

## SUMMARY

The vine is a plant known since ancient times, it was first grown on its own roots. The grafting of the vine occurred due to the introduction into Europe of the various species of American vines, which led to the introduction of the insect called Phylloxera, which in a period of several years spread to all wine-growing countries, causing the largest destructions known in the history of viticulture.

The production of viticultural planting material became an important concern only after the effects of the disaster caused by the emergence of phylloxera (1885), which almost completely destroyed European vineyards, were visible. This led to the establishment of future plantations only with grafted vines, plants that had the potential to ensure greater vigor and higher production capacity.

This doctoral thesis is part of the general context of research on graft grafting, for highlighting and propagating in culture new varieties of vines that were obtained in the area of Moldova, more precisely in the Research and Development Station for Viticulture and Vinification Iași.

The purpose of this doctoral thesis is to obtain viticultural planting material from the newly created varieties within the Research and Development Station for Viticulture and Vinification Iasi, in order to highlight the best association between fruiting vine varieties and rootstocks, in order to be propagated in culture. The newly created varieties were studied in terms of their grafting and forcing behavior, after which observations and determinations were made regarding the behavior of grafted cuttings in the vine nursery, the grafting yield was established regarding the behavior on various rootstocks, in the best association between vinifera and rootstock varieties for the NE area of Moldova was established.

The thesis is structured in two parts comprising a number of five chapters totaling a number of 194 pages, here being included a number of 38 tables, respectively, 29 pictures and figures and of course a number of 160 bibliographic titles.

Chapter I presents the technology of obtaining grafted vines, the main methods of growing grafted vines currently used in viticulture, the whole technology of obtaining grafted vines in the vine nursery and of course the current state of research on obtaining planting material in viticulture both nationally and internationally.

Chapter II contains data on the natural environment where the experiment took place. The climatic data from the period 2010-2020 were analyzed, thus highlighting that the vines can be cultivated within the Iași vineyard in optimal conditions.

The air temperature is the one that determines the spreading area of the vine culture, the type of cultivation system that will be used, the onset and production of vegetation phases, respectively the quantity and quality of grape production. The vine is a relatively heat-demanding plant, being cultivated in areas with an average annual temperature exceeding the threshold of 9°C (Țârdea et al., 1995). Regarding the temperature, in the Copou wine center, within the Iași vineyard, there are conditions that exceed the temperature

of 9°C required for the cultivation of vines, the average annual temperature in the analyzed interval being 10.6°C.

In the temperate continental climate, the vines require an annual rainfall regime of between 500 and 700 mm, of which at least 250-350 mm should be evenly distributed during the growing season, in the form of useful rains (greater than 10 mm) ( Țârdea et al., 1995). The average rainfall in the analyzed period was 571.9 mm annually. Regarding the average rainfall during the vegetation period, in the period 2010-2020, it was 351.6 mm.

In our country, the duration of the sunshine represented by the sum of the actual hours of sunshine during the vegetation period (1.04-31.09), must have values between 1200-1600 hours to be favorable for the cultivation of vines. Values below the 1200 hour limit are unfavorable for successful vine cultivation (Irimia, 2012). In the period 2010-2020 the duration of the sunshine was on average 2100.1 hours, which suggests that in the Copou wine center within the Iași vineyard, the optimal conditions are met regarding the duration of the sunshine in order to be able to successfully cultivate vine.

Regarding the relief and the soils found within the Iași vineyard, it can be said that through their characteristics, these two factors come to strengthen the fact that the vine presents optimal conditions to be able to be cultivated without problems in the area of Moldova.

In Chapter III, the purpose and objectives of the thesis are presented, as well as the material used and the research methodology.

The experience took place at the Research and Development Station for Viticulture and Vinification in Iasi. Over time, the resort has successfully created, approved and introduced into cultivation a number of 10 new grape varieties: Aromat de Iași, Ozana, Alidor, Arcaș, Unirea, Raluca, Paula, Gelu, Golia , Mara.

