ASSESSING QUANTITY AND QUALITY OF SOME MARIGOLD CULTIVARS (*TAGETES* SP.) CULTIVATED AT CLUJ-NAPOCA (CLUJ COUNTY)

EVALUAREA PRODUCTIVĂ ŞI CALITATIVĂ A UNOR VARIETĂŢI DE CRĂIŢE (*TAGETES* SP.) CULTIVATE LA CLUJ-NAPOCA

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Abstract: *Research aimed at identifying the marigold cultivars with the best production and quality results, as well as the easiest cultivars to harvest with a view to medicinal valorisation. In order to reach these objectives, we made up a collection of 8 marigold cultivars of 2 species – Tagetes patula and Tagetes erecta – and we studied their morphological, productive, and qualitative features. We made observations and measurements concerning the size and colour of the inflorescences, production, and carotenoid content. We also assessed the necessary labour force to harvest the inflorescences taking into account that it must be done manually. Marigold inflorescences are important both in phyto-therapy and in obtaining some extracts for the ecological protection of agricultural crops. Among the cultivars we studied, to note the Focul cultivar developed at the SCDL Bacău, with intensely orange coloured inflorescences rich in carotenoids.*

Rezumat. *Scopul cercetărilor a fost identificarea varietăţii de crăiţe cu cele mai bune rezultate de producţie şi calitate, precum şi cel mai uşor de recoltat pentru valorificarea în scop medicinal. Pentru realizarea obiectivelor s-a realizat o colecţie din 8 varietăţi de crăiţe din 2 specii - Tagetes patula şi Tagetes erecta - şi s-au urmărit însuşirile morfologice, productive şi calitative. S-au efectuat observaţii şi măsurători privind mărimea şi culoarea inflorescenţelor, producţia realizată şi conţinutul de carotenoide realizat. S-a evaluat şi necesarul de forţă de muncă necesară pentru recoltarea inflorescenţelor, ţinând cont de faptul că acestea se recoltează manual. Inflorescenţele de crăiţe sunt importante în fitoterapie, precum şi în obţinerea unor extracte pentru protecţia ecologică a culturilor agricole. Din varietăţile studiate s-a remarcat soiul "Focul" de la SCDL Bacău, cu inflorescenţe portocalii intens, mari, bogate în carotenoide.*

Key words: *marigold (Tagetes sp.), production of inflorescences, carotenoid content*
Cuvinte cheie**:** *crăiţe (Tagetes sp.), producţie inflorescenţe, conţinut de carotenoide*

INTRODUCTION

Marigold (*Tagetes* sp.) is cultivated mainly as an ornamental plant, but it can also have other uses, such as medicinal (it is a hypotensive, it increases eye visual sensitivity and adaptation to sudden light changes), or as an extract with fungicide and/or insecticide effect. The ligulae flowers of the inflorescences are rich in carotenoids, essential oils, triterpenes, free and esterified specific fat acids, sterols, flavonoid glycosides, phenol acids and tannins; their herba and radix contain sulphur heterocyclic compounds.

In this paper we present the results of quantity and quality assessment of 8 marigold cultivars cultivated in the year 2007 on the trial field of Jucu belonging to the Agricultural and Veterinary University of Cluj-Napoca.

MATERIAL AND METHOD

The trial was set by direct manual sowing on March 29, 2007, at a row distance of 50 cm. Plant sprouting was very slow and it started about 3 weeks after sowing, on April 22, 2007.

The marigold cultivars we cultivated were as follows:

1. *Tagetes patula* var. *nana*, cultivar Flacăra, noted as (A);
2. *T. patula* var. *nana*, cultivar Delia, noted as (B);
3. *T. patula*, cultivar Flore Plenno, noted as (C);
4. *T. patula* var. *nana*, line GTN-78, noted as (D);
5. *T. patula*, cultivar Honeycomb, noted as (E);
6. *T. patula* var. *nana*, cultivar Carmen, noted as (F);
7. *T. erecta*, cultivar Focul, noted as (H);
8. *T. erecta*, cultivar Uriaş Melanj, noted as (I);

These cultivars come from the Research-Development Station in Truck Farming in Bacău, cultivars A-D and H; Mioplant Switzerland, cultivars E-F, and Agrosel, cultivar I. We should mention that the letter absent in the notation above, i.e. G, belonged to a cultivar whose germination was very low.

During vegetation, we made 3 manual tillages for weed control and soil aeration, as well as a weeding per rows and a plant rarefaction at about 10 cm. Plants had a good evolution, even though precipitations were low in the summer of the year 2007.

We made a series of quantitative and qualitative biometrical determinations concerning the first bloom, the size of inflorescences (diameter in cm), their volume, their drying rate, the production, and carotenoid content in the dried raw matter.

Quantitative assessment of the carotenoids was done in the laboratories of the Pharmaceutical botany course of the Faculty of Pharmacy in Cluj-Napoca. The working technique was as follows: the powdered vegetal product (1 g) was triturated with 50 ml hexane and then decanted. The solution thus obtained was put in a 50 ml balloon and filled up to 50 ml with hexane. We read the solution absorbance to 450 nm in hexane and we calculated carotenoid content with the help of the following formula:

mg carotenoids / g of sample = (A x V x 1000) / ($A^{1cm}_{1\%}$ x G x 100)

where:

A = solution absorbance at 450 nm

V = volume of the solution (= 50 ml)

$A^{1cm}_{1\%}$= carotenoid specific absorbance (= 2500)

G = volume of the sample (grams)

RESULTS AND DISCUSSION

The first inflorescences opened on June 20, about 2 months after sprouting. The cultivars A, B, and D proved to be the most precocious, followed by the cultivar E on July 13, H and I on July 15, and C on July 20 (Table 1).

