes from an economic and social point of view, reffering to the genetic viticultural heritage of Romania, specifically the variety Feteasc㠠neagră in Cotnari vineyard, mentioning the main notes from the task book of wines obtained in the same vineyard, as well as recent studies regarding the behaviour of this variety in Iaşi county area.

The second part of the thesis, personal contributions, starts with ***chapter two*** "*Aim and objectives of the research*", where the main directions of study are presented the experimental work flow and research methods, physical and structural analyses, as well as the analytical ones, from the laboratory.

The experimental process was situated in farn no. 4 belonging to S.C. Cotnari, in a 10 year old vine plantation, the Feteasc㠠neagră variety having as rootstock Berlandieri x riparia Selection Oppenheim 4. Planting distances were of 2,2/1,2 m, with a vertical monoplan trellising system, with 3 rows of double wires.

The experiment was set up on 24 rows, in 8 variants including the control, in 3 repetitions. Each variant had 25 vine trunks, established according to pruning type and fruit load, studying in parallel the variants where short pruning (bilateral cordon on semi-trunk) as well as long pruning (Guyot on semi-trunk) were used. Therefore, the experimental variants are as follows: V0 – pruning in short spurs/ canes, with no green works –control variant; V1 – pruning in spurs/canes + shoot thinning 30%; V2 - pruning in short spurs/ canes + shoot tipping; V3 pruning in short spurs/ canes + de-leafing; V4 - pruning in short spurs/ canes + shoot thinning + shoot tipping; V5 - pruning in short spurs/ canes + shoot thinning + de-leafing; V6 - pruning in short spurs/ canes + shoot tipping + de-leafing; V7 - pruning in short spurs/ canes + shoot thinning + shoot tipping + de-leafing.

In ***chapter three*** "*Characterisation of viticultural ecosystem in Cotnari vineyard*" refers to the description of the ecologo-geographical frame of the vineyard, describing the geographical set, the lithological substrate, the landscape, the edaphic and climatic

factors, spontaneous and cultivated vegetation, hydric resources. For establishing the favourability pf cultivating grape varieties for red wines, the main climatic parameters and ecologo-geographical indices for the time frame 1990-2012 were analysed. Global warming is registered, as the oeno-climatic index (IAOe) has an average multiannual value (1990-2012) of 4499,78, situating therefore Cotnari vineyard in a favourable area for red wine production. In some years, this index places the vineyard in a high favourability area for red wines, the frequency of over 50% of values higher than 4600 of the last twenty two years being proof of it.

***Chapter four*,** entitled "*Observations and physiological analyses*" registers the results received due to measuring the intensity of the photosynthesis in leaves and some additional parameters (photosynthetic active radiation, intracellular CO_2, evapotranspiration, stomata conductance, photosynthesis rate), using the LCpro+ device (ADC BioScientific Ltd.), a portable system for photosynthesis determination with a complete programed control of the situation within the leaf. The method used for analysing the photosynthesis and respiration intensity is non-destructive.

From analyzing the obtained data, the highest rate of transpiration is found in V2 (shoot tipping), closely followed by V1 (shoot thinning 30%), values quite close to that of control V0. The explanation is simple and logical at the same time: a higer foliar surface is directly proportional to a higher transpiration rate. For proof, take into account V7, where, due to shoot thinning, shoot tipping and de-leafing, has the smallest foliar surface and thus, the smallest transpiration rate.

The main physiological parameters that were studied underlines that fact that the presence of a big foliar surface on the vine trunk leads to a better photosynthesis rate with valuable implications on the organic matter accumulations in the plant. These can appear either as sugars, with a major influence on grapes' quality, either as starch in the wooden elements of the trunk, increasing its resistance to frost.

Chapter five "*Analyses regarding the agrobiological characteristics*" underlines that, regarding the viability of fruit buds, in the case of using long elements pruning, Guyot on semi-trunk, the percentage of losing buds is lower than in the case of short element pruning. The variant with the lowest values of buds' viability is V7, because of the massive interventions (shoot thinning + shoot tipping + de-leafing) during the

vegetation period, the reserve substances from the shoot not reaching an optimum level. The trend is the same in the case of secondary and tertiary buds, All in all, in the case of variant V7 (shoot thinning + shoot tipping + de-leafing) with spur pruning, the highest values of buds' loss are registered, the reserve substances do not reach an optimum level, due to, probably, massive green works during the vegetation period.

Regarding the development of the pheno-phases, no significant differences were observed, the annual life cycle appeared almost at the same time in both cases (i.e. short element pruning and long element pruning), no matter of the green works applied.

Regarding the variety's behaviour to short fruiting elements pruning, one notices that the quantity of pruned wood is highest (3,35 kg/trunk total wood, of which 1,22 kg/vine trunk are annual prunings) in the case of V1, where a shoot thinning of 30% was applied. The variant where the smallest amount of wood was pruned is V2, where only shoot tipping was used, removing 1,92 kg/vine trunk total wood, of which annual growth of 0,86 kg/trunk.

High pruning quantities were registered in V7, where shoot thinning, shoot tipping and de-leafing were applied (3,28 kg/ vine trunk), as well as in the case of the control sample (3,2 kg/vine trunk). An amount of under 2 kg/trunk registered in V4 where shoot thinning and shoot tipping were applied (1,97 kg/trunk).

