A PRELIMINARY STUDY CONCERNING THE OIL-YIELDING CAPACITY IN SEVERAL NEW LINES OF SAFFLOWER (*CARTHAMUS TINCTORIUS* L.) IN THE CONDITIONS OF TIMIŞOARA IN 2007

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Abstract: *Safflower (Carthamus tinctorius L.), as an oil plant, has been known since ancient times. It is cultivated in U.S.A., Israel, Morocco, Spain, Italy, France, Pakistan, Tunisia, India, and Australia. Safflower has been cultivated mainly for the edible oil obtained from its seeds. It is mentioned that safflower oil has wide uses in the pharmaceutical industry, due to its purgative and anti-rheumatism effects. It does not result in an increase of the cholesterol level in the blood. Safflower flowers have atonic properties in cough. Pigments of safflower flowers are particularly important because they leave no toxic residues in coloured products. Pigments are synthesised in the root where, during vegetation, they migrate towards leading tissues towards the petals. Carthamine is one of the most valuable non-toxic compounds used in the food industry or in the textiles industry. Results obtained recently in China concern the use of safflower flowers-based medicines with good effects on coronary diseases and on angina pectoris, curing 75.6% of the total patients treated. The incidence of re-occurrence of cardiac crises as well as of side-effects is rarer than in the case of nitro-glycerine-based medicines. In order to reach the goals of our research, we used 12 safflower lines obtained through individual selection from a population of Timişoara preserved in the didactic field of the Plant Cultivation Technologies department. To emphasise the yielding capacity of some new lines of safflower (Carthamus tinctorius L.) under study, we organised, in 2007, a bi-factorial experiment in which experimental factors were as follows:Factor A – sowing time: - 1st time **MARCH** ; - 2nd time **APRIL**; - 3rd time **MAY**; Factor B – safflower lines Population of Timişoara , - T 5, - T 6, - T 9, - T 10, - T 27, - T 33, - T 36, - T 40, - T 41, - T 100, - T 40 short. The experiment was set after the randomised block method. The experimental variants were set with three replications with randomisation of the Factor B (safflower lines). Research carried out pointed out the impact of sowing time on yield as a result of testing new lines of safflower. The highest yield in oil in the 1st time (March) was in the T 10 line – 920 kg/ha. The line noted for its yield in the 2nd time (April) for its highest oil yield in safflower was the T27 line with 310 kg/ha. In the 3rd time (May) we noted the T10 line with oil yield of 195 kg/ha. Safflower oil yield depends on the achene yield level. Sowing time also has an impact on oil content and achene yield, as well as achene oil levels.*

Key word: *safflower, cultivars, yield, oil.*

INTRODUCTION

Safflower (*Carthamus tinctorius* L.) is important as an oil plant in Asia, North America and Central America, and in dry areas with poor soils. Due to its fruits rich in oil (30-35%), it was also introduced in Romania in man's nutrition and in diets since it diminishes blood cholesterol values. The fruits and flowers are also used in medicine since they have hydrogogue purging and anticough properties. Due to the content of pigments in the petals (20% yellow pigments and 0.5% red pigments), they can be used to produce natural colouring agents for the food, textile, pharmaceutical, and cosmetics industry.

MATERIALS AND METHODS

The experimental field was set on a moist cambic chernozem (poorly gleyied), poorly decarbonated, on loessoid deposits, loamy-dusty/clayish-loamy clay.

The experiment was set in the field after the bi-factorial method … in which experimental factors were as follows:

Factor A – sowing time:

- 1st time 21.03.2006
- 2nd time 4.05.2006
- 3rd time 24.05.2006

Factor B – safflower lines obtained by selection from the Timişoara population:

- Timişoara population
- T 5,
- T 6,
- T 9,
- T 10,
- T 27,
- T 33,
- T 36,
- T 40 short size,
- T 41,
- T 100,
- T 40 large size,

* T - Timişoara

Except for the sowing time which turned into an experimental factor, the technology we applied in the cultivation of safflower was the one specific to field crops.

Winter wheat was the pre-emergent crop in safflower cultivation.

Fertilisation was done by using complex fertilisers of the $N_{15}P_{15}K_{15}$ type in amounts of 450 kg/ha, which means 70 kg/ha of active substance for each N, P, and K.

Basic tillage was done 20-22 cm deep in the ground. The germinating bed was worked and levelled by autumn combinator works.

In spring, 2-3 days prior to sowing, we worked the land with a combinator to break the crust and kill the weeds.

In the first decade of March, row distance was 50 cm.

During vegetation, we made density corrections on the rows.

The works were done when the plants reached 2-5 leaves per plant, with a distance of 8-10 cm between the plants.

RESULTS AND DISCUSSIONS

The yields were obtained after the harvesting of the 2nd sowing time.

