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# APPLYING THE EXPERT SYSTEM-CROM FOR THE MANAGEMENT OF PEACH TREE LANDS AND ORCHARDS

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***Abstract***

*At the level of the European Union, Spain was the largest peach grower in 2019, with an area of 47.94 thousand ha and a production of 940.50 thousand tons, followed by Italy and Greece. Romania's peach production amounted to 17.19 thousand tons, far behind other states in the eastern part of the EU. Although it had the largest number of peach trees, 296,424, Constanța County was surpassed in terms of production by Bihor County, which obtained in 2019 5,718 tons of peaches. In order to support this sector, the Fruit-Growing Trees Subprogram of the NRDP (PNDR) 2014-2020 made available to fruit growers the non-reimbursable funds for the reconversion and establishment of new fruit plantations. For this purpose, the paper presents some aspects concerning the management of natural and anthropic resources for peach fruit trees, lands and orchards in expert system-CROM. Following the application of the expert System-CROM, the peach plots and the orchards at Research and Development Station for Tree Culture -SCDP Băneasa, Bucharest received 138 points and were included into the class with natural and anthropic restrictions. Recommendations for the improvement of the peach orchards have also been established.*

***Key words*****:** *expert system, fruit trees lands, orchards, peach*

## INTRODUCTION

Originally from the N-W of China, where it grows spontaneously, the peach (*Prunus persica*) arrived in Europe brought by the Greeks and Romans, around 300-400 B.C. [8].

Today, peach culture has spread to all continents, but favorable conditions meet between 50 degrees North latitude and 35-49 degrees South latitude. This fruit tree ranks 2nd worldwide, in the list of tree species with falling leaves, after apple tree, in terms of economic value [7].

At the Research and Development Station for Pomiculture (SCDP) Băneasa, the genetic treasure for the species apricot, peach and nectarine from the southern part of Romania, is kept in the national collections. While our country has lost many of the old plant varieties, SCDP Băneasa has formed a gene bank with over 655 varieties of apricot trees and 950 varieties of peach trees. At the same time, 11 varieties of peaches have been approved here: Flacara, Splendid, Superba de toamna, Congres, Triumf, Victoria, Antonia, Amalia, Alexia, Eugen and Dida [9], also the Research Station won numerous prizes at national and international competitions for apricots and peaches [14].

In Romania the cultivation of peach trees is restricted by the requirements it manifests for

high temperatures and by its sensitivity to cold [8].

Most recent research on fruit ecology has shown that in a fruit ecology system, one factor cannot be replaced by another, by the phenomenon of compensating the action of vegetation factors, but the effect of an unfavorable factor can be attenuated if one or more complementary factors of the ecosystem replace its biological role [4].

Knowing the factors that compensate, as well as the nature and quantitative limits to which this phenomenon can occur in order not to deteriorate the equilibrium of the ecosystem, is in fact the essence of the research within the CROM Expert System [4].

Only on the basis of the knowledge of the fruit ecosystem natural potential and of the relation of compensation for its factors, it is possible to elaborate technologies that lead to the obtaining of large production with high quality fruits, in the conditions of maintaining and even increasing the soil fertility [4], [11].

## MATERIALS AND METHODS

The Expert System CROM was used to characterize the natural and anthropic resources of the peach orchards from SCDP Baneasa. This system was developed in accordance with the original methodology by "I.C.P.A.", which quantifies the soil, climate, land and infrastructure resources, the production and the quality of fruits [3], [16], [17], [18].

The peach orchards are located at the Fruit Research Development Station from Băneasa, Bucharest. The species studied is Prunus Persica and the varieties used are: Springold, Springcrest, Crimsongold, Independence, Jerseyland and Jerseyglo. The age of trees in the orchard is 14 years old. The peach orchard area is 1.08 ha, it is intensive, with planting distances of 4 m between rows and 3 m between trees/row.

