INTRODUCTION

„With medicinal plants back towards the future” (Tyler V.E., 1999)

Since ancient times, people have wanted to find cures for diseases that tortured them. They used knowledge passed down from generation to generation, and to treat diseases most often used herbs. During the geto-dacian ancestors have used herbs to prevent and cure many diseases.

Medicinal plants produce fewer side effects and much lower secondary effects than synthetic drugs. This category of plants can capitalize on less productive lands, farmers can provide significant income, or honey from ornamental crops; medicinal plants and crops can be an important export material. They can be expanded as cultures in school lots, parks and gardens, combining beauty with usefulness (MUNTEAN et al., 2007).

Medicinal plant’s market is growing herbs in the world and increasingly looking for natural treatments. "Demand is so great that, currently, there are quotas on exports to EU countries, which imports 80% of Chinese herbs used. They always prefer to import from other countries and that is a chance for Romania. Now we grow about 20 species of plants, the rest being taken from the spontaneous flora, developed over 80% in forests. Experts say it would take a "medicinal plant guard" to protect areas in which they grow. Some countries such as Hungary, Moldova and Croatia have come now to export more than Romania, a country with tradition in this field. With climate changes we can acclimatize other plants, as developed in neighboring countries (www.marketwatch.ro).

In the current political context it is encouraged to establish and develop small enterprises in rural areas, to build local human potential and bring added value to local resources. In this context, cultivation and use of medicinal plants is a high and serious opportunity for the development of rural communities.

In this paper we present experimental results obtained in research of 8 marigold and 4 artichoke cultivars in climatic conditions from 2008 to 2010 in the experimental field from Jucu, Cluj County.
1. THE IMPORTANCE OF CULTIVATION AND EXPLOITATION MEDICINAL PLANTS CULTIVATION

In this chapter is presented the importance and utilization of herbal medicinal plants in the world and in our country. Also, the history of cultivation of the medicinal plants and their spread is shown worldwide and in our country.

2. PRESENT STAGE OF RESEARCH, IN THE CULTIVATION AND EXPLOITATION OF SPECIES CALENDULA OFFICINALIS L. AND CYNARA SCOLYMUS L. SPECIES

In chapter two is shown the current state of research on the cultivation and recovery of the species Calendula officinalis L. and Cynara scolymus L. For the two species under study it is described: the importance, biology, ecology, varieties, technology, culture, sowing, work, control, diseases, pests, harvesting, conditioning and production.

3. RESEARCH OBJECTIVES. PEDOCLIMATE CONDITIONS. MATERIAL AND METHODS

3.1. RESEARCH OBJECTIVES

For marigold (Calendula officinalis L.)

A. Research on germination for seeds under different conditions.
   ✓ Determination of germination for different kinds of "seeds" (achene fruit) fructifications Identified in plants;
   ✓ Determination of seed germination indices of different ages (1, 2 and 3 years).

B. Research on the influence of fertilization on productivity elements.
   ✓ Determination regarding the plant’s waist and the average mass for the diameter of 100 fresh flowers in eight experimental cultivation variants studied each using the statistical interpretation of variance and the Duncan test.

C. Comparative evaluation of raw material production studied in applied experimental conditions.
   ✓ Determination of production at each harvest for each experimental variant and statistical interpretation by analysis of variance and Duncan test.

D. Establishing relationships between the average plant size and production, between the mass of 100 fresh production inflorescences.
 ✓ Relationship between 100 fresh flowers and production;
 ✓ The relationship between average plant size and production.

E. Quantitative determination of active principles from raw plant material and the production of raw material per hectare.
 ✓ Determination of carotenoids (in $\alpha$-carotene), flavonoids concentration (expressed in rutozid) and the phenilprophanic content (caffeic acid in %), the spectrophotometric methods in *Calendulae flos*;
 ✓ Determination of active ingredients per hectare production.

F. Economic efficiency in crop cultivation for the eight experimental variants established.
 ✓ Economic calculation efficiency for the eight crops in different experimental variants studied. There will be "Cost-Benefit Analysis" for every cultivar at each fertilization variant for each of the three experimental years. Finally, profits and rates of return for each cultivar, depending on growing Conditions will be presented.

For artichoke (*Cynara scolymus* L.)

A. Research on the influence of fertilization on the elements of the four crop productivity.
 ✓ Determination of medium size plants, the average number of leaves, length and width of the largest leaves for the four cultivars. Each variant was studied in experimental and statistical interpretation of data by analysis of variance and the Duncan test.

B. Comparative evaluation of raw material production studied in experimental plant cultivars with conditions applied.
 ✓ Determination of production of each harvest for every experimental variant by analysis of variance and Duncan test.

C. Establishing the relationship between the average size and plant production and between the average number of leaves and artichoke production.
 ✓ Relationship between average number of leaves and production;
 ✓ Relationship between average plant size and production.

D. Quantitative determination of active principles in vegetable raw material for artichokes and production of raw material per hectare.
 ✓ Determination of the phenilprophanic derivatives (expressed in% caffeic acid) and flavonoids content (% rutozidă) to *Cynarae folium* L.;
 ✓ Determination on production of active ingredients per hectare.