The highest yield was in the 1st time.

The yield obtained after each harvesting was cleaned of impurities and weighed. The calculus and interpretation of the results were done through the variance analysis method (Săulescu, 1967).

Results obtained safflower oil production in 2007. Oil content in safflower planted in March of 2007 are shown in Figure 1.

It is important that a new safflower lines studied sown in March had an oil content much more than that achieved by population Timisoara (27.46%). Highest oil content in achenes under 2007 lines is performed at T 10 to 42.36% and T 9 to 31.74%. Of the 11 lines above in terms of only six safflower oil content in achenes, the oil content of achenelor Population of Timisoara. Safflower production for March is a semantic result given crop product - oil content and is represented in Table 1. Analysis of production results uleiconstată dependence on oil production all 12 production lines of achenes and their oil content.

Largest oil production in safflower planted in March 2007 under T10 lines are made at 920 kg / ha of oil and low class T40 - 662 kg / ha oil, T33 - 621 kg / ha, T9 606 kg / ha oil. It also notes that of the 11 lines studied carried two of these lines in the production of oil obtained from the population of Timisoara - 540 kg / ha. The analysis results shows that there is great variability of oil content in achenes from the 12 forms of safflower tested. This variability

limits the fall in oil 25.83% 42.63% line T6 and T10 line. Of the 11 new lines tested only one line safflower oil content is over 30% (T9).

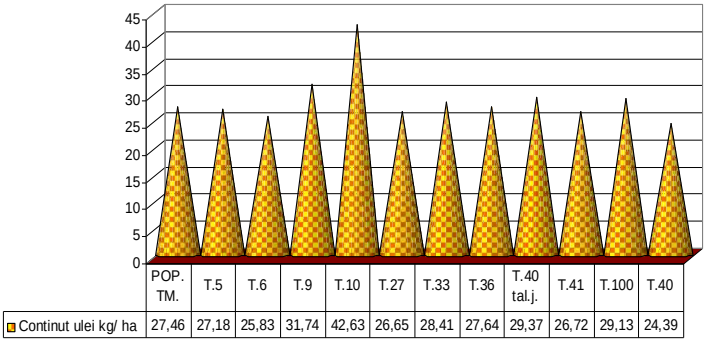


Figure 1. Oil content of safflower seeds sown in March in 2007 in terms of Timisoara

And in 2007 version sown in March to obtain line T10 largest oil production (920 kg / ha).

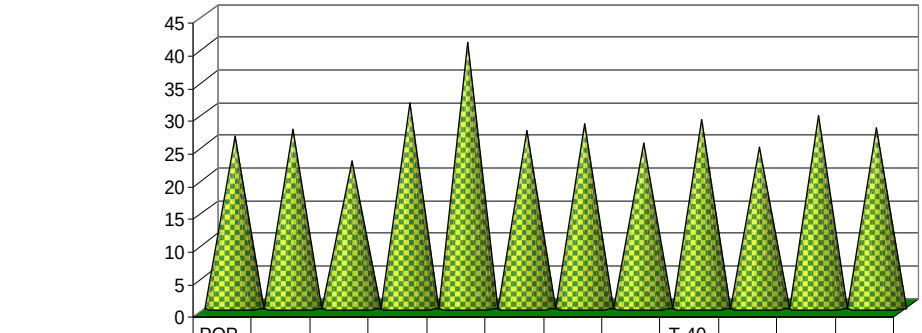
Table 1

Safflower oil production made at sowing in March in Timisoara in 2007

Nr.crt.	Linii	Continut ulei kg/ ha	%	Diferența kg/ ha	Semnificația
1.	**POP.TM.**	540	100	-	
2.	**T.5**	549	102	9	
3.	**T.6**	528	98	- 12	
4.	**T.9**	606	112	66	x
5.	**T.10**	920	170	380	xxx
6.	**T.27**	548	101	8	
7.	**T.33**	621	115	81	x
8.	**T.36**	564	104	24	
9.	**T.40 tal.joasă**	662	123	122	xxx
10.	**T.41**	555	103	15	
11.	**T.100**	603	112	63	x
12.	**T.40**	513	95	- 27	

DL 5%= 59 kg/ha; DL 1% = 81 kg/ha; DL 0,1% = 108 kg/ha

Of all lines studied, five lines of the oil content exceeds the population of origin. Must be assessed in terms of oil content and low waist lines T-40 with an oil content of 29.37% and T9 with an oil content of 31.74%, both higher value of the oil content of achenele Population of Timisoara.Values in the oil content of the population of Timisoara used as blank lines are recorded at T 5 to 27.18%, T6 - 25.83%, T 27 to 26.65%, T 40 to 24.39% and T 41 with 16.72% oil. Oil content in safflower planted in April 2007 in Timisoara in conditions shown in Figure 2.