At the same time, the paperwork presents the areas occupied with peach trees in the main cultivating states of the EU and the main producers. It also presents for Romania the situation of the number of peach specimens and the production obtained, by Macroregions, Regions and counties.

For this analysis, statistical data taken from the Eurostat and NIS sites were used, and were processed and interpreted graphically.

## RESULTS AND DISCUSSIONS

The National Rural Development Program, PNDR 2014-2020 [12], encouraged the development of the tree sector by implementing the Fruit-Growing Trees Subprogram [13], [15] (Figure 1), and in particular the cultivation of peach trees on the basis of *the Principle of priority tree species (peach / nectarine / apricot, shrubs, cherry, apple)*, which gave to peach trees the maximum score – 10 points [1].

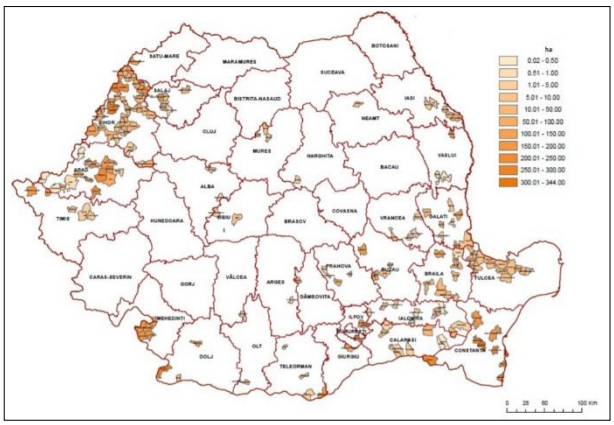

Fig. 1. Territory of the fruit-growing trees-themed sub-programme – Peach and nectarine culture
Source: [13].

However, despite the fact that peaches are particularly tasty and fragrant, appreciated by consumers, Romania cannot boast of large areas and productions in this category, as we will see in the following analysis.

The biggest peach grower in the European Union in the year 2019 was Spain, with 47.94 thousand ha, followed by Italy (41.93 thousand ha) and Greece (33.61 thousand ha) - Figure 2.

Romania occupied the 9$^{th}$ place, cultivating 1.72 thousand ha. Analysing the areas in 2015 - 2019, we see an increase of 1.78% in 2019 compared to 2015.

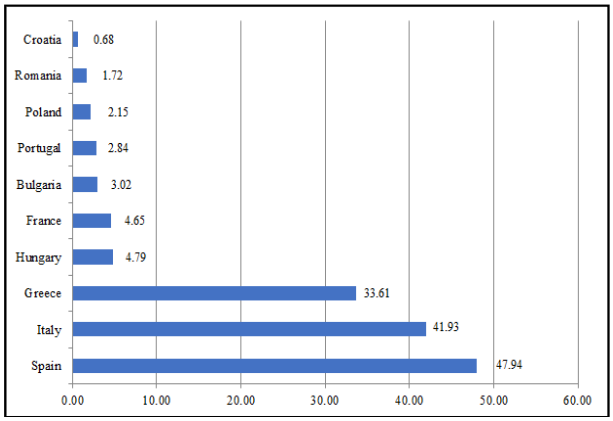


Fig. 2. Top 10 peach growers in the European Union
Source: [6], own interpretation.

Regarding the production of peaches for the year 2019 (Figure 3), the first places in the European ranking were also occupied by Spain, 940.50 tons and Italy 809.89 tons. Our country ranked 8th, with a harvest of 17.19 tons of peaches. For the period 2015-2019, there is a decrease in the peach production by 17.67% in 2019 compared to 2015.

