THE MANAGEMENT OF THE PLOTS AND OF THE PLUM ORCHARDS USING AN EXPERT SYSTEM-CROM

Daniela DANA[1], Irina-Adriana CHIURCIU[2], Valentina VOICU[3], Elena SOARE[4]

[1]Technological Secondary-School Prundu, Giurgiu, Mihai Viteazul Technological Secondary-School, 17 Bucharest-Giurgiu, Călugăreni, Giurgiu, Romania, danad8136@gmail.com
[2,4]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania, irina.chiurciu@yahoo.ro, economiegen2009@yahoo.com
[3]National Research Institute for Soil Science, Agrochemistry and Environment Protection, 61 Marasti Blvd, District 1, Bucharest, Romania, valy_c76@yahoo.com

Corresponding author: irina.chiurciu@yahoo.ro

Abstract

The paper presents aspects concerning the management of natural resources (climate conditions, soil fertility and relief conditions) and anthropic resources (the orchard infrastructure), as well as the quantification and characterization of the indicators of these resources in an expert system-CROM. The main objective of this study was the monitoring of the natural and anthropic resources, at the private farm in Domasnea locality, in order to establish the restrictions and recommendations for the improvement of the plots and of the plum orchards.

Key words: *plum trees, plots, orchards, expert system*

INTRODUCTION

It is unanimously admitted that a category of assortments can achieve its biological potential only if the ecological offer of the area optimally satisfies the biological needs. [2, 6]
The model applied in the expert system-CROM is comparable with similar systems in Germany, Czech Republic, Slovakia and other states from the European Union. The advantages are the different approach, more appropriated for the local conditions, the more technical and economic rapport between the baseline resources and the direct consequences on production and quality of fruits and on the socio-administrative field. [2, 4]
The private farm where the expert system-CROM was applied is located in the Domaşnea locality, the Fourth Development Macro Region, the West Region, in the south-eastern part of Caras Severin County, in the north of the Domaşnea-Mehadia depression, at an altitude of 492 m. The nearest town (Herculane resort) is 25 km away. [3]
The study was made on the fruit trees of the species Prunus, the variety Early Tuleu and Anna Spath. The species of the rootstock is Prunus and the variety used is the Cherry plum.

The tree age in the orchard is 17 years old.

MATERIALS AND METHODS

In order to characterize the natural and anthropic resources at the private farm in Domaşnea, an integrated expert system was used. The expert system-CROM was developed in accordance with an original methodology by I.C.P.A. [2, 8, 9, 10], which quantifies by addition points and depreciations points the climate resources, the soil and infrastructure resources, the production and the quality of fruits.
In this system:
- The meteorological elements are quantified in accordance with the frequency of repetitiveness of optimal climatic intervals and thresholds for each fruit tree category, in ten years. Climate resources can get between 0 and 40 addition points;
- The soil conditions are granted with 0-25 addition points;
- The relief conditions depending on their role in the fruit tree ecosystem are granted with 0-15 addition points;
- The indicators for orchards characterization can get between 20 and 100 addition points;

- The orchards infrastructure can receive 0-35 depreciation points.

To evaluate the fruit tree lands and orchards in the expert system, from the sum of the addition points the depreciation points will be subtracted. Depending on the obtained values, the fruit tree lands and orchards will be grouped in three categories: without natural and anthropic restrictions, with natural and anthropic restrictions, improper for fruit tree cultivation.

For this study statistical data from the National Institute of Statistics (INS) were collected and processed and they were used indicators such as: the number of plum trees; the total plum production; the average production per plum tree for the period 2005-2016.

RESULTS AND DISCUSSIONS

Climate resources expertise
The following indicators were used for the expertise of the climatic resources at the private farm in Domașnea, Caraș-Severin: the average air temperature, the absolute minimum temperature, the thermal amplitude in November-February and the rainfalls in the period between the V-VII months.

For the plum tree cultivation, the optimal average air temperature is between 7^0C and 10^0C. In the study period it was 10.3^0C and the frequency of repetitiveness of the optimum intervals was 90%.

The absolute minimum temperature of -22^0C for plum species was not recorded. The thermal amplitude in November-February greater than 20^0C had a frequency of repetitiveness about 40% (Figure 1).

The rainfalls were quantified for May-July, and the optimum quantity of 200-260 mm was recorded with a frequency of repetitiveness of 40%.