	POP. TIM.	T.5	T.6	T.9	T.10	T.27	T.33	T.36	T.40 t.j.	T.41	T.100	T.40
Continut ulei kg/ ha	26,32	27,43	22,56	31,29	40,63	27,21	28,22	25,33	28,74	24,62	29,37	27,62

Figure 2. Mean oil content of safflower achenele by sowing in April 2007 in Timisoara in conditions

Analysis of oil content of safflower planted achenele climate conditions in April of 2007 reveals that six of the 11 new lines of safflower have a higher oil content in achenes than in control variant population Timisoara (26 , 32%). Highest oil content in achenes lines are made at T 10 to 40.63%, T 9 to 31.29%, T 100 to 29.37% and 28.74% T 40 .- tj. It is 2007 and the conditions in terms of oil content is remarkable line T10. Under the oil content of the T variant blank lines are from 6 to 22.53%, T 36 to 25.33% and T 41 to 24.62%. If we compare the content of safflower oil achenele sown in March and April of safflower planted in the state that by sowing in April to all variants oil content is reduced by at least 2 to 3%. Safflower oil production from sowing in April 2007 are presented in Table 2. Five new lines of safflower production test and field trial Higher oil are witness Timisoara population. These lines are T10 - 252 kg / ha, T27 - 310 kg / ha, T33 - 291kg/ha, T36 - 261 kg / ha and T40 low waist - 184kg/ha. What is important is that finding and late sowing (30 days compared to the optimal sowing of safflower oil) to obtain production of achenes and oil production provides some much lower than that obtained at sowing safflower in March (best period).

For five of the 11 lines of safflower oil production is carried higher than in control variant and six production lines of oil falls witness, bonuses and production differences are statistically uninsured.As production increases and the differences are within experimental error. Content and production of safflower oil made from sowing in May 2007 in Timisoara in conditions. Oil content in safflower sown in May in Timisoara in 2007 is illustrated in Figure 3.

Change the oil content falls within the range 21.31% to 37.56% in line T36 and T10 line. Lines with an oil content above 25% are lines: 25.29% T5, T9 - 29.71; T10 - 37.56%; T33 - 26.37% T40 low waist - 27.34%, T41 - 25.52%, T 100 to 27.93% and T40 - 25.58%. Lowest oil content is achieved in line T36 containing 21.31%.

Analyzing the average content of oil obtained from safflower achenes sown in May shows that seven of the 11 lines tested safflower, oil content is higher in achenes than in the achenele Population of Timisoara (23.27 %). A single line of the 11 lines tested in achenes a lower oil content than the base population control Timisoara. T36 line is - 21.31%.

Table 3 are planting safflower oil production in May in 2007.

Table 2

Safflower oil production in 2007 achieved the sowing in April in Timisoara

Nr.crt.	Linii	Continut ulei kg/ ha	%	Diferența kg/ ha	Semnificația
1.	**POP.TM.**	166	100	-	
2.	**T.5**	161	97	- 5	
3.	**T.6**	119	72	- 47	
4.	**T.9**	148	89	- 18	
5.	**T.10**	252	152	86	
6.	**T.27**	310	186	144	
7.	**T.33**	291	175	125	
8.	**T.36**	261	157	95	
9.	**T.40 talie joasă**	184	110	18	
10.	**T.41**	161	97	- 5	
11.	**T.100**	132	80	- 34	
12.	**T.40**	135	81	- 31	

DL 5%= 165 kg/ha; DL 1% = 225kg/ha; DL 0,1% = 302kg/ha

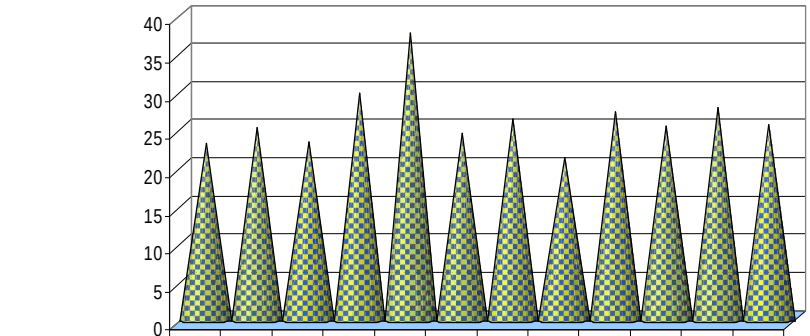


Figure 3. Content values of safflower oil achenele sown in May in Timisoara in 2007

Yields of oil obtained from safflower sowing in May are small. They vary between 76 kg / ha in line T36 and 195 kg / ha in line T10. The population of Timisoara in oil production is achieved 94kg/ha. Of the 11 lines studied seven lines have higher yields than achieved by witnesses. The lines studied best results are obtained from oil and 124kg/ha lines T9-T10 - 195kg/ha that increases oil production to control 32% and 108.6 are the two lines increases the production of 30 kg / that 101 kg ha / ha are insured separately statistically significant and very important line T9 T10 line.