E. Calculation of economic efficiency in crop cultivation- four variants studied in experimental set.
Economic calculations of the efficiency for the four cultivars, in different experimental variants. "Cost-Benefit Analysis" will be made for each cultivar at each fertilization variant for each of the three experimental years. Finally, profit and rate of return for each cultivar according to cultivation conditions will be presented.

3.2. CLIMATE CONDITIONS IN WHICH THE RESEARCH WAS CONDUCTED

Research has been conducted in the experimental field of USAMV Cluj-Napoca, Cluj County in Jucu, from 2008 to 2010.

3.2.1. Soil conditions in the field of research at Jucu

Soil from the field experiences is of type faeoziom argic - stagnated (argiloiluvial mold, low-moderate pseudogleizat in depth).

The field is located on the old terrace of Somesu Mic with 7-10% slope. Soil reaction is slightly acid, humus supply in good, very good total nitrogen, mobile phosphorus very low and potassium good.

3.2.2. The climate of the years 2008 - 2010 from Jucu

In 2008 the average annual temperature of 10,71°C was higher than the annual average of 2,41°C, in 2009 was 2,8°C higher than the annual average, and in 2010 the annual average greater than 2,9°C.

In terms of rainfall, 2008 was very dry, recorded a deficit of 149.7 mm annual rainfall, 2009 was excessively dry, with a deficit of 249.6 mm from the annual average and 2010 was very rainy, with a surplus of 83.2 mm from the annual average.

3.3. EXPERIMENTAL FACTORS AND GRADUATIONS

Our research took place for two species of medicinal plants - Calendula officinalis L. and Cynara scolymus L. Each of these were installed by bifactorial experiences.

Factors and experimental graduations are presented next.

The marigold (Calendula officinalis L)

Factor a - fertilization.
   a1 - unfertilized (F0);
   a2 - 20 t / ha manure fermentation (F20);
   a3 - 40 t / ha manure fermentation (F40).

Factor b – growing
   b1 - Petrana;
   b2 - Cluj population 2;
   b3 - the Novi Sad;
b4 - Agrosel 696;
b5 - Starsem 922;
b6 - del Pacifico Belezza;
b7 - Diana;
b8 - Natali.

The artichoke (*Cynara scolymus* L.)

**Factor a** – Fertilizer
   a1 - unfertilized (F0);
   a2 - 20 t / ha manure fermentation (F20);
   a3 - 40 t / ha manure fermentation (F40).

**Factor b** – growing
   b1 - Unirea;
   b2 - Violet;
   b3 - Agrosel 656;
   b4 - Chisinău.

**Factor c** - density.
   c1 - 70 x 40 cm (3.57 pl / m) (D40);
   c2 - 70 x 60 cm (2.38 pl / m) (D60).


The location field experience in research was the Faculty of Agriculture Veterinary Medicine Cluj, from Jucu, in 2008-2010.

3.4. MATERIAL AND METHODS OF WORK

3.4.1 The material used

To achieve the objectives we set up experiments using eight growing marigold (*Calendula officinalis* L.) and 4 of artichoke (*Cynara scolymus* L.).

**Marigold cultivars** were:
1. **Petrana** - Veterinary Medicine Bucharest variety created and approved in 1990;
2. **Cluj 2** - population of Veterinary Medicine Cluj-N.;
3. **Novi Sad** - Faculty of Agronomy population at the University of Novi Sad;
4. **Agrosel 696** - population acquired in trade;
5. **Starsem 922** - population acquired in trade;
6. **Del Pacifico Belezza** - population acquired in trade;
7. **Diana** - sort of Moldova;
8. **Natali** - sort of Moldova.
Artichoke cultivars were:
1. Union - Romanian variety, approved in 1993;
2. Violet - Italian variety;
3. Agrosel 656 - commercial cultivar;

3.4.2. The experimental method

Marigold experimental variants were established by direct seeding by hand on 21/04/2008, 08/04/2009, 04/05/2010 respectively, at a distance of 70 cm between rows.

Each cultivar was sown in four repetitions, each 25 sqm. Plant emergence occurred at approx. 3 weeks after sowing, respectively at 4/28/2010 5/18/2010.

Determination of marigold seed germination was carried out according to the methodology in force (SR 1634/99), which applies to seeds quality control laboratories.

During vegetation were made a series of biometric measurements, the marigold cultivars, such as measuring medium plants, diameter of the inflorescence, the mass of 100 inflorescences, inflorescences production and drying efficiency. Measurements were made to 30 plants in each experimental plot environments.

The sowing was performed manually in the artichokes nests (2-3 seeds / nest) on 05.01.2008, 14.04.2009 and 11.05.2010. Plant emergence occurred on average after 18 days. Planting distances were 70x40 cm (3.57 pl / m) and 70x60 cm (2.38 pl / m), according to research protocol.

The experience was located in four repetitions of 10 sqm. Biometric measurements (measurement medium size plant, leaf length and width of largest leaf, the average number of leaves and determination of production of fresh leaves) were conducted at 10 plants in each plot experimental environments. Harvesting was done manually with a sickle, twice (July 17. and October 10.) In 2008, three times (July 15., September 1. and October 15.) and in 2009 twice (July 15. and September 30.)

