STUDIES UPON THE DEVELOPMENT OF AN INTEGRATE SYSTEM FOR PRODUCTION AND USE OF *CAMELINA SATIVA* IN THE TRANSYLVANIAN PLAIN CONDITIONS (I)

Naghiu[1)] Al., C. Topan[1)], V. Dancu[2)], Livia Naghiu[1)], V. Sarb[1)], AdrianaDavid[1)]
[1)] University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture, 3-5 Manastur Street, 400372, Cluj-Napoca, Romani;
[2)] C.I.O.S. Ludus, Romania

Abstract. The present paper is the first part of a series dedicated to the development of an integrate system for production and use of *Camelina Sativa*. There will be studied during a five years research programme the optimum crop technologies for the Transylvanian Plain conditions, together with the best use of the crop. The agricultural year 2011-2012 was characterized by being very dry. The first experimental results were encouraging, demonstrating that *Camelina sativa* is not claiming special cropping conditions, being suitable for the Transylvanian Plain area. The best results (1,95 t/ha) were achieved using a 176 plants/m^2 density and a ration N/P/K of 100/66,8/40 (25 cm between the rows). Harvesting one of the most important parts of the technological chain, as it could lead to high yield losses without and accurate adjustment of the combine.

Key words: *Camelina sativa*, crop technology

INTRODUCTION

Actually, at the beginning of the third millennium, agriculture production is passing important changes. Despite the world population increasing in number and demands the agricultural development assures the conditions for providing enough food for everybody and the necessary raw materials for industry. The inequity of the "pie" distribution at the world level is a political matter, not a technical one, and this is not a subject of the present paper.

The big step forward is now related to the permanent life quality increasing. The quantity and the quality of the food together with the enlargement of the raw materials for industry are important targets for agriculture, together with the necessary contribution to the environment preservation.

In this context, in the last years it was rediscovered *Camelina Sativa*. Camelina sativa has been traditionally cultivated as an oilseed crop and the archaeological evidence shows it has been grown in Europe for more than 3,000 years [1, 2]. The earliest find sites include the Neolithic levels (in Switzerland), the Chalcolitic one (in Greece) and *Sucidava-Celei* (Romania) [2]. During the Bronze and Iron ages Camelina sativa was a quite important oil crop in the Northern Greece beyond the development of the olive crop [1, 2]. According to *Zohary* and *Hopf*, until the 1940s, it was an important oil crop in eastern and central Europe (e.g. Poland), and currently has continued to be cultivated in a few parts of Europe (e.g. Denmark) for its seed oil, which was used in oil lamps and as an edible false flax oil [5].

It is interesting the dual interest on this vegetable oil: as a vegetable fat for food products and as a raw material for special biofuels (bio kerosene).

As a consequence in many countries in the world there were developed very interesting researches upon the Camelina sativa cropping systems.

In this direction it was established a complex research team to study the optimum crop technology in the conditions from the Transylvanian Plain together with the best capitalization of the seeds. The research programme is planned to be developed on five years with the main objective of optimum agricultural technology for higher yields and higher oil content (fig. 1). During this period there will be tested several crop conditions, e.g. different sowing periods: mid of September, late November, March, in order find the crop behavior.

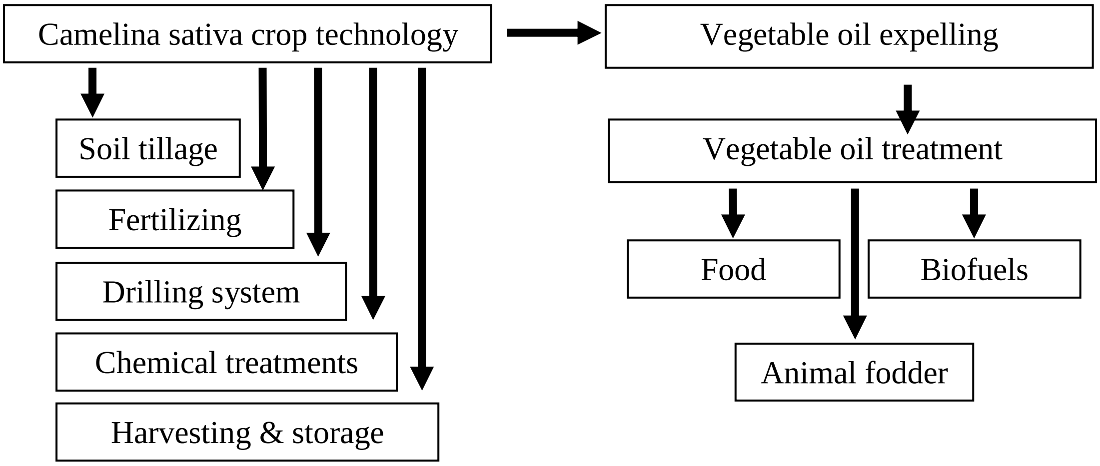

Fig. 1. General research programme scheme

MATERIAL AND METHOD

The cultivar seeds were of German origin.

First step was the seeds germination study, followed by the field tests.

The field researches were carried out in the fields of the Cultivar Testing Center (CIOS) Ludus, area that offers the characteristic conditions for the Transylvanian Plain. The research fields are situated on a plane at 370 m altitude.

The experimental plots were situated on the loamy iluvial chernozem soil, with a moderate acid reaction (pH = 5,5…6,2). The soil has a clay texture with a 3 % humus content and a good supply with phosphorus (63,16) and potassium (147,0).

