

ABSTRACT

Keywords: cherry, agroproductivity, phenophase, vigor, fruit quality.

The sweet cherry is part of the category of species of particular importance in world and domestic fruit growing, constituting the first link in the annual chain of fruit production. It meets in our country optimal conditions for the manifestation of its agrobiological potential, with the possibility of exploiting the hilly steppe and silvo-steppe areas. The precocity of the species, the production yield and the lack of alternation of fruiting give the sweet cherry a priority place in the cultivated area, with continuous expansion trends.

Sweet cherry research and study, along with expansion and development, has seen an upward trend since the end of the last century. In the 1990s, new types of rootstocks or crown formation systems initiated the transition to high-density plantations, resulting in production from the first years, higher return on investment and implicitly the orchard. The reduced habit of the trees and the innovative systems of crown formation have facilitated the development of "pedestrian" orchards, which allow easier carrying out of all works. At the same time, sweet cherry breeding programs in the main growing countries (Canada, USA, Germany, Czech Republic, etc.) significantly increased the size of the fruits, maintaining and improving their firmness.

The doctoral thesis entitled "*Research on the assessment of the agroproductive potential of some indigenous and foreign sweet cherry cultivars with a view to the sustainable use of pedoclimate resources in the N-E area of Romania*" falls within the general context of research on the agrobiological peculiarities of some sweet cherry cultivars in order to highlight the most valuable properties with productive and qualitative potential, adapted to the ever-changing climatic conditions.

The purpose of the paper was to evaluate the agro-productive potential of eleven cultivars of sweet cherry, four from the international range (Germany, Czech Republic, USA) and seven cultivars created at the Research Station for Fruit Growing in Iași.

The doctoral thesis totals a number of 199 pages, being structured in two parts and comprising seven chapters to which the bibliographic part and appendices are added. Within this, a number of 43 tables, 48 figures and over 200 bibliographic titles are included.

The researches were organized within a trial field with sweet cherry cultivars, located on the territory of the Research-Development Base, Fruit Tree Nursery- Sârca of RSFG Iași.

Part I of the work includes the introduction and the three chapters, in which the documentary research of the specialized literature highlights the importance of growing the sweet cherry and the current state of knowledge of the problem addressed.

Chapter I briefly summarizes the importance of sweet cherry growing and the nutraceutical value of the fruits. The chemical composition, as well as other physical properties of the fruit (size, color), are the main criteria by which the destination of the cherries is determined. The value of sweet cherry growing is also based on relatively simple technology, with an abundant production every year, making good use of land with varied soils and locations. At the same time, the chapter presents the situation of the areas and production of sweet cherry at the global, national and regional level. The fruit-growing region of N-E Romania is drawn around Iași fruit-growing, a fact for which this chapter briefly mentions the history and the current situation in this area.

Chapter II includes research updates related to the addressed issue, highlighting the concept of agroproductivity represented by the productivity and quality of the species. Also, the research carried out over time targeted the factors that influence this concept, listing ecological, biological and technological factors. Thus, fruit productivity is based on the biological units characteristic of crops of great economic importance known as cultivars or cultivars. In his work "Agricultural Ecology", Azzi (1959) defines the term productivity. In his opinion, productivity represents the ability of a cultivated plant to use the environmental conditions in order to give maximum yields.

Part II of the thesis includes the own research that sums up chapters III-VII, followed by the bibliography and appendices.

Chapter III describes the ecological framework in which the research was carried out, both from the point of view of the geographical location and geomorphological factors, as well as from the point of view of climatic resources. Research Station for Fruit Growing Iași is located as a landform in the southern part of the lower Jijia plain and Bahlui, with transitional surfaces to the Central Moldavian Plateau. The relief of the unit is characterized by wide, sculptural interfluves, consisting of flat and gently sloping plateaus.

At the same time, this chapter presents the quantification of pedo-climatic resources for sweet cherry culture at RSFG Iași and the organizational and institutional framework of the unit.

Chapter IV presents the purpose and objectives of own research. The zonal assortment of sweet cherries is characterized by diversity, as the time of ripening of the fruits and their destination, but the determining factor on the value of sweet cherry cultivars (respectively the quantity and quality of the harvest it provides) is the pedoclimatic conditions of the area. Through the objectives of the thesis, the cultivars with the best properties will be identified in terms of the qualitative aspect of the fruit valorization destination, but also the appreciation of the agrobiological value of the cultivars and their ability to acclimatize to the pedoclimatic conditions in the North-Eastern area of Romania.