Quantitative determination of active principles from plant raw material harvested from marigold and artichokes was carried out in laboratories in the discipline of Pharmacognosy from Faculty of Pharmacy and Pharmacy "Iuliu Hațieganu" Cluj-Napoca. The harvesting of Jucu, media were sampled from each experimental plot and were taught colleagues from UMF. Samples were dried in the shade.

The concentrations determined for *Calendulae flos* carotenoids (mg/100 g), flavonoids (expressed in% rutozidă) and phenilprophane (expressed in% caffeic acid).
The *folium Cynarae* concentrations were determined phenilprophanic derivatives (expressed in% caffeic acid) and flavonoids (expressed in% rutozidă). Interpretation of results, both biometric and the content production and active principii were made by analysis of variance, Duncan test and statistical calculation program that bifactorial "ANOVA" the discipline of experimental techniques of Veterinary Medicine Cluj-Napoca.

Economic efficiency indicators were calculated to reveal the effectiveness of soil fertilization with organic fertilizers and value cultivars tested, in terms of production.

Economic efficiency was established by calculating the following economic indicators:

- **production per hectare achieved** - was taken into account the production of flowers (marigold) and leaves (artichokes) obtained in dry years from 2008 to 2010;
- **value of trading** - was based on the production of flowers (marigold) and leaves (artichokes) dry and average selling price;
  \[ V = Qt \times P_v, \]
  where:
  - V - value of trading;
  - P_v - the selling price per kilogram;
- **average price recovery** - is the average market price for marigold flowers, that artichoke leaf of each year;
- **cost of production** - is one indicator of economic activity that characterizes a farmyard.
  - **cost per unit of product** - is the expression of all the money and manpower consumption made on the farm materialized per unit (per kilogram of flowers).
  - **raw product** - is obtained by summing the production value of the subsidies in the budget calculation culture and per hectare.
  - **gross margin** - the difference between gross product (PB) obtained directly proportional expenses (ChDP), which are also called variable per unit area.
- **changing the gross margin (%)** - is the ratio of gross margin and gross margin control (F0);
- **change in cost per unit of product (%)** - is the ratio of cost per unit of output and cost per unit of product control (F0);
- **changing production (%)** - is the ratio between the number of units produced and number of units produced witness;
- **taxable profit** result as the difference between total expenditure and production values that culture;
• net income + grants that the equivalent taxable income minus taxes plus the subsidy
• rate is expressed as% of taxable income and taxable income is calculated by dividing the costs
• net profit + subsidy rate, by dividing net income + subsidies main production costs.
• gross profit - was calculated as the difference between production value and total production costs;
• rate of return - is the ratio between profit and unit production cost. Reflects profit to 100 lei spent;

The overall assessment of the effectiveness of economic activity is of great utility category "return" (profitability) defined by the entity's ability to produce profit. Size is an expression of absolute profit profitability. The relative values express the rate of return.

4. RESULTS OBTAINED FOR MARIGOLD
(CALENDULA OFICINALIS L.)

4.1. RESULTS OF PLANT BIOLOGY FOR MARIGOLD

4.1.1. Results on the germination of different fruit formation

Determination of germination "seeds" (fruit achenes) of marigold from 3 samples collected during the 3 experimental years (2008-2010), was conducted in late May-early June 2011. Making marigold seeds germinated was made 27/05/2011. From the results we see that energy is the highest germination of seed with a length of 3 years (from harvest 2008) and much lower in fresh seeds. Difference from the average of three years is very significant in a positive way in 2008 and significantly negative in the other two years.

Germination capacity was higher in fresh seeds (2009 and 2010) than in harvest seeds from 2008, with distinct differences in yields significantly positive in 2009 and 2010. The Duncan test showed significant differences regarding the germination capacity.

4.1.2. Results on the size of the plants

Data on the influence of fertilization on the medium marigold plant, between 2008-2010, is shown in Figure 4.1.2.1. The difference is distinct significant compared to F0 regarding the average size of plants at F20, except the Agrosel 696 cultivar where the difference is significant and the Belezza del Pacifico cultivar where the
difference is insignificant. At F40 the differences are very significant from to F0, to all cultivars.

![Graph showing the influence of fertilization on the cultivars of marigold plants waist](image)

DL (p 5%) = 1,99; DL (p 1%) = 2,64; DL (p 0,1%) = 3,43.

Fig. 4.1.2.1. The influence of fertilization on the cultivars of marigold plants waist (Jucu, average 2008-2010)

The figure 4.1.2.2. presents the influence of cultivars on the waist, as the average of 2008-2010.

Significant differences compared to the control (Petrana) are observed in all cultivars, except the Diana cultivar where the difference is distinct significantly.

The analysis of multiple comparisons method (Duncan test) found significant differences between cultivation, except Novi Sad and Natali, Agrosel 696 and Belezza which have approximately the same size plant.
4.1.4. Results of the mass of 100 inflorescences

The weight of 100 marigold flowers is an important indicator of the size of the inflorescences. It was determined at all the 8 marigold cultivation in the three conditions of soil fertility, in 2008-2010.

Data on the influence of fertilization on the mass of 100 inflorescences marigold, as an average of the years 2008-2010, are shown in Figure 4.1.4.1.