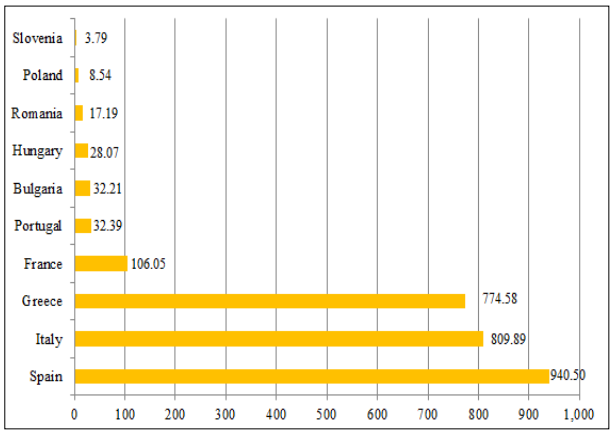


Fig. 3. Top 10 peach producers in the European Union
Source: [6], own interpretation.

Most peach trees (408,594) were grown in the year 2019 in Macroregion Two and accounted for 35% of all peach trees in Romania (Figure 4).
Macroregion Three recorded the lowest number - 117,946, meaning 10% of the total peach trees.
By county, the situation was presented as follows: in 3 counties there were more than 100,000 specimens - Constanța, 296,424, Bihor - 228,586 and Timiș - 137,783; in the other counties we counted less than 50,000 peach trees (Figure 5). Buzau County is an exception, with 55,367.

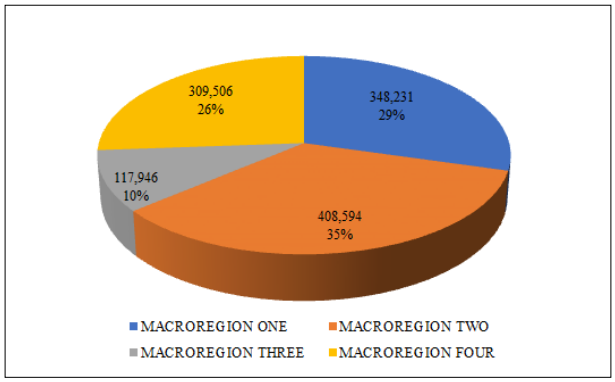


Fig. 4. Number of peach trees cultivated by Macroregions of Romania in 2019
Source: [10], own interpretation.

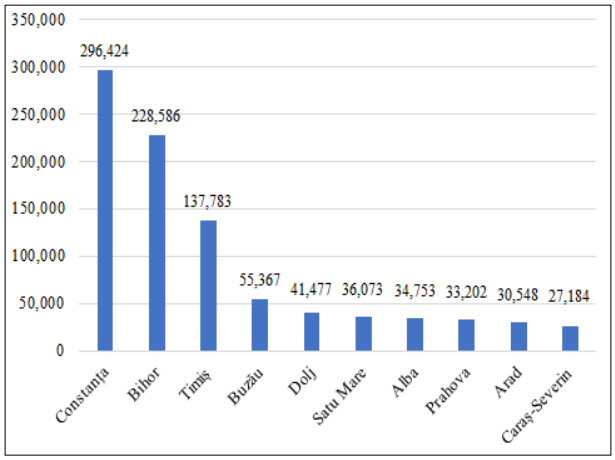


Fig. 5. Number of peach trees in Romania, by counties, in 2019
Source: [10], own interpretation.

Romania's peach production in 2019 resulted from: Macroregion One - 7,703 tons (44%), Macroregion Two - 4,249 tons (24%), Macroregion Four - 4,092 tons (23%) and Macroregion Three - 1,590 tons (9%), as we can see in Figure 6.
Among the Regions of Development, the North-East Region stands out with 6,658 tons (representing 86% of the production of peaches obtained in Macroregion One).
Also the South-East Region harvested 3,829 tons (representing 90% of the production of peaches obtained in Macroregion Two) and the West Region 2,967 tons (representing 73% of the production of peaches obtained in Macroregion Four).
The county with the highest peach production was, in the year 2019 Bihor - 5,718 tons. It was followed by Constanța - 2,504 tones and Timiș, 2,015 tons. In the other counties the registered production was less than 1,000 tons (Figure 7).