For the present research, four fruiting vine varieties created and approved within SCDVV Iași (Aromat de Iași, Paula, Gelu and Golia) were chosen, and Chasselas doré, a cosmopolitan variety with mixed properties, was chosen as control.

In addition to the varieties created within SCDVV Iași and the variety chosen as a control, in order to carry out this research, three rootstock varieties were chosen on which the five fruiting vine varieties were grafted: Riparia gloire, Crăciunel 2 Selection and Oppenheim Selection 4 Crăciunel clone 4 (SO4-4).

The research was carried out within the Research and Development Station for Viticulture and Vinification Iași, during two consecutive years, 2019 and 2020. During the research, a series of measurements and analyzes were performed which were divided into two categories: measurements grafting, respectively, measurements carried out in the vine nursery.

Regarding the grafting measurements, a series of parameters were followed and analyzed, which in turn were grouped into two categories:

- before forcing grafted vines: *harvesting rootstock and scions, determining the total carbohydrate content, preparing the material for grafting, proper grafting of*

*cuttings, treatment with biostimulators, waxing and stratification of grafted cuttings, forcing of grafted cuttings;*

- after the end of the process of forcing the grafted vines: *the location of the roots on the grafted cuttings, the callusing on the diameters of the grafted vines, the degree of calusing of the grafted vines, the percentage of planted vines where wood was not matured.*

The measurements carried out in the vine nursery followed the behavior of the grafted vines both during the vegetation period, where biometric measurements were performed on vegetative growth and biochemical determinations regarding the content in chlorophyll pigments and carotenoids, and after harvest, where a series of biometric measurements and biochemical determinations were applied. In the vine nursery the measurements were again grouped into two categories:

- during the vegetation period: *the growth rate of the shoots, the determination of the content in photosynthetic pigments;*
- after harvesting: *total number of roots, number of roots larger than 2 mm in diameter, length of roots larger than 2 mm in diameter, total length of the shoot, length of the mature wood of the shoot, thickness at the second internode of the shoot, yield in the vine nursery, the determination of the ash content.*

Chapter IV presents the results obtained by grafting. The experience began with the harvesting of grafting material represented by grafting rootstocks and scions. The scions were harvested from the fruit-bearing vineyards of S.C.D.V.V Iași, that corresponded from a technical and qualitative point of view.

The Riparia gloire rootstocks and the Crăciunel 2 selection were harvested from the ampelographic collection located within the Vasile Adamachi Farm, while the Oppenheim Selection 4 clone Crăciunel 4 (SO4-4) was harvested from S.C.D.V.V Iași.

After harvesting, the grafting material was stored over winter in cold storage and kept at a controlled temperature of 1-4°C.

The determination of the total carbohydrate content was done before the forcing process, before removing the used material from the warehouse so that it could be prepared for grafting. Determinations of the total carbohydrate content of rootstock and scions were performed in two phases, a representation of the starch in the scions by the colorimetric method based on the staining reaction of the starch with Lugol's reagent and by the chemical method with the reagent antron.

The determination of the total carbohydrate content by the chemical method with the antron reagent involved in the first phase the analysis of the moisture in shoots, after which the determination of the starch and soluble sugars was continued. This determination was made for both rootstock and scions.

Due to the fact that the rootstock varieties have a considerable length of shoots, the determination of the total carbohydrate content was made on three portions, respectively base, middle and top. In the basal part, the best result was obtained at the rootstock SO4-4 (13.39%) in the first year of the experiment, while in the following year Riparia gloire

(16.60%) was evidenced. In the middle of the shoot, the best result was obtained at the Riparia gloire rootstock in both years (13.49% in 2019 and 15.85% in 2020). SO4-4 (12.64%) in the first year and Riparia gloire (15.20%) in the following year were highlighted in the portion at the top of the shoots.

In parallel with the analysis of carbohydrates in the rootstocks' shoots, the analysis of scions was also performed, noting the Golia variety (15.64%) in 2019 and the Paula variety (17.21%) in 2020.