The average of the three experimental years shows a similar situation, that there are no significant differences in F20 than in F0 regarding the mass of 100 flowers, and the F40 to F0 differences are insignificant, except the Petrana and Belezza del Pacifico with distinct significant differences and the Agrosel 696 cultivar with a significant difference compared with controls.

The synthesis of experimental results on the influence of 8 cultivars on the mass of the 100 marigold flowers by analysis of variance and multiple comparisons (Duncan test), as an average of 2008-2010 is shown in Figure 4.1.4.2.
Average weight of 100 inflorescences (g)

**Fig. 4.1.4.1.** Influence of fertilization on mean mass of 100 inflorescences for marigold cultivars (Jucu, average 2008-2010)

DL (p 5%) = 25.70;  DL (p 1%) = 34.07;  DL (p 0.1%) = 44.13.

**Fig. 4.1.4.2.** The mass of 100 inflorescences for marigold cultivars (Jucu, average 2008-2010)

DL( 5%) = 14.92;  DL( 1%) = 19.69;  DL( 0.1%) = 25.34

DS5% = 15.00 - 17.41
The mean of the three experimental years, calculated by analysis of variance, lead to a very significant finding that the differences are positive in all cultivars in terms of mass of the 100 inflorescences compared to the control (variety Petran). Insignificant differences in terms of mass of 100 flowers, performed by Duncan test, was found between the average of three years at the Novi Sad, Agrosel 696 and Starsem 922, between Starsem 922 and Belezza del Pacifico Stars and Cluj 2 and Belezza del Pacifico.

4.2. RESULTS ON PRODUCTION FOR MARIGOLD INFLORESCENCES

The production of dried flowers in the eight cultivars studied under different conditions of fertilization, in 2008-2010, is the most important parameter for assessing their behavior in climatic conditions from Jucu, Cluj.

Data on the influence of fertilization on the production of dried flowers, as the average of the years 2008-2010, is shown in Figure 4.2.1. All the cultivars reacted very well to fertilization, the differences in fertilization being very significant at the 20 t/ha, and at the 40 t/ha compared with the unfertilized witness.

![Graph showing production of inflorescences (kg) for different cultivars and fertilization levels.]

Fig 4.2.1. Influence of fertilization on the production of flowers in cultivars for marigold (Jucu, average 2008-2010)

DL (p 5%) = 34.70; DL (p 1%) = 45.99; DL (p 0.1%) = 59.58.
In Figure 4.2.2, experimental results are presented on the influence of the eight cultivars on production, as the average of 2008-2010. In all the cultivars was obtained higher production compared to the control with significant differences. Duncan test analysis revealed significant differences between the cultivars regarding the production of the flowers. Between Novi Sad, Diana and Natali and between Cluj2 and Belezza del Pacifico about the same production was made.

Fig 4.2.2. The production of flowers in cultivars for marigold (Jucu, average of the years 2008-2010)

4.5. RESULTS ON THE CHEMICAL COMPOSITION OF INFLORESCENCES AND PRODUCTION OF ACTIVE INGREDIENTS PER HECTARE

Phenilprophants, flavonoids and carotenoids were analyzed and determined, in 2008, in terms of quantity from dry *Calendulae flos*. After identification of active principles content for each cultivar in three variants of fertilization, the content of active ingredients per hectare was expressed. In Figure 4.5.1, production of carotenoids is shown (kg) per hectare affected by fertilization with manure. Production of carotenoids is higher in fertilized with 40 t/ha manure (F40). Among cultivars, the highest values were determined from: Cluj 2 (0.95 kg / ha in F0, 1.11 kg / ha and 1.17 kg F20 / F40 ha), Novi Sad (0.88 kg / ha at F0, 0.92 kg / ha and 0.94 kg F20 / F40 ha), STARS 922 (0.84 kg / ha in F0, 0.91 kg / ha and 0.99 kg F20 / ha F40) and Diana (0.84 kg / ha in F0, 0.91 kg / ha and 1.01 F20 kg / ha to F40).
4.6. RESULTS REGARDING THE ECONOMIC EFFICIENCY OF MARIGOLDS

Economic efficiency was monitored in all eight crops, for the three variants of fertilization. Economic efficiency calculation was performed using marigold yields obtained in 2008-2010 in the three agrofunds (F0, F20 and F40). Indicators of economic efficiency, average years 2008 - 2010, is shown in Table 4.6.1.

In the case of Petrana cultivar, higher productions were obtained than in the F0 version, with 149 kg / ha in F20 and 260 kg / ha in version F40, which resulted in superior production values, to that obtained from F0 to 1.477 lei / F20 and 2.559 lei / ha in F40. The F40 version, the taxable income is higher with 1.088 lei / ha from F0, the rate of return of 42.02%, or 100 lei spent to produce ataxable profit of 42.02 lei.

Yields obtained at Cluj 2, varies between 1.243 kg / ha and 1.541 kg / ha, which resulted in production values between 12.364 lei / ha and 15.305 lei / ha, depending on the variant of fertilization. The highest rate of return on taxable income was obtained from version F40 (47.59%), followed by F20 (45.66%) and F0 (41.79%).
Table 4.6.1.