We have to mention that after 1990 Bihor County ranked 2nd countrywide in terms of quantity of exported peaches [5], although the number of peach trees and the production obtained were on the 3rd place after plums and apples at county level [2].

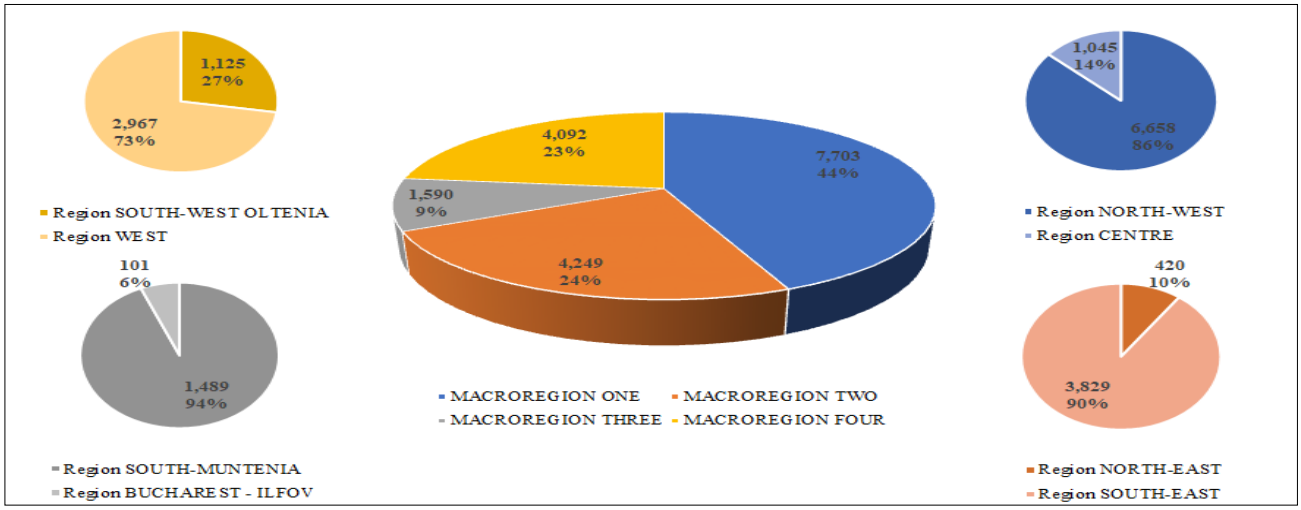


Fig. 6. Peach production obtained in Romania in 2019
Source: [10], own interpretation

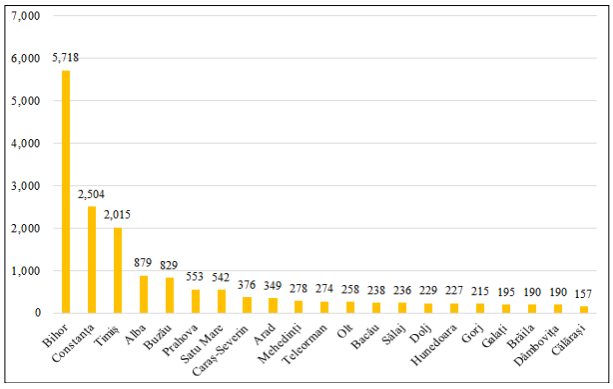


Fig. 7. Largest peach producers in Romania, by counties (tons)
Source: [10], own interpretation.

In the following we will analyse, in the light of the Expert-CROM System, the climate, land and soil resources present at SCDP Băneasa and the private production sector in its area of influence. It should be noted that this research station has expanded its area of activity to some counties from the south of Romania, of which we mention: Călăraşi, Ilfov, Ialomiţa, Teleorman [14].

*Climate resources expertise*

The optimal annual temperature must be above 8.5°C and in the study period it was 12.2°C. The frequency of repetitiveness of the optimal temperature was 90-100%, in ten years. The rainfalls were quantified for May-July, and the optimal quantity is 200-250 mm.

