UDC: 633.861-157(496.5)
Professional paper

THE STUDY OF MORPHOLOGICAL AND PRODUCTION INDICATORS OF SAFFLOWER CULTIVARS (*CARTHAMUS TINCTORIUS L.)* IN ALBANIA

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ABSTRACT

Safflower is an annual oil plant of the Ombrelifere or Asteriaceae family. It is widespread in the wild state in some countries of the world. It is treated as a weed. For several years, it has been treated as a food coloring plant, for various textiles and as a dyestuff agent for human hair. Meanwhile, it is also used for the production of lipstick for women. Later, the values for the oil content found in its fruit were determined. Precisely for this, studies have been done on various genetic, technological, agricultural, and industrial aspects. For several years, the study of some cultivars of safflower was carried out in Albania. The study was carried out in the district of Lushnja, initially in collaboration with the University of Viterbo, Italy, and later, the work continued for several years, independently in Albania. Eleven cultivars originating from Italy, France, Spain, and the USA were included in the study. The study was carried out according to the methodology designed and approved by both Universities, making biometric measurements of morphological and productive indicators: plant height, number of branches on the plant, number of pods (captions) per plant, number of fruits (achen) per pod and plant, the weight of 1000 fruits (g), production per plant (g) and yield (kv/ha).

Keywords: Safflower, branch, cultivar, pod, fruit, achen, dyestuff, oil.

INTRODUCTION

Oil plants have been the object of scientific work in every country constantly because they are needed for the production of different oils, especially edible oil, which is irreplaceable for meeting human needs. In the Balkans, oil plants have been widespread and therefore remain the object of research and scientific work with the main aim of improving some of their indicators such as:

a- a- Increasing the yield.
b- Increasing the oil content of their seeds.
c- Continuous improvement of oil quality.
d- Improving the cultivation technology of oil plants
e- Mechanization of all links of the technology of cultivation of oil plants.
f- Improvement of industrial processing technologies for the production of oil plants to increase the industrial radius of oil extraction.

In Albania, oil plants are comparatively younger than other plants in the fields. They were first represented by the peanut and later by the sunflower. In the former Institute of Agricultural Research (IAR)- Lushnja, today the Agricultural Technology Transfer Center (ATTC), there was

a scientific sector of oil plants with three specialists and scientific researchers. Considering the problems that these plants have and humanity's need for vegetable oils, especially edible oils, new plant alternatives for the production of oils of plant origin have been constantly sought. Through various efforts, it has been possible to treat the safflower plant (*Carthamus tinctorius L*.) as an alternative plant for the production of vegetable oils.

SCIENTIFIC METHODOLOGY

For the safflower plant (*Carthamus tinctorius L.)* partial studies have been done with success in the following aspects:

a- Botanical descriptions of different plant organs.
b- Chemical and biochemical analyzes through which the chemical components were determined, especially fatty acids (palmitic, erucic, oleic, linoleic, linolic and stearic).
c- Medicinal and nutritional values of safflower as well as ways of use for these purposes
d- Agronomic studies have been carried out determining the most important parameters of the cultivation technology, and care during the plant period as well as some of the most disturbing and damaging diseases and pests for this plant.

In Albania, it has been determined that one of the most widespread and important species of the *Carthamus* genus, Carthamus "leshatak" (*Carthamus lanatus L.),* is found in the wild in the oak areas, identified and described by Prof. Mustafa Demiri. *Carthamus tinctorius L.* is an annual plant, it grows in dry grassy places, mainly in the area of oak. The leaves contain bitter substances, the fruits 27-36% oil, while the flowers 0.02% essential oil with aroma. The juice obtained by boiling the plant is used against scabies and ringworms. Animals do not eat it, while as silage it is relished by all kinds of animals. It is a bad pre-plant for all agricultural crops.

