Camelina sativa (camelina, false flax, wild flax, German sesame, Siberian oilseed), is a flowering plant in the family Brassicaceae. It has been grown in Europe for a long time (in the Bronze Age it was considered a major crop), as an oilseed crop to produce high quality vegetable oil. In modern age, camelina cultivation has been diminished, but in very recent years, the surfaces have increased. This reconsideration of camelina crop is due to the interest for biofuels and low input production systems. Camelina could be an interesting solution for marginal lands and for conservation tillage systems.

INTRODUCTION

On the basis of an increase in request for high quality oils, biofuels and edible powders, the surfaces occupied by the oleaginous crops are continuously extending. For the temperate climate, basic oleaginous species are represented by soya, sunflower and oilseed rape. The percentage of the three species will continue to grow in agriculture, taking into account the wide adaptation of these crops and the continuous development of new varieties and hybrids, with improved characteristics.

However, each of these major oleaginous crops has its limits. In the last years, there was an increased interest in developing agricultural systems with minimal requirements for fertilisers, pesticides, energy and they offer a better control for soil erosion as opposed to conventional systems. This has determined the extension of researches on Camelina sativa species as an oleaginous plant, with minimal crop requirements, as a well adapted species for marginal lands cultivation, or as a source for soil conservation through agricultural practices.

Camelina is a plant originating from Middle Est. There is much archeological evidence showing that the plant has been cultivated in Europe for at least 3000 years. The oldest archaeological sites include the Neolithic period in Switzerland (dated in 2nd millennium B.C.), the Chalcholitic period in Greece (dated in 3rd millennium B.C.) [6].

Oils could be obtained from camelina and poppy seeds, being used in alimentation, illumination and leather tanning.
According to Zohary and Hopf, until 1940, the *Camelina sativa* crop was an important oil crop in Eastern and Central Europe, and has currently continued to be cultivated in a few parts of Europe for its seed which was used, [2] for example, in oil lamps (until the modern harnessing of natural gas and propane and electricity) and as an edible oil. Sativa was spread in Central and Eastern Europe, the oil obtained from the seeds being used in oil lamps for illuminating purposes and as edible oil [6]. The plant continued to be cultivated in several parts of Europe for its seeds (Poland, Romania, Russia etc.).

**MATERIAL AND METHODS**

**Botanical and biological particularities**

*Camelina sativa* (L) Crantz is part of the *Brassicaceae* family, the *Camelina* type that includes many species. The plant is generally known as “camelina”, *false flux, gold of pleasure, lennica* etc. For the production of alimentary oil, two species are used: spring camelina - *Camelina sativa* (Figure 1) and fall camelina - *Camelina silvestris* [7]. For biofuels, spring camelina is considered.

*Camelina sativa* is a plant with a taproot, whose branched stem in the superior third has a height between 40 and 100 cm. The plant is glabrous or covered with fine hairs in the upper part.

Its leaves are simple, glabrous or covered with fine hairs, lanceolate shaped, short-petiolate at the base, and sessile in the upper part.

Its flowers are small, pale yellow, of type 4 as all the crucifers. They are racemously disposed in inflorescence. The fruit is a long pyriform pod of 6-12 mm and contains 7-10 rust-colored or yellowish-brown seeds of approx. 0.7 mm x 1.5 mm. It is an allogamous plant.

Camelina proved to be an allelophatic plant [4].

**Economic and alimentary importance**

Camelina is cultivated especially for seeds with content in oil of 26-46% [5]. Camelina oil is used in a fresh condition in alimentation, having a “specific taste of onion and mustard, as well as a pleasant, moderate and pure perfume” [7]. Possessing siccative properties, the oil is also used in the paint and varnish industry. Camelina oil is also utilized in the manufacture of soap, in the metallurgic industry etc. Camelina cakes are being used with good results in animal feed, as an organic fertiliser or as a solid biofuel.
Crop technology

_Camelina sativa_ belongs to the oleaginous plants’ group, with a short period of vegetation, reaching maturity in 70-95 days. It is a long day plant and, as such, it shortens its vegetation period along with the northward advance.

Due to the short period of vegetation, it can be successfully cultivated in the North of Europe, sometimes exceeding even the line of the Arctic Circle. Concurrently, camelina can be also cultivated in highlands, at heights up to 1400 m. Camelina does not pose many requirements regarding the climate, and high temperatures from the flowering period do not influence the production considerably. It presents a low sensibility towards late spring frosts. For its development, it needs a bit of warmth, the crop containing forms of spring and fall camelina. Those planted in the fall are relatively resistant to frost, surpassing from this point of view the oilseed rape. Fall forms are cultivated more in the southern regions where there are no harsh winters; instead, spring forms are being cultivated both in the northern regions and in the southern ones. Camelina can be successfully cultivated in arid areas. Due to the short period of vegetation, summer drought is avoided.

Camelina is not pretentious towards the soil. It thrives well even on light, sandy soils, poor in nutrients. Camelina does not grow well on heavy, clay soils that form a crust and block the normal emergence of plants. Also, the peat or the swampy soils are not suitable. Camelina finds very good conditions for developing in our country. It can be recommended especially in areas with poor, eroded soils, in which other less pretentious crop plants do not offer satisfactory results.
**Crop rotation.** Camellina does not pose many conditions towards the place we offer in the crop rotation. It gives satisfying results after any preceding plant; the best are the widely-grown crops. Camellina can successfully replace the fall cereals compromised by frosts, due to the fact that it has a short period of vegetation, which allows a late sowing. In turn, camellina is a good predecessor for most of the crop plants, as it leaves the land early and in a good fertilisation state.