Indicators regarding the economic efficiency in growing marigolds
(Jucu, average 2008 – 2010)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fertilization</th>
<th>Production kg/ha</th>
<th>Production value lei/ha</th>
<th>Total expenses lei/ha</th>
<th>Profit net + subsidy lei/ha</th>
<th>Taxable profit %</th>
<th>Net profit + subsidy %</th>
</tr>
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<tr>
<td>Petrana</td>
<td>F0</td>
<td>1.097</td>
<td>10.912</td>
<td>8.014</td>
<td>2.898</td>
<td>36.16</td>
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<td></td>
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<td>1.246</td>
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<td>9.485</td>
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<td>1.541</td>
<td>15.305</td>
<td>10.370</td>
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<td>4.304</td>
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</table>

In Figure 4.6.1. is given the situation of profit from the cultivation of marigolds, average years 2008-2010. The greatest net profit was obtained by cultivation of Belezza del Pacifico (3,69 thousands lei / ha), followed by Cluj 2 (3,65 thousands lei / ha) and Starsem 922 (3,50 thousands lei / ha).
The price expressed in the exploitation of marigold inflorescence production is conventional, although the cultivation was done by ecological principles. The price for the production of organic calendula would be min. 30% higher, so that net profit would be appropriately higher. The Ministry of Agriculture in our country gives organic medicinal herbs growers, in 2011, grants of 270 € per hectare.

5. OBTAINED RESULTS FOR ARTICHOKE (*CYNARA SCOLYMUS* L.)

5.1. RESULTS OF PLANT BIOLOGY OF ARTICHOKES

5.1.1. Results on plant size

Like the research protocol states, in each of the three experimental years (2008-2010) measurements were performed to determine waist artichoke plants in each experimental plot.

In table 5.1.1. is summarized and interpreted statistically (by analysis of variance) the data on the influence of fertilization on two different thicknesses (3.57 pl/sqm, respectively 2.38 pl/sqm) on medium size artichoke plants at the four cultivars. The average of the three experimental years, in the F20 version, reveals distinct significant differences from F0 on the medium size plants, at a density of 3.57 pl/sqm, at the cultivator Violet and Chisinau and very significant at a density of 2.38 pl/sqm, at the Chisinau cultivar.
Comparative analysis of the waist for the four plants of artichoke growing by analysis of variance and multiple comparisons method (Duncan test) is shown in Figure 5.1.1.1. In all the cultivars the medium waist is lower compared to the control with significant differences. The method of multiple comparisons (Duncan test) shows significant differences are found growing in terms of average plant size. Approximately the same size was determined in cultivars Agrosel 656 and Viololet.

**Table 5.1.1.1.**

<table>
<thead>
<tr>
<th>Plant’s density (pl/sqm)</th>
<th>Cultivar</th>
<th>Unirea</th>
<th>Violet</th>
<th>Agrosel 656</th>
<th>De Chișinău</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fertilization with manure</td>
<td>Waist (cm)</td>
<td>Difference (cm) and Significan.</td>
<td>Waist (cm)</td>
<td>Difference (cm) and Significan.</td>
</tr>
<tr>
<td>3.57 (D40)</td>
<td>F0 (Mt)</td>
<td>41.83</td>
<td>-</td>
<td>27.25</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td>45.50</td>
<td>3.67*</td>
<td>31.75</td>
<td>4.50**</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td>50.17</td>
<td>8.33***</td>
<td>45.83</td>
<td>18.58***</td>
</tr>
<tr>
<td>2.38 (D60)</td>
<td>F0 (Mt)</td>
<td>48.42</td>
<td>-</td>
<td>30.83</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td>50.58</td>
<td>2.17</td>
<td>34.67</td>
<td>3.83*</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td>54.67</td>
<td>6.25***</td>
<td>51.50</td>
<td>20.67***</td>
</tr>
</tbody>
</table>

DL (p 5%) = 3.28; DL (p 1%) = 4.37; DL (p 0.1%) = 5.72.

**Fig. 5.1.1.1.** The average size of the artichoke plants (Jucu, average 2008-2010)
5.1.2. Results on the average number of leaves

In Table 5.1.2.1. are summarized and statistically interpreted (by analysis of variance) the data on the influence of fertilization on for two different thickness (3.57 pl/sqm, respectively 2.38 pl/sqm) on the average number of four cultivation of artichoke leaves, as the average of the years 2008 -2010.

From the average of the three experimental years we observed significant differences compared to the control (F0), F20 and F40 to the original version, the density of 3.57 pl/sqm, the cultivation Agrosel 656 and F40, the density of 2.38 pl/sqm, the Unirea. The F0 version is found significant distinct differences at 3.57 density pl/sqm for Violet cultivar and density cultivation of 2.38 pl/sqm in all cultivars compared to F20.

Significantly distinct differences are found in F0 and F40 versions at density 2.38 pl/sqm for Agrosel 656 cultivars and Chisinau cultivars.

Comparative analysis of the average number of leaves was made at the four artichoke cultivation through analysis of variance and multiple comparisons method (Duncan test) that is shown in Figure 5.1.2.1., average 2008-2010.

By averaging the three experimental years, we found significant differences in the average number of leaves at the four artichoke cultivations. Approximately the same average number of leaves was determined in cultivars Violet and Agrosel 656.