Based on the literature descriptions, data on the requirements of this plant to the climate, soil, and nutrients, as well as the fact that one of the most important species is located in Albania, we think that the safflower plant can be cultivated successfully in Albania and some areas of the Balkans, both as spring and winter plant. Therefore, the study was undertaken to evaluate some morpho-biological and productive indicators of some safflower cultivars (eleven) of the species *Carthamus tinctorius*

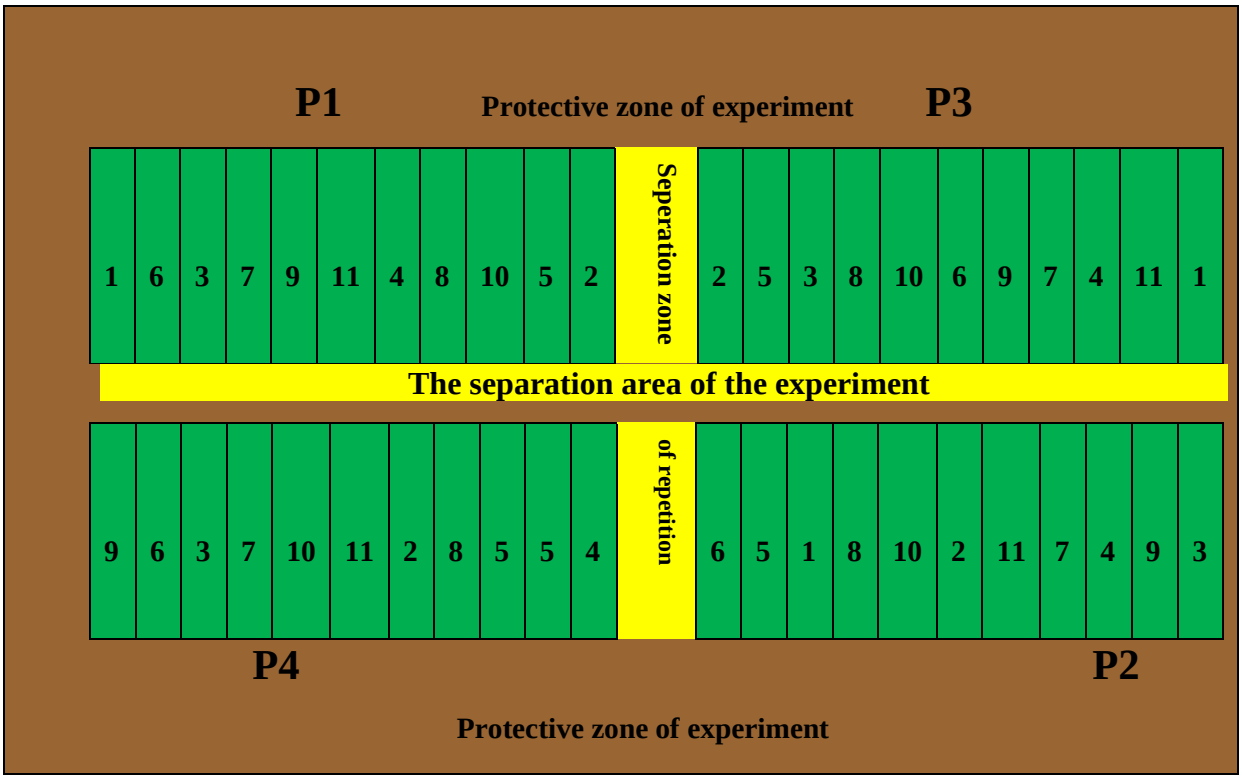
A- The cultivars included in the study:

1. Montola 2000. 2. Roberto. 3. Bacum. 4. Ruggero. 5. Espheau. 6. Benno.

7. SAFF 2002. 8. Benno (2) 9. Bellisario 10.Guaimaro 11. VC – 150.

The experiment was set up according to a randomized block design with four replications.

The size of the variant is 3 x 2.4 m = 7.2 m2. Planting is done based on the literature, with a distance between rows of 60 cm and between plants of 4-5 cm.



Scheme No. 1 Setting up the experiment

In fertilization, 80 kg of active substances nitrogen and phosphorus were used respectively, while 100 kg of active substances were used for potassium. Phosphorous and potassium fertilizers were used in the basic fertilization, as well as 30% of the amount of nitrogenous fertilizers in the form of urea.

To perform the biometric measurements, 10 plants for each variant in their central part (most protected) part were predetermined. Indicators were measured:

1. Plant height (cm).
2. Number of branches per plant.
3. Number of pods per plant.
4. Weight of 1000 fruits.
5. Production per pods, (g)
6. Yield kv/ha

For all the above indicators, data processing was done to draw the most accurate conclusions about the differences between cultivars.

During the vegetation, supplementary fertilization was done in two hands accompanied by hoeing.

Harvesting was done at the stage of full ripening, also measuring the harvested area for each variety.