**Soil tillage.** The land intended to camellina crop establishment must be very well levelled and superficially hoed, as camellina has small seeds. When crop rotation comes after cereals, soil tillage begins by stubble harrowing, followed by a tillage at 20-22 cm deep. After corn and sunflower only the deep fall ploughing is done. Before sowing, the soil must be tilled with a combinator to a depth of 5-6 cm.

**Seed and sowing.** Camellina emerges at 10°C, and plants resist to late spring frosts reaching minus 5°C, therefore, the crop can be established without any danger, as early as possible in spring. Early sowing gives the possibility for seeds to find the necessary moisture for germination. Late sowing reduces the yield because of weed competition. Fall camellina is sown in November - December.

Sowing is executed with drill machines in rows, to a distance of 12.5 cm between rows and a seed rate of 6-7 kg/ha, assuring a density of 200 plants/m². Good results can also be obtained by sowing directly in the stubble, if the land is cleared of weeds. Drill machines in rows are used directly on the stubble (with a disc drilling) and the same seed rate. In winter, the method of superficial sowing can be used by seed broadcast on the frozen soil, case in which the seed rate reaches up to 14 kg/ha. The sowing depth is of 1-1.5 cm.

**Plant protection.** Due to the short period of vegetation and the fast rate of growth, camellina controls very well the weeds in case of winter or early spring sowing.

The first work of plant protection is executed after plants’ emergence and consists of perpendicular harrowing of the crop in the direction of the rows, executed with a light harrow, in order to destroy the weeds. When camellina plants have reached the height of 6 - 7 cm, the first work with the comb-harrow is done and the second one before the floral buds formation.

Chemical weed control in the camellina crop is not well established. In studies conducted over several years, camellina was not affected by Trifluralin herbicide incorporated in fall or spring before sowing, but the yield has not recorded growths, as compared to the variants which the herbicides were not used [4]. Currently, herbicides are not recommended to be used in the camellina crop, as their use would include a significant increase in the production cost, with no production gains.

For fertilisation doses of chemical fertilisers are recommended: N: 60-75 kg/ha; P₂O₅: 30-40 kg/ha; S: 12-24 kg/ha, but it also responds well to lower doses.
In terms of water, conditions are reduced, being better adapted to arid areas than other oleaginous plants, valuing well the winter and spring rainfalls.

**Pests and diseases.** From the studies extended on several years, it was noticed that the damages caused by diseases and pests to camelina crops do not usually justify the chemical control measures. The diseases that sometimes affect camelina crops are represented by:

- **Blight** (*Peronospora camelinae*) is sometimes observed in camelina crops. It appears as a grey or white mould which is manifested in the upper part of the stem. As a control measure, crop rotation is imposed and if necessary, chemical control with specific fungicides.

- **White mould** (*Sclerotinia sclerotiorum*) is manifested sometimes on stems as discolored lesions, on which a white, soft mushroom can develop. Following the lesions, stems can bend or break, causing yield losses. As in the case of oilseed rape, the crop rotation method is imposed and if necessary the application of fungicides treatments is required. The attack is not virulent as in the case of oilseed rape crop.

Camelina has proven to be resistant to black leg (*Leptosphaeria maculans, Phoma lingam*), which is a serious disease of oilseed rape. Also, camelina is resistant to alternalia blight (*Alternaria brassicae*), a disease that causes significant damages to the oilseed rape [4]. Amongst pests, the attack of crucifer flea beetle (*Phlylotreta cruciferae*) was observed in the camelina crop during the arid years, but it does not cause serious damages as in the case of the oilseed rape.

**Harvesting.** Camelina is characterized by a uniform maturation. The proper moment for harvesting initiation is when pods turned brown and seeds have gained the characteristic shape, size and color. The losses caused by shattering in case of harvesting delay are significant and can even reach up to 20-30%, therefore being required for the harvest to be done on time. After thashing, if necessary, the seeds are cleaned of impurities, usually remaining mixed with other pod remains, weed seeds, insects etc. For their storage, they must be dried, so that the percentage of water will not exceed 8-9%. The production of seeds for camelina can reach 800-1500 kg/ha, but yields of over 2000 kg/ha can be obtained by applying superior agrotechniques.

**CONCLUSIONS**

1. *Camelina sativa* has unique agronomical features that could substantially reduce and even eliminate the requirements regarding the soil preparation and annual weed control.

2. It is compatible with reduced systems of soil works (minimum tillage), or with systems without works (no till), with reduced inputs.
3. It presents high resistance to draught and disease and pests attacks.
4. It resists very well to high temperatures during flowering time.
5. It can be also used as a cover crop.
6. It does not impose conditions towards the soil. It thrives well even on light, sandy soils, poor in nutrients, where more pretentious crops do not give results.
7. It is recommended for cultivation of marginal or degraded lands.
8. The seed rate is reduced (6-14 kg/ha) and it does not require special and expensive sowing equipments.

Considering all the special qualities of this oleaginous species, further researches and an extension on a longer period of time are required.

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