Analyzing the total carbonate content in both rootstocks and scions, it can be seen that it exceeds the threshold of 12%, necessary to be grafted in both years of experience.

The grafting process was carried out at the beginning of spring in each of the two years of experience, following a series of stages: preparation of grafting material, actual grafting of previously prepared material, treatment with biostimulators, waxing and stratification of grafted cuttings, and finally forcing them.

After the completion of the forcing process and after the acclimatization of the grafted vines, observations and determinations were made on several growth parameters.

The location of the roots on the grafted cuttings is the first parameter analyzed following the place where the roots appear, these being formed at the base of the rootstock cutting or at its second node. In the first year of experience, the highest percentage of vines with roots present at the base was V7 (Gelu / Riparia gloire) - 95.93%, and in the second year V4 (Paula / Riparia gloire) was noted - 94.93 %. At the second node, V8 (Gelu / Crăciunel 2) stood out - 7.10% in 2019 and V1 (Aromat de Iasi / Riparia gloire) - 9.10% in 2020.

Callusing on diameters is another parameter analyzed, the cuttings being grouped into three categories of diameters, 7-8.5 mm, 8.6-10 mm and 10.1-12 mm. In the first year, the variants V7 (Gelu / Riparia gloire) were noted - 44.40% for the first diameter, V12 (Golia / SO4-4) - 38.40% for the second diameter and V1 (Aromat de Iași / Riparia gloire) - 49.53% at the last diameter. In the following year, the variants V12 (Golia / SO4-4) - 42.47%, V7 (Gelu / Riparia gloire) - 41.40% and V1 (Aromat de Iasi / Riparia gloire) - 42.47% were highlighted.

Simultaneously with the grouping of the grafted vines on the three groups of diameters, observations were also made on the degree of callus, and the grafted vines were grouped this time in two categories, with fully formed callus and without callus. Regarding the vines with fully formed callus, the best result was obtained in 2019 for the V5 variant (Paula / Crăciunel 2) - 99%, and in 2020 for the V3 variants (Aromat de Iași / SO4-4) and V7 (Gelu / Riparia gloire), both with 99%.

Another parameter analyzed after the end of the forcing process was the percentage of vines with buds that did not enter vegetation, for which the vines were analyzed and only those in which the bud from the graft cutting has not entered vegetation were noted. Here was noted in 2019 V9 (Gelu / SO4-4) - 30.33%, and in 2020 V8 (Gelu / Crăciunel 2) - 28.27%.

Regarding the percentage of grafting, the vines taken into account had a fully formed callus at the grafting point, with buds from grafted cuttings in vegetation and which had roots at the base of the rootstock cuttings. In 2019, V12 (Golia / SO4-4) stood out - 73.73%, in the following year V5 (Paula / Crăciunel 2) stood out - 79.80%.

At the end of the forcing process, in order to be planted, the grafted vines must meet certain criteria: to have a fully formed callus at the grafting point, to have the buds in vegetation and to have roots. In addition to vines that have met all three conditions, vines whose buds are not yet in vegetation, although they have calluses and roots have been considered suitable for planting. The best results were obtained at V5 (Paula / Crăciunel 2) - 99% in 2019, respectively, V3 (Aromat de Iași / SO4-4) and V7 (Gelu / Riparia gloire) with a percentage of 99%.

Chapter V presents the results obtained in the vine nursery. After the end of the forcing, the grafted vines were sorted, immediately after they were waxed and stratified in plastic crates where they were kept for a short time until their planting in the nursery.

After the grafted vines were planted in the vine nursery, in the first phase the vegetative growths of the shoots were followed for each variant created. A number of six measurements were performed at an interval of 15 days between them, being covered in the interval 1.06-15.08 for each year of the experiment. After the completion of the six measurements, the best result was obtained in 2019 for the V9 variant (Gelu / SO4-4) whose shoot measured 45.39 cm, while in 2020 the best growth of the shoot was recorded in the V1 variant (Aromat de Iași / Riparia gloire) - 61.15 cm.