RESULTS AND THEIR DISCUSSION

The experiment was set up by the designed methodology and the planting of cultivars was done on March 10 and 16 for all the years of the study. During the vegetation of the plants, measurements were made for all morphological and productive indicators, and after harvesting, threshing was done for each variant separately (avoiding mixing). Also, the corresponding yield calculations were performed

I. **The height of the plant**

By comparing the plant height data, we notice that the cultivars have no statistically proven differences (Dmv: 0.05=14.8962 and 0.01 19.0822), excluding the Espheau cultivar which has a greater height.

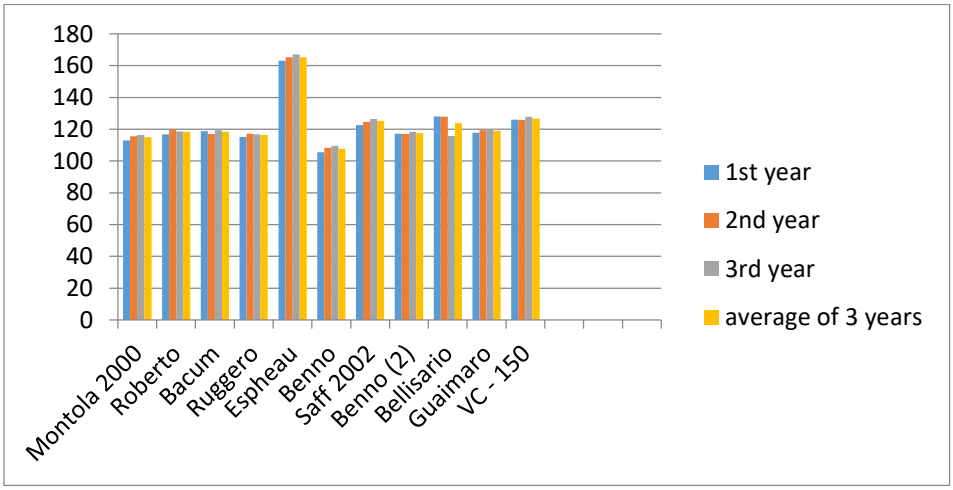


Chart No. 1 Plant height (cm)

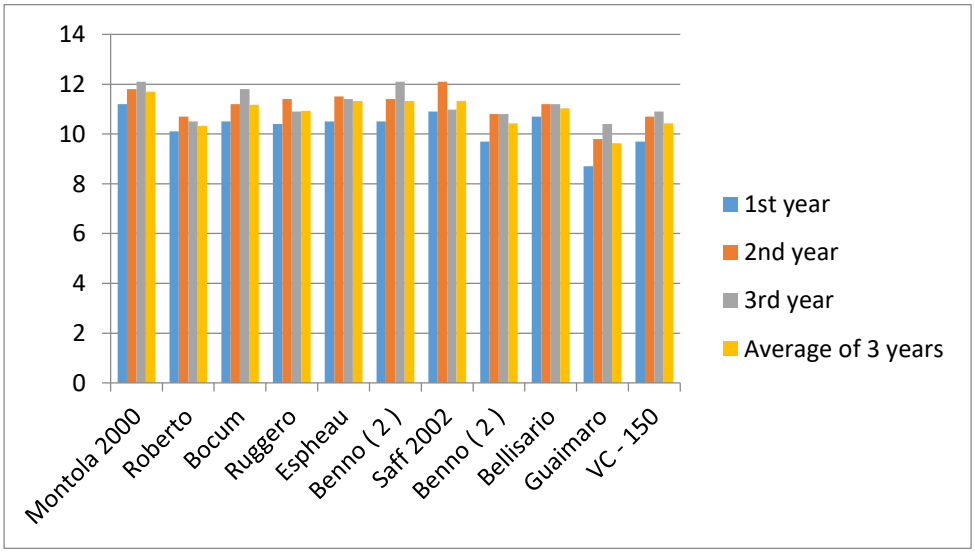


Chart No. 2 Number of branches/plant

The number of branches per plant is approximate and there are no differences confirmed by the statistical processing of the data (Dmv 0.05 2.004542 and 0.01 2.567844).