In *Chapter V* the research material and methods are mentioned and described. The biological material used is represented by 11 cultivars of sweet cherry, of which

seven Romanian cultivars, created and approved by RSFG Iasi (*Bucium, Cătălina, Cetățuia, George, Golia, Maria* and *Marina*) and four cultivars of international relevance (*Regina, Kordia, Hudson* and *New Star*). In order to carry out the study, observations and determinations were made regarding the vigor of the trees, the length of the annual shoots and their number on each variant and repetition, the main phenophases of fruiting, natural fertility, self-fertility, determination of the viability and germination capacity of pollen, monitoring of environmental factors, the influence of the limiting factors of production (frost, drought, specific sweet cherry diseases), fruit production, the main physico-chemical properties of the fruits and the way they are used (fresh consumption or processing).

Chapter VI, through its twelve subchapters, summarizes the results obtained in following the observations made on the cultivars, according to the research methods established.

In **subsection 6.1**, the data obtained from the observations regarding the growth and fruiting phenophases of the sweet cherry cultivars studied during 2018-2020 are presented. The flowering phenophase occurred in all cultivars in the first and second decade of April, with an average duration between 6-12 days. The *Cetățuia, Cătălina* and *Kordia* cultivars showed the earliest flowering, while *Hudson* and *Regina* were the last to flower. From the end of flowering to the ripening of the fruits, a period of 40 days was necessary and the accumulation of the temperature sum of 595-602°C, for the early cultivars (*Cetățuia, Cătălina*), of 60-65 days, with 886-1247 °C for cultivars with medium ripening and over 80 days and 1625°C for sweet cherry cultivars with late ripening (*George*).

Subchapter 6.2, summarizes the fertility results of sweet cherry cultivars. Fertility of cultivars assessed by evaluating the viability and germination capacity of pollen, as well as natural fertility, but also self-fertility still the genetic characteristics of the cultivars, but also the influence of climatic factors. Thus, viability pollen had minimum values in the three years of study in the *Kordia* cultivar (58.8% in 2018, 62.0% in 2019 and 60.4% in 2020) and maximum values in the *Cătălina* cultivar (89.9% between 2018 -2020). The average values of the germination capacity was above 40% in all 11 cultivars, a percentage considered satisfactory for a proper fruiting in the sweet cherry species. The self-fertility coefficient divides the cultivars into three groups: self-fertile (*Maria*, 54.5%), partially self-fertile (*Golia, Cetățuia, New Star, Bucium, Cătălina, Maria, George* and *Hudson*) and self-sterile (*Regina* and *Kordia*).

In **subsection 6.3**, the results obtained regarding the growth vigor of the trees are analyzed. In the agroclimatic conditions of the North-East of Romania, according to the cross-sectional area of the trunk, the cultivars studied are classified into cultivars of medium vigor, with a growth spurt between 50-100 cm³ (e.g. *Kordia, Hudson, New Star, Cătălina*) and cultivars with an increase in trunk growth of 30-50 cm² (*Regina, Bucium, Cetățuia, Maria*). The maintenance technology applied to the

experience was corresponding to the extension dynamics of the old branches, as an element of appreciation of the light requirements of the cultivars studied. Thus, the volume of the crown was maintained in the form of an ascending curve, reaching values between 3.77 m³ (*Cătălina*) and 6.34 m³ (*New Star*) in the ninth year after planting.

Subchapter 6.4. includes the results of the study of the particularities of fruiting that are specific to each cultivar and were analyzed by determining the fruiting formations by variants and repetitions during the years of study. The dynamics of the formations showed high variability between cultivars during the study period. The total number of medium branches/tree varied between 96 (*Bucium*, in 2018) and 486 (*Hudson*, in 2020). According to the number of fruiting short shoots/tree, the minimum values were recorded for the *Cătălina* and *George* cultivars, and the maximum value was determined for the *Regina* cultivar (630 fruiting short shoots). According to the determinations, the cultivars studied are classified into cultivars with dominant fruiting on medium branches (e.g. *New Star*), cultivars with dominant fruiting on short shoots (*Regina*, *Golia*, *Maria*), cultivars with mixed fruiting (*Kordia*, *Cătălina*, *Cetățuia*). Depending on the rainfall regime, the level of annual shoots places the cultivars within the normal growth parameters, the lengths of the annual shoots exceeded 25 cm, in all 11 studied genotypes.