For the peach plantation studied, the rainfall quantity was 120 mm and the frequency of repetitiveness of the optimal quantity was 60-80%. (Table 1).

Table 1. The quantification of the climatic resources for peach tree lands and orchards from SCDP Băneasa, Bucharest

| Species/variety/rootstock/age | Class of expertise | Addition points |
|---|---|---|
| Prunus Persica/Springold, Springcrest, Jerseyland, Jerseyglo, Crimsongold, Independence /Mirobolan/14 | Excluded for peach | 30 |

Source: [4].

The peach yields were studied in connection to the thermal amplitude for November-February (Figure 8).

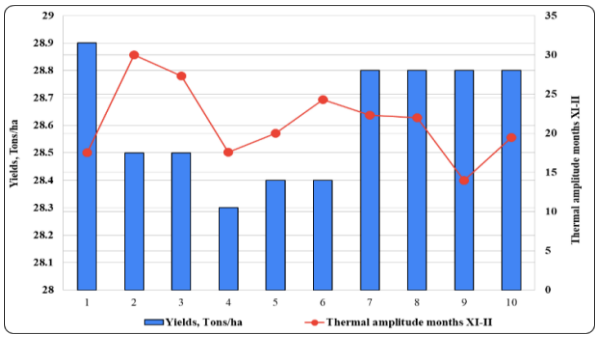


Fig. 8. The variation of the yield levels in relation to the thermal amplitude (°C, XI-II months) for peach trees, Springold variety, at SCDP Băneasa, Bucharest
Source: [4], own interpretation.

*Soil resources expertise*

By quantifying the soil resources in the Expert System-CROM (Table 2), the following were found:

-the active edaphic volume is 100%,
-the soil reaction pH ($H_2O$) is 5.10,
-exchangeable Al content is < 50 ppm,
-absent salinization,
-absent alkalization,
-absent active $CaCO_3$ from carbonate horizon,
-the industrial pollution is the threshold alert.

The peach orchards were included in the class without soil restrictions.

Table 2. Quantification of climatic resources for peach tree lands and orchards from SCDP Băneasa, Bucharest

| Species/variety/rootstock/age | Class of expertise | Addition points |
|---|---|---|
| Prunus Persica/Springold, Springcrest, Jerseyland, Jerseyglo, Crimsongold, Independence /Mirobolan/14 | Without soil restrictions | 22 |

Source: [4].

*Land resources expertise*

The next indicators concerning the relief conditions were characterized:

-the general slope is < 5%,
-the land is flat with S-W orientation,
-surface and deep erosion is absent,
-landslides are absent,
-the aeration porosity is between 16 and 30%.

The relief conditions were granted 15 addition points and the peach orchards were included in the category without land restrictions (Table 3).

Table 3. Quantification of land resources for peach orchards from SCDP Băneasa, Bucharest

| Species/variety/rootstock/age | Class of expertise | Addition points |
|---|---|---|
| Prunus Persica/Springold, Springcrest, Jerseyland, Jerseyglo, Crimsongold, Independence/Mirobolan/14 | Without land restrictions | 15 |

Source: [4].

*Expertise for peach orchards characterization criteria, production and the quality of the fruits*

The indicators for characterization of the peach orchards are:

-the age of the trees (14 years),
-the assortment of varieties recommended for Bucharest and authorized for fresh consumption (mixed),
-the stage of vegetation for the peach orchards (good).

All of these are granted 84 addition points in the Expert System-CROM (Table 4).

Table 4. Expertise of the peach orchards from SCDP Băneasa, Bucharest

| **Species/variety/ rootstock/age** | **Class of expertise** | **Addition points** | **Indicators for characterization** |
|---|---|---|---|
| Prunus Persica /Springold, Springcrest, Jerseyland, Jerseyglo, Crimsongold, Independence/ Mirobolan/14 | 5-20 years | 34 | Age of the trees |
| | Mixed | 33 | Assortment of varieties |
| | Good | 17 | Stage of vegetation for orchards |
| | Total Addition points | 84 | - |

Source: [4].