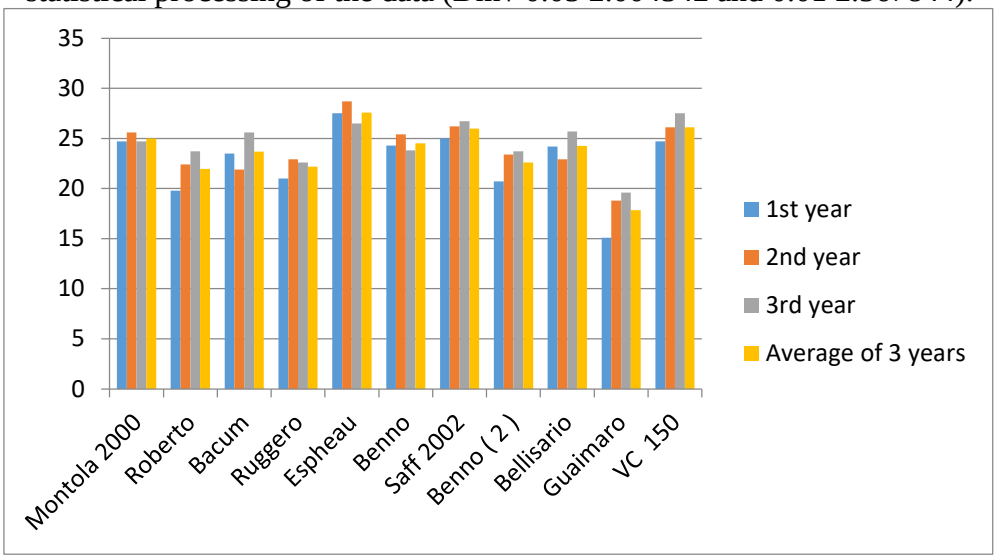
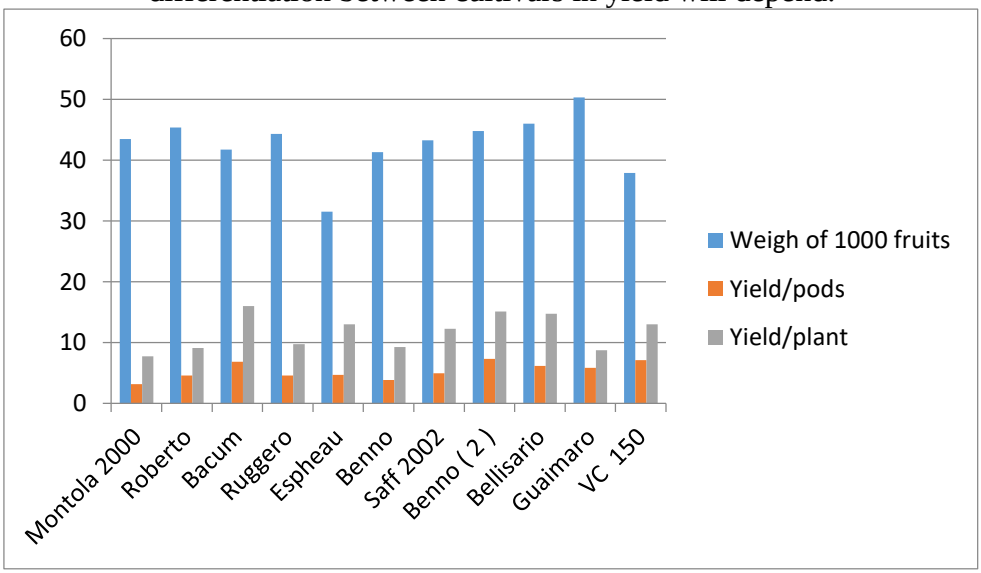


Chart No. 3 Number of pods/plants

The total number of pods per plant was analyzed to extract differences between cultivars. In principle, the cultivars that have a greater height and a higher number of branches also have a higher number of pods specifically: Espheau, Benno e Bellisario, and the Roberto cultivar has the lowest height. Practically, two groups are formed for both levels of security, on which the differentiation between cultivars in yield will depend.



Graph No. 4 Weight of 1000 fruits, production per cone (g), and production per plant (g)

The above indicators are different and interdependent, so in the case of a low number of pods per plant, the fruits are of higher weight, so they compensate for each other. The weight of 1000 seeds show differences (Dmv 0.05= 5.471868 and 0.01= 7.009532) and the cultivars Guaimaro and Bellisario have the highest weight, both cultivars have plants with dense bushes and few branches. The cultivar VC 150, which forms more pods, has a lower weight. The yield per pod is again

different between cultivars. The middle pods are fuller and give higher production and have 5-7 fruits. The ratio of formed flasks to the number of producing flasks is 3-4 to one, so almost one in every five flasks is productive. The ratio of formed pods to the number of producing flasks is 3-4 / 1, so almost one in every five pods is productive. A regularity is observed in all cultivars, the upper branches form fewer pods and give less production. Production per plant shows differences between cultivars, distinguishing cultivars: Bacum, Benno (2), Bellisario and Saff 2002.