Table 1

Blooming period in the 8 marigold cultivars (Cluj-Napoca, 2007)

Cultivar	June	July	August	September	October
A					
B					
C					
D					
E					
F					
H					
I					

Medium size of inflorescences and diameter in cm in the 8 marigold cultivars are shown in Table 2.

Table 2

Medium size of inflorescences in the studied marigold cultivars (Cluj-Napoca, 2007)

Cultivar	A	B	C	D	E	F	H	I
	3.3	3.0	4.3	3.0	4.6	4.0	6.0	9.0

We can see from the data above that the largest inflorescences are formed in the species *Tagetes erecta* – cultivars H and I, and the smallest ones in the species *T. patula* var. *nana* – cultivars A, B and D. There are also intermediary cultivars, i.e. C, E and F.

Total fresh production of marigold inflorescences in the year 2007 is shown in Table 3.

Table 3

Total fresh production of marigold inflorescences (Cluj-Napoca, 2007)

Cultivar	Fresh inflorescences (kg/ha)												Difference		Significance
	1	2	3	4	5	6	7	8	9	10					
	June 22	July 4	July 13	July 20	July 31	August 21	August 31	September 10	September 20	October 1	Average per harvesting	Annual	kg/ha	%	
	400	500	000	600	400	400	600	800	700	500	990	9900		00	
	200	700	400	600	500	200	000	100	900	600	920	**9200**	300	47	* *
				000	700	800	300	600	500	500	914	3400	6500	7	0 0
	300	800	500	700	600	500	200	800	500	400	930	**9300**	400	47	* *
			000	100	200	100	500	700	600	500	338	8700	1200	4	
			000	100	200	400	600	600	500	500	363	8900	1000	5	
			800	100	800	700	300	600	500	400	**275**	6200	300	32	* *
			300	800	200	600	200	400	200	000	**338**	6700	800	34	* *

DL (p 5%) = 1172.50; DL (p 1%) = 1583.33; DL (p 0.1%) = 2108.43.

From a statistic point of view, in the cultivars B, C, H and I the differences are very significantly positive compared to the cultivar A, with differences over 6,000 kg of fresh inflorescences per ha.

The drying of the inflorescences was done naturally, in a dry, clean, and shadowed environment.

In order to point out the size of the inflorescences from the point of view of their volume and drying rate, we present in Table 4 the volume of 100 fresh inflorescences after drying and their drying rate.

To note the **cultivar H**, in which the ligulae flowers remain open and rich even after drying, the ration ligulae flowers/receptacle larger compared to the other cultivars (Fig. 1).

The inflorescences were dried naturally, in a dry, clean, and shadowed environment, in the storehouse and laboratories of the course of Plant cultivation technologies of the Agricultural and Veterinary University of Cluj-Napoca.

Table 5 presents the results of quantitative measurements of the carotenoids in marigold inflorescences in the 8 studied cultivars.

Table 4

Volume of 100 fresh marigold inflorescences their drying rate (Cluj-Napoca, 2007)

Cultivar	Volume of 100 inflorescences		Drying rate (%)
	fresh	dried	
A	160	36.80	23
B	67	14.07	21
C	195	40.95	21
D	74	16.28	22
E	269	53.80	20
F	257	51.40	20
H	395	**79.00**	20
I	450	**90.00**	20

Table 5

Carotenoid concentration in *Tagetes sp.* Inflorescences (dried vegetal material)

No.	Volume (g)	Absorbance (450 nm)	Concentration (mg of carotenoid /g of sample)	Concentration (mg of carotenoid /100 g of sample)
A	0.136	0.3590	0.5280	52.80
B	0.109	0.4121*5	3.7808	**378.08**
C	0.111	0.5275*2	1.9009	190.09
D	0.152	0.4131*5	2.7178	**271.78**
E	0.109	0.5009*2	1.8380	183.80
F	0.115	0.3002*5	2.6100	**261.00**
H	0.106	0.6367*2	2.4025	**240.25**
I	0.113	0.2045	0.3620	36.20

To note for their high carotenoid concentrations the cultivars B (378.08 mg/100 g of inflorescences), D (271.78 mg/100 g of inflorescences), F (261 mg/100 g of inflorescences) and H (240.25 mg/100 g of inflorescences).

CONCLUSIONS

1. The blooming period in the year 2007 in the studied cultivars was about 4 months long, but longer in the cultivars A, B and D (June 20 – October 20).
2. The largest mean size of the inflorescences was in the cultivars I (9 cm diameter) and H (6 cm diameter) of the species *Tagetes erecta*.
3. The volume of 100 dried inflorescences was the highest in the cultivar I (90 g), followed by the cultivar H (79 g).
4. Total production of fresh inflorescences was between 19,900 kg in the cultivar A and 29,300 kg/ha in the cultivar D. The necessary labour force to harvest the cultivars H and I was 2 times smaller than in the other cultivars.
5. We recommend the expansion of the cultivar H to be valorised phyto-therapeutically (the cultivar Focul of the SCDL Bacău).

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LITERATURE

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