Table 3

Safflower oil production made at planting in May of 2007 in terms of Timisoara

Nr.crt.	Linii	Continut ulei kg/ ha	%	Diferența kg/ ha	Semnificația
1.	**POP.TM.**	94	100	-	
2.	**T.5**	108	115	14	
3.	**T.6**	95	101	1	
4.	**T.9**	124	132	30	xx
5.	**T.10**	195	208	101	xxx
6.	**T.27**	90	96	- 4	
7.	**T.33**	88	94	- 6	
8.	**T.36**	76	80	- 18	
9.	**T.40 tal.joasă**	103	109	9	
10.	**T.41**	98	104	4	
11.	**T.100**	100	107	6	
12.	**T.40**	93	99	- 1	

DL 5%=19 kg/ha; DL 1% = 27kg/ha; DL 0,1% = 36kg/ha

Table 4

Summary of oil production in 2007 in terms of Timisoara
Summary of average values of oil production in 2007 in terms of Timisoara

Factorul A momentul semănatului	Factorul B – Linii noi de şofrănel												Prod medie kg/ha	Prod. relativă %	Diferența +/- kg/ha	semnificaț ia
	Pop. Tm	T.5	T.6	T.9	T.10	T.27	T.33	T.36	T.40 tal.j	T.41	T.100	T.40				
a1 martie	540	549	528	606	920	548	621	564	662	555	603	513	601	100	Mt	
a2 aprilie	166	161	119	148	252	310	291	261	184	161	132	131	193	32	-408	000
a3 mai	94	109	95	124	195	90	88	76	103	98	100	93	105	17	-498	000

DL 5% =112 kg/ha;
DL 1% = 184 kg/ha;
DL 0,1% = 226 kg/ha

Factor B average production

Prod medie kg/ha	Linii											
	Pop. Tm	T.5	T.6	T.9	T.10	T.27	T.33	T.36	T.40 tal.j	T.41	T.100	T.40
	267	272	247	293	456	316	333	300	316	271	278	247
%	100	102	93	110	171	118	125	112	118	101	104	93
Diferența	Mt	5	-20	26	189	49	66	33	49	-4	11	-20
Semnificația					xxx							

DL 5% = 81 kg/ha; DL 1% = 111 kg/ha; DL 0,1% = 149 kg/ha

As in the first two years of experimental cycle and the conditions of 2007, by sowing in April and May, production is greatly reduced. At sowing in April is the output produced 193 kg / ha which represents only 32% of oil production conducted in March. Output gap of 408 kg / ha provided statistically very significant. By sowing safflower in May oil production losses are even greater. Thereby sowing safflower oil production in May is only 105 kg / ha which represents 17% of oil obtained from seeding in March (601 kg / ha), the difference in production is 496 kg / ha and provided statistical as very significant. With regard to oil production achieved, they vary between 247 kh / ha 456kg/ha line T6 and T10 line. by comparing the average oil production of the 11 lines safflower shows that nine of them achieved oil production beyond that achieved by Populations of Timisoara - 267 kg / ha. Of the nine lines with higher yields than achieved by the population of Timisoara, the largest oil production is achieved 456kg/ha line T10, which increase the production of 171 kg / ha provided statistically very significant. On other lines, differentiated production increases are uninsured statistical. Synthesis and production of oil in 2007 shows that the best yields are obtained by sowing safflower oil in March, then time to ensure that the plants grow and develop phases of vegetation in good growing conditions.

CONCLUSIONS

The analysis results of oil production of 12 types sown in three epochs (March, April and May) of 2007 reveals that:

- Safflower oil production is dependent on the production of achenes,
- Oil content in achenes from the 11 safflower lines varies
- Sowing when the difference in climatic factors during the growing phase differential in turn lead to changes in oil content.
- What is found in analysis results is that the oil content in achenes with delayed sowing reduced. Thus from an average of 28.93% obtained by sowing in April it is 28.28% and sowing in May average oil content is lower than 2% of that achieved in March.
- The conclusion that can be drawn is that whatever the safflower cultivation, delayed sowing reduced not only drastically reduces production of achenes and oil content in them.
- T10 line by sowing in March the average content of oil in achenes is 42.63% at sowing in April, the oil content is reduced to 40.63% (down 2%) for the same line sown in May May oil content of achenelor only reach 37.56% - more than 5% less than that achieved at the optimal sowing period, March.

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