The production obtained with sweet cherry cultivars is presented in **subchapter 6.5.** and includes significant differences in fruit production/tree between cultivars, with values between 18.13 kg/tree (*George*) and 31.3 kg/tree (*Marina*). The values of the productivity index (kg fruits/cm³ - the area of the trunk section) was between 0.15 (*George*) and 0.37 (*Bucium*), placing the sweet cherry cultivars in the group with an average productivity index (0.15-0.5 kg/cm³).

Subchapter 6.6. summarizes the results regarding the variability of the productivity index between the years of study. Between the cultivars taken in the research, as an average value of the 3 years (2018-2020), significant differences were recorded from a statistical point of view, regarding the productivity index. The correlation coefficient (r) of the evaluated cultivars, calculated between the increase in trunk thickness and fruit production/tree, recorded positive but insignificant values (0.177 kg/cm²).

The research carried out on the productive potential of the studied sweet cherry cultivars is highlighted in **subchapter 6.7.** Thus, in the period 2018-2020, there was a positive, but statistically insignificant, correlation between the average fruit weight and the amount of production. The *Regina* cultivar, which on average presented the highest average fruit weight (10.55g) recorded an average production compared to other evaluated cultivars of 23.03. The highest production was accumulated in the cultivars *Bucium* (34.10 kg/tree) and *Marina* (31.10 kg/tree), related to an average fruit weight of only 7.98 g and 6.41 g, respectively.

Subchapter 6.8. includes correlations between growth and fruiting parameters. The correlation between the production of fruit per tree and the volume of the tree crown recorded in the period 2018-2020 for all sweet cherry cultivars studied is significantly negative, having a value of 0.0603. The coefficient resulting from the correlation of the volume of the crown and the production of the cultivars, highlights the fact that an increase in the volume of the crown prints a significant decrease in the production per tree obtained.

The results regarding the resistance of cultivars to production limiting factors are highlighted in **subchapter 6.9.** Thus, the extreme winter temperatures during the three years varied within relatively small limits, so that the percentage of affected buds that recorded the highest value was in the *Marina* cultivar - 27%, in 2018, when on March 1 the temperature air temperature dropped to - 17°C.

From another perspective, the cultivars showed good tolerance to the attack of the main diseases that affect the sweet cherry (anthracnose and moniliosis), the most resistant cultivars being: *Regina*, *New Star*, *Cetățuia* and *Maria*.

Subchapter 6.10 summarizes the results of the best cultivars in terms of fruit quality. In terms of physico-chemical properties, the cultivars stood out according to size ($\geq 8g$: *Regina*, *Kordia*, *New Star* and *Bucium*) and dry matter content (*Bucium*-17.77%, *George*-17.10%, *Maria*-16.16% and *Golia*-15.47%). The taste appreciation of the fruits was indicated by the gluco-acidimetric index (sugar/acidity) in which the *Hudson* and *Regina* cultivars recorded the highest values ($\geq 40\%$).

The utilization destination of the fruits of the sweet cherry cultivars studied was established in **subchapter 6.11.** The main quality parameters (skin color, firmness of the pulp, taste, adhesion to the stone, shape) framed the cultivars according to the destination. Thus, the fruits of the early cultivars are intended exclusively for fresh consumption (e.g. *Cetățuia*, *Cătălina*), while the cultivars with medium and late ripening can be consumed both fresh and exploited in an industrialized form.

The assortment of sweet cherry trees propagated within the RSFG Iași is highlighted in **subchapter 6.12.** Within the Sârca Nursery of RSFG Iași, over 30.000 grafted sweet cherry trees are produced annually, from superior biological categories. A 21% share is represented by the early maturing cultivars (*Cătălina* and *Cetățuia*). Also, the *George* cultivar gained a wide spread in private gardens due to the late ripening period of the fruit. Based on the research carried out over time, the production performances, the size of the fruits and the demands of the consumers have fundamentally changed the old cultivar. Thus, through the selection of clones from the existing assortment and the introduction of valuable foreign and domestic cultivars, the sweet cherry assortment has been continuously improved. The staggered fruit harvest of the sweet cherry cultivars studied during 2018-2020 ensures a varietal conveyor lasting 46-52 days.