The obtained yields for the 2 varieties of plum trees at the private farm in Domașnea were studied in relation to the thermal amplitude. For the studied years the plum yield fluctuated according to the climate and to the thermal amplitude. The yield decreases while the quantum of the thermal element is higher than 20^0C (Figure 1).
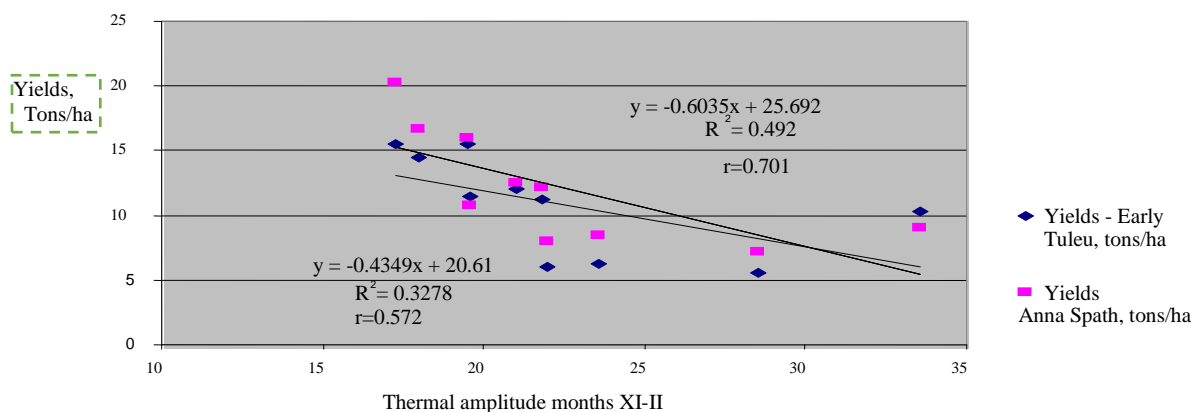

Fig.1. The relation between the yields and the thermal amplitude (^0C, XI-II months) for plum trees, Early Tuleu and Anna Spath varieties, at the private farm in Domașnea, Caraș-Severin

Table 1. The quantification of the climatic resources for plum trees, Early Tuleu and Anna Spath varieties, at the private farm in Domașnea, Caraș-Severin

Species/variety/ rootstock/age	Class of expertise	Addition points
Prunus/Early Tuleu/ Anna Spath/ Cherry plum /17	With climatic restrictions	39

From the quantification of the climatic resources for plum trees, in the expert system-CROM, 39 addition points were obtained (Table 1).

Soil resource expertise
In order to expertise the soil resources for plum trees the following indicators were used: the active edaphic volume, pH, salinization, alkalization, exchangeable Al content, $CaCO_3$ with depth of horizons Cca, Cpr, Rz, active $CaCO_3$ from carbonates horizon and the effect of the industrial pollution. Depending on the baselines values, the soil properties, at the private farm in

Domaşnea, receive 25 addition points. The plots and the plum orchards were included in the class without soil restrictions (Table 2).

Table 2. The quantification of the soil resources for plum trees, Early Tuleu and Anna Spath varieties, at the private farm in Domaşnea, Caraş-Severin

Species/variety/ rootstock/age	Class of expertise	Addition points
Prunus/Early Tuleu/ Anna Spath/ Cherry plum /17	Without soil restrictions	25

Land resources expertise
For characterization of the plum plots resources the indicators concerning the relief conditions (slope, aspect, surface and deep erosion, landslides) and drainage conditions (un-negleyed non-pseudogleyed soil volume and aeration porosity) were used. The relief conditions and the drainage conditions are granted 15 addition points using an expert system-CROM and the plum tree lands and the orchards were included in the category without land restrictions (Table 3).

Table 3. The quantification of the plot resources for plum trees, Early Tuleu and Anna Spath varieties, at the private farm in Domaşnea, Caraş-Severin

Species/variety/ rootstock/age	Class of expertise	Addition points
Prunus/Early Tuleu/ Anna Spath/ Cherry plum /17	Without land restrictions	15

Expertise for plum orchards characterization criteria, production and the quality of the fruit
The criteria for the characterization of the plum orchards are: the age of the trees, the assortment of species, the varieties and the rootstock, the stage of vegetation for the orchards, the production and the quality of the fruits. All of these are granted 91 addition points in an expert system-CROM (Table 4).