In the case of pruning in long elements, the highest amount of pruned wood were registered in the case of V1 where shoot thinning of 30% (3,35 kg/vine trunk), closely followed by V7, where all three works were applied (shoot thinning + shoot tipping + de-leafing) as well as the control sample V0 with 3,32 kg/trunk. The lowest values were registered in V3 where de-leafing was applied, pruned wood amounting up to 1,92 kg/trunk.

Regarding the total length of growth on the trunk, the highest values were registered in the variant where all three operations were applied (shoot thinning + shoot tipping + de-leafing), proof that, in a vigorous grape variety, the presence of a lower vegetative mass on the trunk favours vegetative growths.

Regarding the fertility elements, these registered higher values when pruning was done in short elements compared to long ones, fact that can demonstrate that there is a

higher amount of multiannual wood on the trunk, leading to a better differentiation of fruit buds on the trunk, with favourable influences on the variety's fertility.

The number of inflorescences on the trunk had higher values in the case of pruning in short elements, compared to long ones; V7 variant (shoot thinning + shoot tipping + de-leafing) was registered as having the highest values, namely 35-37 inflorescences/ trunk.

The productive yield had high values for both pruning methods, in the case of V7 variant (shoot thinning + shoot tipping + de-leafing), the decrease of the vegetal apparatus led, finally, to a higher production on each shoot of the trunk.

Chapter six "*Analyses regarding technological characteristics*" refers to results regarding production level aspects, average mass of grape, mass of 100 berries.

The average mass of a grape was highest in variant V4 (shoot thinning + shoot tipping), underlining the importance of these operations in increasing the grapes' dimensions, by limiting the competition with the intense growth of shoots. The two pruning methods show higher values for long elements pruning, due to the higher amount of vegetative mass developing on the trunk.

The highest values for the analysis of 100 berries mass were registered in the case of V2, where shoot tipping was applied; the mass ranged between 235 g for cutting in short elements and 231 g for cutting in long fruiting elements. Closely following was V5, where shoot thinning and de-leafing were applied (232 grams, respectively 228 grams) while the lowest values were identified in V3 where grapes were only de-leafed. Therefore, the variants to which green works were applied earlier than the ripening moment led to obtaining higher values for the mass of 100 berries, compared to the variant where the green works were applied at the ripening moment (V3).

Analysing the grape production, it registers that higher levels pf production are found in variants where short fruiting elements are used compared to longer ones. Higher productions were obtained in the case of V7 (shoot thinning + shoot tipping+ de-leafing) and V2 (shoot tipping), while the lowest values were identified in the case of V3 (de-leafing).

Taking into consideration the experimental variants, the spur pruning had the highest production in V7 (shoot thinning + shoot tipping + de-leafing), namely 3,5

kg/trunk, followed by V2 (shoot tipping), with 3,4 kg/trunk, the lowest amount being registered for in V3 (de-leafing), with 2,9 kg/trunk, except the control variant, V0.

When pruning was done with long elements, the maximum production was found in the case of variant V2, where the vegetal mass was reduced by 30%, namely of 3,3 kg/trunk, followed by V7 (shoot thinning + shoot tipping + de-leafing). The lowest values were in the case of V3 (de-leafing), of 2,8 kg/trunk and in the control variant, V0, with 2,6 kg/trunk.

Chapter seven refers to "*Analyses regarding the quality of the production*". In the case of spur pruning, the sugars' accumulation, on the 15th of September 2011, range between 211 g/L in V2 (shoot tipping) and 243 g/L in V3 (de-leafing). On the 25th of September (grapes are over ripened), the highest values are still in variant V3 (de-leafing), namely of 264 g/L sugars, while the lowest is registered in the control variant V0, of 221 g/L.

In the case of pruning in long elements, in 20011, at full maturity, the highest sugars concentration was found in V3 (de-leafing), that of 237 g/L sugars, while the lowest was identified in the control variant, of 218 g/L. By over ripening, the grapes reached the following values: the extremes were found in V7 (shoot thinning + shoot tipping + de-leafing) 246 g/L sugars and in V0 229 g/L sugars.

In 2012, full maturity, due to climatic conditions, came earlier than 10th of September, the production trend was similar to that of the previous year, but with smaller values because of the accentuated drought.

The uvologic indices for Fetească neagră grape variety are as follows : the berry's structure index was higher when short elements' pruning was applied, the highest values being recorded in V1 (shoot thinning 30%), namely of 19,51; this demonstrated that the berries' mass was the highest and that less vegetal mass leads to a growth in dimension of the berries. Applying the whole segment of fitotechnical measures together with long elements' pruning led to a diminishing in berry mass (V7), namely of 15,70.

Chapter eight "*Statistical analysis and interpretation of results*" refers to statistical hypothesis testing and formulation calculating statistical significance of differences in the influence of factors on same biological indicators yield and quality of

the variety. Statistical analysis of recorded data from experiments performed was performed using Statgraphics Centurion XVI software ® (StatPoint Technologies, Inc., USA). Procedures have been "one- way ANOVA" and "multifactor ANOVA" which were designed to build a model of statistical description of the impact of two or more determinants Xj (year of production, type of cutting and experimental variations made) on dependent variables Y (percentage loss of buds primary, secondary and tertiary, the percentage of fertile tillers, number of inflorescences per vine, number of grapes per vine, average weight of a grape, the average yield per vine, grape sugar content and total acid) , supporting the results of the analysis values .

In conclusion, it can be said that Fetească neagră grape variety is adapted to the pedo-climatic conditions of Cotnari vineyard, the qualitative and oenologic potential being used at maximum, proof for obtaining quality red wines, of DOC-CMD or DOC-CT type.