The area climate is a continental one, with very hot summers and moderate cold winters. The passing from a season to another is quite fast.

The mean multiannual temperature is of 8,7 ^{0}C (14,6 ^{0}C in May and 17,9 in June).

From the precipitation point of view, the mean multiannual level is of 550 mm, sufficient for most of the region crops. The rainfalls are un-uniformly distributed during the year, 65…75 % of them being in the period October-July. The agricultural year 2011-2012 was characterized by being excessively dry.

The prior culture was winter wheat.

The small dimension of the seeds imposes a high level of soil shredding. 25 cm depth ploughing was followed by the use of a harrow and a leveler. The crop chemical treatments included a herbicidation with Dual Gold, 1,5 l/ha, work that was followed by the use of a combinatory harrow and a roller.

The basic fertilization was done prior to the sowing (table 1).

Table 1

Crop fertilization

Nr. Crt.	Density	Fertilization (kg us)								
		R1			R2			R3		
		N	P	K	N	P	K	N	P	K
D1	156	72	66,8	40	100	66,8	40	120	66,8	40
D2	176	72	66,8	40	100	66,8	40	120	66,8	40
D3	312	72	66,8	40	100	66,8	40	120	66,8	40

The crop was sown on the 05.04.2012 with the SAXONIA drilling machine, in three variants: D1 – 152 plants/m^2, D2 – 176 plants/m^2 and D3 – 312 plants/m^2. The distance between the rows was of 25 cm.

During the vegetation period it was distributed nitrogen in there variants: 72, 100, 120 kg/ha.

RESULTS AND DISCUSSION

Germination.

Heat is one of the most important climatic factors acting directly on the ability germination seeds. Thus, to determine the optimum temperature for germination of Camelina Sati seeds there were studied the effects of the following temperatures: 24 °C, 15 °C, 5 °C.

Fig. 2 The germination experiment

Based on the results and statistical calculations (analysis of variance) performed (shown in table 2), significant differences were found from negative temperature control, fact that allows us to statue that it is a direct correlation between temperature and germination energy.

In terms of germination (table 3) it was found that at 15 °C the differences are significantly distinct negative to temperature control, but the more the temperature drops it was observed that germination of Camelina Sativa is significantly negative compared to the control base, in the same direct proportionality.

In the same time, significant differences were found between the three different temperatures by applying the *Duncan significance test*.

Table 2

Influence of temperature on germination energy

Experimental factor Temperature	Germination	%	Difference	Significance	Duncan Test
T1(24°C)	86,88	100	0	Mt.	C
T2 (15°C)	70,38	81	-16,5	000	B
T3(5°C)	15,38	17,7	-71,50	000	A
	LD/LSD (p 5%)			3,48	
	LD/LSD (p 1%)			4,82	
	LD/LSD (p 0.1%)			6,70	

Table 3

Influence of temperature on germination

Experimental factor Temperature	Germination	%	Difference	Significance	Duncan Test
T1(24°C)	87,25	100	0	Mt.	C
T2 (15°C)	80,63	92,4	-6,63	00	B
T3(5°C)	25,25	28,9	-62	000	A
	LD/LSD (p 5%)			3,48	
	LD/LSD (p 1%)			4,82	
	LD/LSD (p 0.1%)			6,70	

Field tests. The emergence date was 18.04 and the blossom period was 24.05-18.06. The precipitations from the first May decade have favorite the blossoming process.

Fig. 3. Camelina sativa plant development: a – early development; b - nearing maturity

Fig. 4. The Camelina sativa experimental field

The plants height was situate between 75,0 and 79,9 cm, showing a good development even in the dry conditions. The branching was between 12 and 15,8.

During the vegetation period it was a very good weed control of the test plots by mechanical & hand work.

The crop yields obtained in the different experimental conditions show that the best results were achieved using a 176 plants/m^2 density and a ration N/P/K of 100/66,8/40 (see fig. 5).

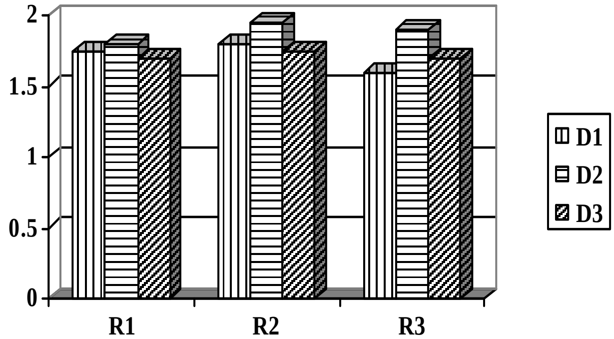

Fig. 5. Yields of the in the experimental fields
(D_i – different densities, R_i – repetitions)

A great importance has the harvesting moment as the yield could be dramatically diminished by shaking. As harvesting is usually done in first decade of July the best day period is early morning, when the air humidity is a little bit higher than in other parts of the day and the losses are lower. In the same time, the harvesting combine adjustment should be accurate.

CONCLUSIONS

The first experimental results were encouraging demonstrating that *Camelina sativa* is not claiming special cropping conditions, being suitable for the Transylvanian Plain area. Even in hard climatic conditions this crop gives good yields if the optimum agricultural technology is applied.

The further experiments will be focus on changing the sowing period, enlarging so the crop adaptability to different crop rotation systems according to the different farm conditions from Transylvania. The oil expelling efficiency together with its quality will be analyzed on a multiannual base.

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