Table 5.1.2.1.

<table>
<thead>
<tr>
<th>Plant’s density (pl/sqm)</th>
<th>Fertilization with manure</th>
<th>Cultivar</th>
<th>Unirea</th>
<th>Violet</th>
<th>Agrosel 656</th>
<th>De Chişinău</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.57 (D40)</td>
<td>F0 (Mt)</td>
<td>7.75</td>
<td>-</td>
<td>6.58</td>
<td>-</td>
<td>5.50</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td>7.58</td>
<td>-0.17</td>
<td>7.67</td>
<td>1.08**</td>
<td>6.92</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td>8.50</td>
<td>0.75*</td>
<td>6.67</td>
<td>0.08</td>
<td>7.67</td>
</tr>
<tr>
<td>2.38 (D60)</td>
<td>F0 (Mt)</td>
<td>7.50</td>
<td>-</td>
<td>7.67</td>
<td>-</td>
<td>7.50</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td>8.58</td>
<td>1.08**</td>
<td>8.67</td>
<td>1.00**</td>
<td>8.67</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td>9.58</td>
<td>2.08***</td>
<td>8.58</td>
<td>0.92*</td>
<td>8.58</td>
</tr>
<tr>
<td>DL (p 5%) = 0.70;</td>
<td>DL (p 1%) = 0.94;</td>
<td>DL (p 0.1%) = 1.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2. RESULTS ON THE PRODUCTION OF LEAVES FOR ARTICHOKE

Centralization and interpretation of statistics (by analysis of variance) of data on the influence on fertilization of two different thickness (3.57 pl/sqm, respectively 2.38 pl/sqm) on the production of fresh leaves from four cultivation of artichokes, as the average of the years 2008-2010 is shown in table 5.2.1.

From the average of the three experimental years we found significant differences in the fertilized variant F20 with the density of 3.57 pl/sqm to the variant F0 in cultivars Unirea and Agrosel 656. Such significant differences were observed in the F0 fertilized variant with 40 t/ha manure in both thicknesses of the cultivars FC, Violet and Agrosel 656.

Synthesis of experimental results on the influence of the four cultivation on the production of dried leaves from the average of the years 2008-2010, by way analysis of variance and multiple comparisons (Duncan test) is shown in Figure 5.2.1. From the average of the three experimental years we found by analysis of variance, significant differences in terms of negative production of dried leaves from the control (variety FC) for all cultivars.

Analyzing the production of dried leaves using the multiple comparisons method (Duncan test), we found significant differences in cultivation.
The influence of fertilization on production of two different thickness of the dried leaves for artichoke (Jucu, average 2008-2010)

<table>
<thead>
<tr>
<th>Plant’s density (pl/sqm)</th>
<th>Fertilization with manure</th>
<th>Cultivar</th>
<th>Unirea</th>
<th>Violet</th>
<th>Agrosel 656</th>
<th>De Chișinău</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Production (t)</td>
<td>Difference and Significance</td>
<td>Production (t)</td>
<td>Difference and Significance</td>
</tr>
<tr>
<td>3.57 (D40)</td>
<td>F0 (Mt)</td>
<td></td>
<td>4.12</td>
<td>-</td>
<td>3.49</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td></td>
<td>4.86</td>
<td>0.74***</td>
<td>3.85</td>
<td>0.35^-</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td></td>
<td>5.65</td>
<td>1.53***</td>
<td>4.26</td>
<td>0.77***</td>
</tr>
<tr>
<td>2.38 (D60)</td>
<td>F0 (Mt)</td>
<td></td>
<td>3.06</td>
<td>-</td>
<td>2.81</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td></td>
<td>3.65</td>
<td>0.59**</td>
<td>3.07</td>
<td>0.26^-</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td></td>
<td>4.62</td>
<td>1.56***</td>
<td>3.75</td>
<td>0.94***</td>
</tr>
</tbody>
</table>

DL (p 5%) = 0.40;    DL (p 1%) = 0.53;    DL (p 0.1%) = 0.69.

Fig. 5.2.1. The production of dried leaves from artichoke (Jucu, average 2008-2010)
5.5. RESULTS OF CHEMICAL COMPOSITION OF LEAVES AND ACTIVE PRINCIPLES PRODUCTION

From dried *Cynarae folium*, phenilprophanic derivatives and flavonoids were determined. The used plant material was *Cynarae folium* from four varieties of artichokes: FC, Violet, and Agrosel 656 Chisinau, harvested in July 2008 in the experimental field from Jucu. The plant material was stored in dry conditions without light, heat and humidity.

The first analysis of active principles of *Cynarae folium* was for phenilprophanic derivatives (caffeic acid%).

Total production of phenilprophanic derivatives per hectare is given in Figure 5.5.1.

Phenilprophanic production (kg) per hectare is higher in the fertilization with 40 t / ha manure (F40). The highest values were determined by the variety Unirea (291 kg / ha in F0, 328 kg /ha in F20 and 379 kg / ha to F40).

![Fig. 5.5.1. Phenilprophanic production (kg/ha) from artishokes (Jucu, 2008)](image)

A second analysis of the active principles of *Cynarae folium* was the flavonoids content (% rutozidă) in *Cynarae folium*.