*Expertize for peach orchards infrastructure*

The degree of technical equipment of the plantation was evaluated and the following were found:

-the existence of sufficient storage spaces for equipment, materials and production,
-the existence of the locally arranged irrigation and drainage system,
-the mechanized means owned.

The possibilities for valorizing fruit production for fresh consumption and for industrial processing are at medium level.

Proximity to the market and access to the market is good.

In this case 13 depreciation points are marked, for the equipping degree of the plantation and for the possibilities for valorising the fruit production (Table 5).

Table 5. Expertise of peach orchards infrastructure from SCDP Băneasa, Bucharest

| **Species/variety / rootstock/age** | **Class of expertise** | **Depreciation points** | **Indicators for characterization** |
|---|---|---|---|
| Prunus Persica /Springold, Springcrest, Jerseyland, Jerseyglo, Crimsongold, Independence / Mirobolan/14 | Medium | 8 | The equipping degree of plantation |
| | Medium | 5 | Possibilities for valorising fruit production |
| | High | 0 | Proximity of the market |
| | High | 0 | Possibilities of access to the market |
| | Total depreciation points | 13 | - |

Source: [4].

The method of calculating the value of the peach trees, lands and orchards in the Expert System-CROM is presented in Table 6.

Table 6. Evaluation of peach tree lands and orchards in the Expert System-CROM

| Species/ variety/ rootstock /age | Class of expertise | Natural resources | | | Anthropic resources | | Total points |
|---|---|---|---|---|---|---|---|
| | | Climate | Land | Soil | Indicators for characterization of orchards | Orchards infrastructure | |
| Prunus Persica/ Springold, Springcrest, Jerseyland, Jerseyglo, Crimsongold, Independence / Mirobolan / 14 | With natural and anthropic restrictions | 30 | 15 | 25 | 84 | 13 | 138 |

Source: [4].

Collaboration between farmers, business and researchers for research initiatives through operational groups is important especially for the fruit-growing sector [12], as the restructuring and modernization of this sector requires both new varieties and new management techniques.

## CONCLUSIONS

From the analysis presented in this article we can conclude that:
-Peach trees have the second most important economic value, after apple trees, in terms of tree species with falling leaves;
-In 2019, Spain was the largest peach cultivator in the EU followed by Italy and Greece.
-Romania ranked 9$^{th}$ in terms of area cultivated with peach trees, having 1.72 thousand ha.
-There is an increase in the peach trees areas of 1.78% in 2019 reported to 2015.
-Considering the peach production in 2019 Spain and Italy also occupied the first places in the European ranking.
-Romania was of the 8$^{th}$ place regarding harvest with only 17.19 tons of peaches.
-Compared to 2015 there is a decrease in the peach production by 17.67% in 2019.
-Macroregion Two had the most peach trees - 408,594 in 2019 meaning 35% of all peach trees in Romania. On the opposite side is Macroregion Three with 117,946, representing 10% of the total peach trees.
-Only 3 counties from Romania had more than 100,000 specimens - Constanța, 296,424, Bihor - 228,586 and Timiș - 137,783
-As expected, the highest peach production was obtained in 2019 in Bihor County - 5,718 tons, followed by Constanța - 2,504 tones and Timiş - 2,015 tons.
Following the application of the Expert System-CROM, the peach tree lands and orchards from SCDP Băneasa received 138 points and were included in the class with natural and anthropic restrictions.
In order to improve the possibilities for valorising the fruit production, it is recommended to use a larger assortment of varieties.
The equipping degree of plantation needs to be improved by creating high-performance irrigation and drainage systems.
The peach plantation from SCDP Băneasa has a special economic importance, because by applying some improvement measures, the obtained production can be high and the incomes can be important.

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