In parallel with the measurement of the vegetative growth of the shoots in the vine nursery, the determination of the photosynthetic foliar pigments in the leaves was also determined. Determination was performed by collecting the leaves for each variant, in order to determine the content in photosynthetic pigments, chlorophyll (a and b) and carotenoids, in the middle of each month, on the 15th, in June, July and August.

After determining the content of photosynthetic pigments, two ratios were made between the analyzed pigments, the first being between chlorophyll a and b, and the second ratio was made between the sum of the two chlorophyll pigments and carotenoids.

After completing both sets of analyzes from the vegetation period, a correlation was made between the vegetative growth of the shoots and the content in chlorophyll and carotenoids. Following the correlation between vegetative growth and the amount of chlorophyll (a + b), a direct and linear relationship is found, in the sense that the higher the content in chlorophyll, the higher the vegetative growth.

At the end of the vegetation period, when the grafted vines matured the wood of the cord, they were harvested. Grafted vines were harvested from the vine nursery in the fall after the leaves fell. Immediately after the grafted vines were harvested from the vine nursery, before being graded the vines were analyzed and observations were made on several parameters.

The total number of roots was the first parameter analyzed, and the best result was obtained in the first year of the experiment at variant V2 (Aromat de Iasi / Crăciunel 2) - 19.65 roots, and the following year the best result was obtained in variant V11 (Golia / Crăciunel 2) - 20.75 roots. After establishing the total number of roots for each variant, those with a diameter of more than two millimeters were taken into account for the second parameter analyzed, here the variant V2 (Aromat de Iași / Crăciunel 2) was noticed both in 2019 ( 9.71) as well as in 2020 (9.90). The third parameter also related to the root system was

related to the length of the roots with a diameter of more than two millimeters, here V11 (Golia / Crăciunel 2) in both years with values of 32.16 cm and 35.61 cm, respectively, stood out. .

After the measurements on the root system, we moved on to those of the shoots. Here the total length of the shoot, the length of the mature wood of the shoot and the thickness at its second internode were analyzed. Regarding the total length of the shoot, the best result was obtained at V9 (Gelu / SO4-4) both in 2019 (36.31 cm) and in 2020 (45.55 cm). After measuring the total length of the shoot, for the next parameter analyzed, only the length of its mature wood was measured and taken into account. Here, in the first year of experience, the V12 variant (Golia / SO4-4) was noted - 31.93 cm, and in the second year, the V8 variant (Gelu / Crăciunel 2) - 38.68 cm. The last parameter analyzed was the thickness at the second internode for each shoot of the grafted vines, noting in both years of the experience the V8 variant (6.32 mm in 2019 and 6.73 mm in 2020).

The yield in the vine nursery was established after the completion of the observations on the root system and on the shoots. The best results were obtained in the V11 variant (Golia / Crăciunel 2) which had a percentage of 83% in 2019 and 81% in 2020.

The determination of the ash content was done at the end in order to highlight the density of the wood after the end of the vegetation period, and the best result was recorded in the V8 variant (Gelu / Crăciunel 2) in both years of experience (6.34% - 2019 and 6.55% - 2020).

At the end of each year of experience, the economic efficiency of the production of planting material from the newly created varieties was calculated. Here, the Golia variety stood out due to the very good quality vine yield obtained for the V11 variant - Golia / Crăciunel 2, thus having the best values of efficiency indicators in both years of experience (revenues from the sale of goods: 664 lei in 2019 and 648 lei in 2020; gross profit: 89.05 lei in 2019 and 104.31 lei in 2020; profit rate: 15.49 in 2019 and 19.21 in 2020). On the other hand, the Paula variety registered the lowest values of these indicators for variant V5 - Paula / Crăciunel 2 (revenues from the sale of goods: 368 lei in 2019 and 400 lei in 2020; gross profit: 49.35 lei in 2019 and 64.35 lei in 2020; profit rate: 15.49 in 2019 and 19.21 in 2020), and the control variety Chasselas doré had values somewhere in the middle, between the two varieties that stood out both positively and negative.