Total production of flavonoids is shown in Figure 5.5.2.
Fig. 5.5.2. Flavonoid production (kg/ha) from artichokes (Jucu, 2008)

Such as the phenilprophanic derivatives, the largest production of flavonoids were obtained from the variant fertilized with 40 t / ha manure (F40). The highest values were determined by the variety Unirea (144 kg / ha in F0, 163 kg / ha in F20 and 188 kg / ha to F40).

The results fall within the limits of FR X Cynarae folium monograph: at least 1% total polyphenols and flavonoids at least 0.35%.

5.6. RESULTS ON ECONOMIC EFFICIENCY OF ARTICHOKE

Economic efficiency was monitored in all four cultivars of grown artichokes, for the three types of soil fertility. Economic efficiency calculation was performed using Cynarae folium yields obtained in 2008-2010 in the three agrofunds (F0 unfertilized, F20 fertilized with 20 t / ha manure and F40 fertilized with 40 t / ha manure).

Indicators of economic efficiency were made for the three agrofundus (F0, F20 and F40), the four cultivation of artichokes, average 2008-2010, is shown in Table 5.6.1.

If the variety Unirea, the higher yields were obtained from F0 version, with 663 kg / ha for F20 and 1.545 kg for F40 variant, which resulted in production values superior to that obtained from F0 with 3.520 lei for F20 and 8.201 lei / ha for F40. The
F40 version, taxable income is higher with 5.062 lei / ha from F0, with a rate of return of 96.87%, or for 100 lei spent is produced a taxable profit of 96.87 lei.

Violet variety yields obtained vary between 3.152 kg / ha and 4.005 kg / ha, which resulted in production values between 16.640 lei / ha and 21.161 lei / ha, depending on the variant of fertilization. The highest rate of return on taxable income was obtained from version F40 (81.94%), followed by F20 (73.53%) and F0 (69.50%).

For Agrosel cultivation, the largest taxable profit was obtained from F40 with 3.248 lei / ha higher than F0, with a rate of return of 73.07%, followed by F20, with 2.144 lei / ha higher than F0 and rate of return of 67.16%, or 100 lei spent to produce a taxable profit of 67.16 lei.

Lastly, for the cultivation of Chisinau we obtained the most production for version F40, higher by 410 kg / ha from F0 to F20 achieved a higher taxable profit 1.131 lei / ha for F0, with a rate of return of 55.61%. In contrast to F40, taxable income is higher with 1.203 lei / ha for F0 and a rate of return of 55.62%, or 100 lei spent to produce a taxable profit of 55.62 lei.

Table 5.4.1.
The indicators of economic efficiency in growing artichokes
(Jucu, average 2008-2010)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fertilization</th>
<th>Production kg/ha</th>
<th>Value of production lei/ha</th>
<th>Total expenditure lei/ha</th>
<th>Profit</th>
<th>Return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Taxable lei/ha</td>
<td>Net + subsidy lei/ha</td>
</tr>
<tr>
<td>Unirea</td>
<td>F0</td>
<td>3.590</td>
<td>18.938</td>
<td>10.646</td>
<td>8.292</td>
<td>7.448</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td>4.253</td>
<td>22.458</td>
<td>12.046</td>
<td>10.412</td>
<td>9.229</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td>5.135</td>
<td>27.139</td>
<td>13.785</td>
<td>13.354</td>
<td>11.700</td>
</tr>
<tr>
<td>Violet</td>
<td>F0</td>
<td>3.152</td>
<td>16.640</td>
<td>9.817</td>
<td>6.823</td>
<td>6.214</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td>3.457</td>
<td>18.257</td>
<td>10.521</td>
<td>7.736</td>
<td>6.981</td>
</tr>
<tr>
<td>Agrosel 656</td>
<td>F0</td>
<td>2.470</td>
<td>13.037</td>
<td>8.511</td>
<td>4.526</td>
<td>4.285</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td>3.485</td>
<td>18.413</td>
<td>10.639</td>
<td>7.774</td>
<td>7.013</td>
</tr>
<tr>
<td>De Chişinău</td>
<td>F0</td>
<td>2.273</td>
<td>12.006</td>
<td>8.139</td>
<td>3.867</td>
<td>3.731</td>
</tr>
<tr>
<td></td>
<td>F20</td>
<td>2.647</td>
<td>13.985</td>
<td>8.987</td>
<td>4.998</td>
<td>4.681</td>
</tr>
<tr>
<td></td>
<td>F40</td>
<td>2.683</td>
<td>14.185</td>
<td>9.115</td>
<td>5.070</td>
<td>4.742</td>
</tr>
</tbody>
</table>

In Figure 5.6.1. situation of profit is given to the cultivation of artichokes, average of 2008-2010. The greatest net profit was obtained from the variety Unirea (8,98 thousands lei / ha), followed by Violet (6,75 thousands lei / ha), Agrosel 656 (5,31 thousands lei / ha) and Chisinau (3,90 thousands lei / ha).
6. CONCLUSIONS

6.1. CONCLUSIONS ON MARIGOLDS

- **Concerning seed germination:**
  - for marigold seeds of 3 years (production 2008) germination energy (38%) was much higher (> 100%) than fresh seeds; maximum germination capacity was for seeds harvested in 2009 and 2010.