Table 4. The expertise of plum orchards, Early Tuleu and Anna Spath varieties, at the private farm in Domaşnea,Caraş-Severin

Species/variety/ rootstock/age	Class of expertise	Addition points	Indicators of characterization
Prunus/Early Tuleu/ Anna Spath/ Cherry plum /17	5-10 years	34	Age of plum trees
	High	40	Assortment of species
	Good	17	Stage of vegetation for the orchards
	Total addition points	91	-

Expertise for the plum orchards infrastructure
To characterize the plum orchards there are quantified: the equipping degree of the plots and plantations, the possibilities for valorising fruit production, the possibilities of access to the market and the degree of modernization of the transport routes. In this case 5 depreciation points are marked, for the possibilities of access to the market (Table 5).

Table 5.The expertise of plum orchards infrastructure, Early Tuleu and Anna Spath varieties, at the private farm in Domaşnea, Caraş-Severin

Species/variety/ rootstock/age	Class of expertise	Depreciation points	Indicators of characterization
Prunus/Early Tuleu/ Anna Spath/ Cherry plum /17	High	0	The equipping degree of the plots and orchards
	High	0	Possibilities for valorising fruit production
	High	0	Proximity of the market
	Low	5	Possibilities of access to the market
	Depreciation points	5	-

If the production potential is not in a proper balance with a proper management the economic indicators and the profitability of the investment are affected.

The statistical data that have been processed and will be presented later highlight the leading position of Caras-Severin County in the cultivation of plums.

The analysis of Figure 2 shows that the Fourth Macroregion has the largest number of plum trees (the state and private sector), compared to the other Macroregions of development, during 2005-2016.
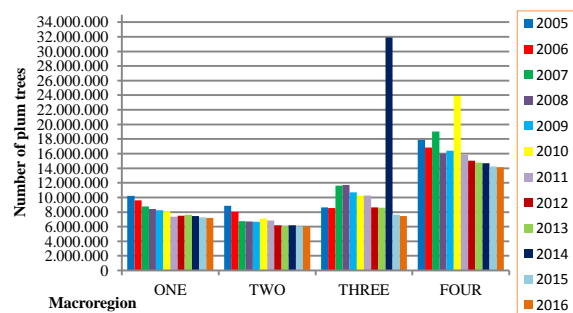

Fig.2. The dynamics of the total number of plum trees per Macroregions of development
Source: [5], own interpretation.

This number is decreasing, with the highest value registered in 2010 - 23,903,571, and the lowest in 2016 - 14,102,572. The decrease in the total number of plum trees is registered also for the other Macroregions of development.
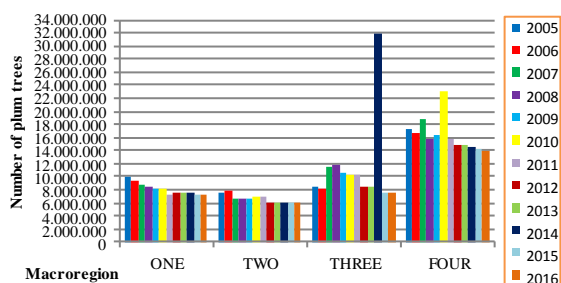

Fig.3. Dynamics of the number of plum trees in the private sector, by Macroregions of development
Source: [5], own interpretation

Regarding the number of plum trees in the private sector during the period 2005-2016 (Figure 3), on the first place is the Fourth Macroregion, with the highest number in 2010 - 23,184,272 plums, and the lowest in 2016 - 14,082,023 plumes. Remarkable is the same tendency to decrease the number of plums also in the private sector.

The share of plum trees cultivated in the private sector, total of plum trees - for the Fourth Macroregion - ranges between 96.99% (2010) and 99.96% (2013).