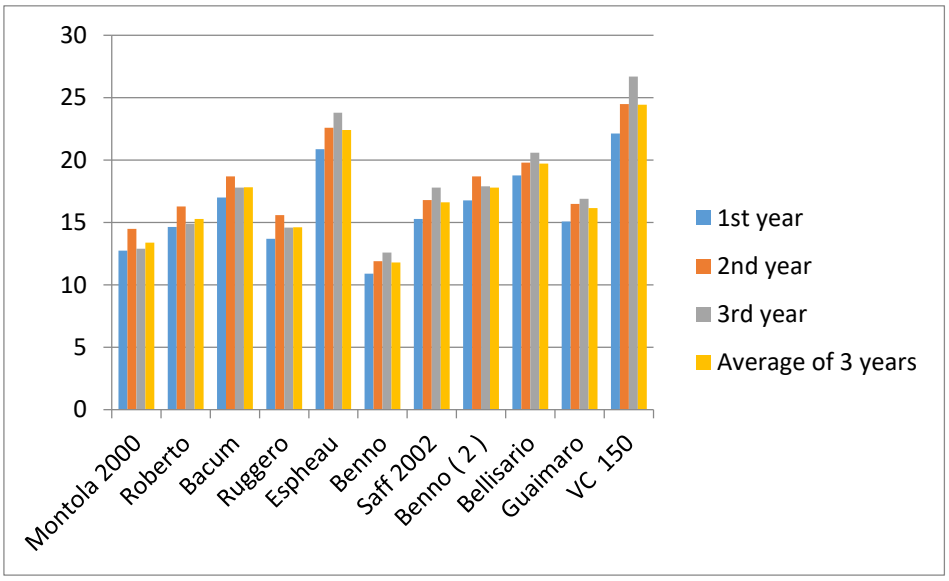


Chart No. 5 Yield kv/ha

Dmv 95% 6.120814

Dmv 90% 7.84084

If we analyze the yields compared to the Dmv value, we conclude that:

a- The cultivars Espheau, VC 150, Bellisario, Benno (2) and Bacum are the best cultivars for the 95% probability level.
b- While the cultivars Saff 2002, Guaimaro and Ruggero are included in the second group for the 99% probability level.
c- Cultivars Montola 2000 and Benno form the group with the lowest yield, compared to the other cultivars.

If we make a comparison with the sunflower plant and the peanut plant, we will distinguish the safflower plant for some advantages it has:

- First, the safflower plant has a higher yield of fruit and oil.
- Second, it has better oil quality because it has higher oleic and linoleic acid content.
- Thirdly, there is the possibility of mechanization of production harvesting.
- Fourth, it can be planted even in soils where other plants cannot be planted
- It is more resistant to diseases and pests.

Conclusions and recommendations

From the data processing and analysis of all the morphological and productive indicators of safflower cultivars (*Carthamus tinctorius L.*), we can draw some conclusions and give the following recommendations:

A. Conclusions

1. Safflower is an alternative oil plant that produces better quality oil and gives a higher oil yield than other oil plants.

2. It can be cultivated as an autumn plant as well as a spring plant because it tolerates low temperatures.

3. The cultivars present differences in morphological and productive indicators that testify to the sensitivity of cultivars to environmental conditions and cultivation technology.

4. The highest yielding cultivars are Espheau and VC-150 which yielded higher than the other cultivars.

5. For the best cultivars, the study of cultivation technology parameters can be carried out in larger areas.

6. After safflower cultivation it is necessary to carry out soil analysis to determine the cause: why is safflower a bad pre-plant?

7. Performing chemical analysis of safflower oil is very important to determine the quality of the oil.

8. Performing analyses to determine the spectrum of fatty acids is very important and determining the ecological and technological factors for changing their level and especially fertilization.

B. RECOMMENDATIONS

From the studies carried out so far, as well as from the conclusions drawn, we can give recommendations on the most important aspects, among which we can mention:

1. The two cultivars that have given the best results, Espheau and VC-150, should be studied in different areas and especially for the main cultivation parameters.
2. The two cultivars that give the highest yield can be propagated, also studying them from being affected by pests and their main diseases.
3. Performing chemical analyses with modern methods by the company "OLIM", as well as performing production, economic, and quality calculations could more clearly show the values of this alternative oil plant for the future.

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