- **Regarding the influence of fertilization with manure on plants, waist and mass of 100 inflorescences:**
  - marigolds size was influenced directly proportional with fertilizations and precipitations, vary depending on the cultivar. The largest size (average 2008-2010) was recorded for F40, for the cultivars del Pacifico Belezza (> 90 cm) and Agrosel 696 (88,7 cm);
average weight of 100 fresh flowers was different depending on the cultivar, fertilization and climatic conditions. The highest values were registered in 2008 and F40, for Belezza del Pacifico (355 g) and Cluj 2 (345 g). In average for over three years, the two had the same mass cultivation of 100 inflorescences on F40, F20 and F0 but, Cluj 2 had exceeded Belezza del Pacifico.

**concerning the production of *Calendulae flos***:

- there were dried marigold flowers productions between 1.042 and 1.700 kg / ha. The highest yields were obtained in 2008, when climatic conditions were more favorable than in other years.
- from the fertilization of the three options, the best effect was seen in the F40 production in all cultivars, with significant differences from the witness unfertilized (F0);
- average productions, 2008-2010, of dried flowers were higher for Belezza del Pacifico cultivars (1.418 kg / ha) and Cluj 2 (1.403 kg / ha).

**concerning the chemical composition of flowers and production of active ingredients per hectare**:

- increasing carotenoid production was recorded in the cultivation of Cluj, 1.17 kg / ha (the F40) and 1.11 kg / ha to F20, followed by cultivation of Diana, with 1.01 kg / ha, at F40;

**economic efficiency of growing marigolds in Jucu, 2008-2010**:

- of the studied cultivars, the largest net profit (average 2008-2010) is obtained from Belezza del Pacifico (3,69 thousands lei), followed by the Cluj 2 with an average net profit of 3,65 thousands lei, due to high production;
- of the three agrofunds, manure fertilizing with 40 t/ha turns out to be the most efficient in economic terms, to all of the cultivars.

6.2. CONCLUSIONS ON ARTICHOKE

**regarding the influence of fertilization with manure and plant density culture of waist and the number of artichoke leaves**:

- artichoke plant size was influenced directly proportional to the fertilization with manure in doses of 20 t / ha (F20) and 40t / ha (F40) and inversely proportional to the density culture(directly proportional to the distance between plants). The largest size (average 2008-2010) was recorded at low density (D60, with 2.38 pl/sqm) to cultivate Unirea (over 54 cm to 50.6 cm F40 and F20);
- fertilization and greater distance between plants (D60) stimulated the formation of leaves, in different ways depending on the cultivar, more to the
Unirea (the F40, D60) and Agrosel 656 (F40 and F20 at, D40), with very significant meanings to F0.

- **Regarding the production of Cynarae folium:**
  - at artichokes, in 2008-2010, we harvested production from 1.96 t / ha (656 Agrosel to F0, D60, in 2009) and 6.2 t/ha (Unirea from F40, 2008) dried leaves. Three of the four cultivations (exception De Chişinău), were fertilized with 40 t / ha manure (F40) resulted in very significant production increases from F0 in both densities;
  - at higher density (D40) production increases were 7-26% higher than in D60, comparing the average values of the three years of production;
  - most productive cultivar was found to be Unirea, its average production being higher, with very significant difference compared to other cultivations.

- **Regarding the chemical composition of leaves and production of active ingredients per hectare:**
  - phenilprophanic derivatives production was between 163 kg /ha for the cultivation of De Chişinău (F0) and 379 kg / ha in the Unirea (F40). This production is mainly determined by the amount of Cynarae folium per hectare.
  - production of flavonoids, kilograms per hectare, is determined mainly by differences in production for Cynarae folium is between 81 kg, the cultivation of De Chişinău, F0, and 188 kg in Unirea, F40.

- **Regarding the economic efficiency of growing artichokes in Jucu, 2008-2010:**
  - from the cultivars studied, the highest net profit was obtained in cultivation Unirea (8.976 lei / ha), followed by far by the Purple (6.745 lei / ha). The main driver of profit was due to the production of plant material.
  - from the three agrofunds, the ones fertilized with 40 t / ha manure turned out to be the most economically efficient of all cultivars due to higher production per hectare.

**Recommendations**

- We recommend extending the culture of two cultivars of marigold Cluj 2 which has large flowers (which leads to higher productivity in harvesting), abundant, high production and high content of active ingredients, mainly carotenoids. Also, economically, it is more profitable (average rate of profit = 38%) than other studied cultivations, especially if fertilized with 40 t / ha manure every four years.
At artichokes, we recommend growing the variety Unirea, which has shown good results in the period 2008-2010, in the experimental field from Jucu, whose climatic conditions are similar to those of the Transylvania Plain. Unirea has excelled in high yields and quality, which is confirmed by the high rate of profit (74%), especially if fertilized with 40 t / ha manure every four years.

Given that herbs are well suited to cultivate in organic cultures, provided they are certified as such, the economic results would be much better in this system, due to price recovery over large production and subsidies granted, 270 euro / ha in 2011.
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