Figure 4 shows the number of plums cultivated in the private system in the West Region, part of the Fourth Development Macroregion. Caras Severin County, where Domaşnea is located, has the largest number of plum trees cultivated in the private system. The highest value was registered in 2007 - 6,009,678 plum trees, and the lowest in 2012, 2,034,827 plum trees.
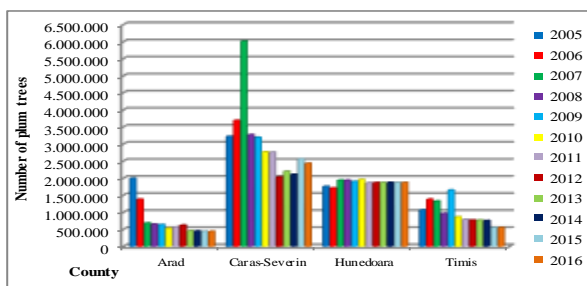

Fig.4. The dynamics of the total number of plum trees in the counties of the Fourth Macroregion of development
Source: [5], own interpretation

The largest plum production in the West Region, in the period 2005-2016, in the private sector, was obtained in Caras-Severin County, in 2008 - 31,654 tons (Figure 5). For the same county, the smallest production was 17,798 tons in 2016.
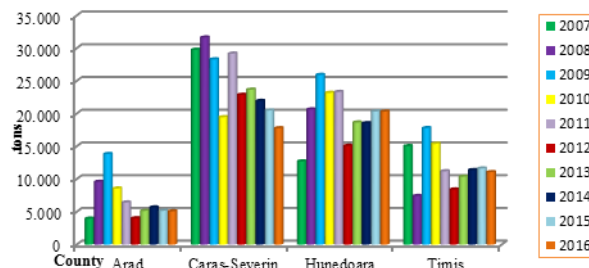

Fig.5.The plum production in the private sector of the West Region by county
Source: [5], own interpretation

Figure 6 shows the average plum production, in kg /plum tree, obtained in the West Region,
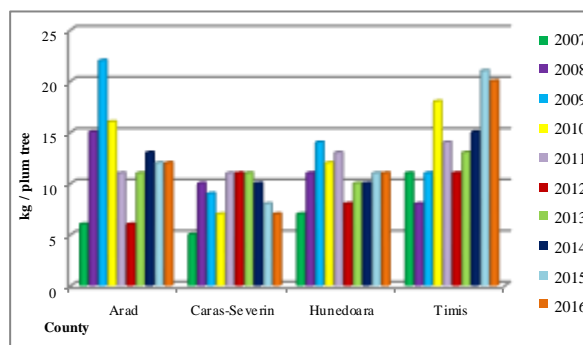in the private sector, during 2007-2016.

Fig.6. Average plum production obtained in the Western Region in the private sector
Source: [5], own interpretation

For Caras-Severin County, the smallest production 5 kg / plum tree was harvested in 2007, and the highest was 11 kg / plum tree (2011, 2012, 2013).

Regarding the average plum production, in Arad County and in Timis County, they recorded the highest values (Arad 22 kg / plum tree - 2009, respectively Timis 21 kg / plum tree - 2015).

In areas with natural favourability or with potentiated favourability (in the condition of the irrigation facility) equal to or higher than 2, (Annexe 7 "areas STP" 4.1a, [1]) the cultivation of plums or fruit trees in general represents a business opportunity.

The statistical data show that the number of people leaving the city is higher than those who leave the rural environment [7].

The EU non-reimbursable funds that can be accessed through the Romania's Agency for Rural Investment Financing (AFIR, [1]) constitute a point of interest for those who give up city life in favour of the rural environment, as well as for the agricultural education graduates.

CONCLUSIONS

Following the application of the expert system-CROM, the plum plots and the orchards at Domașnea private farm received 175 points and were included into the category: with natural and anthropic restrictions.

Natural conditions favour plum trees cultivation, only the thermal amplitude (XI-II months) greater than 20^0C has negative effects on the plum yields. The Anna Spath variety was less affected than the Early Tuleu variety.

In order to avoid production fluctuations, it is recommended to use a larger assortment of varieties to compensate the decrease of plum yields caused by the climatic factor.

To improve access to the market, it is recommended to build asphalt roads.

The largest number of plum trees in the private sector is cultivated in the Fourth Development Macroregion.

The County of Caras-Severin ranks first in the West Region in the number of plum trees cultivated in the private sector. The highest value was recorded in 2007 - 6,009,678 plum trees, and the smallest, in 2012 - 2,034,827 plum trees.

The largest plum production in the West Region, in the period 2007-2016, in the private sector, was obtained in the county of Caras-Severin in 2008 - 31,654 tons.

The average plum production obtained in the Caras-Severin county ranges between 5-11 kg/ plum tree.

European non-reimbursable funds are one of the reasons why young people choose to return to rural areas.

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