

Original article

The Study of the *Ocimum Basilicum* L. Specie Cultivated in Organic System

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Abstract

The nursery transplant plantation was performed at 50 cm row distance and 20 cm between plants by row in 16.05.2009. In 2009, when culture was founded 40 t/ha manure was administered, 3 manual hoeing and 6 sprinklings with foliar fertilizer - 0.2% Bionat (product accepted in organic cultures). Based on the biometric determinations, the average plant weight increased from the first harvesting phase to the fifth (from 60.8 g to 150.1 g); the vegetation period was of 126 days (16.05 – 18.09). The herbal production increased from the first harvesting phase, meaning from 5910 kg/ha to 16113 kg/in the fourth phase, and decreased in the fifth harvesting phase (14241 kg/ha). The biggest triterpenic acids content was reported during second harvesting phase (2.1462 g%)

Keywords: biometric determinations, productive potential, triterpenic acids

1. Introduction

Basil is known and used since antiquity. The genus name, *Ocimum* derives from the greek name "okimon". It is specie considered orginary from China, India Asia, Africa and subtropical areas from America. It is spread in culture in many areas from the globe. In our country it is cultivated in gardens and is recommended to be planted in areas from South and South – Western part of the country, especially [1, 3]. From *Ocimum basilicum* L. the aerial part is used (*Basilici herba*) dried or fresh. The vegetal product contains volatile oil (0.5 - 1.5 %) with different chemical composition function of chemotype. Linalole, linolil acetate, methyl-carvicol, camphor and tannins were emphasized (5 %) etc.

The compounds from aerial parts have intestinal antiseptic effect, carminative, digestion stimulant and expectorant. The basil volatile oil has antibacterial and antimycotic action, being also used in food industry, perfumes and cosmetics [3].

2. Material and method

The field trial was carried on at the Botanical Garden of the Faculty of Agriculture from the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. The Dacia strain was used in the trial.

I. Bio-morphological determination in *Ocimum basilicum* L.

In 2009 we established five harvesting phenophases, function of he developmental dynamics of the central and main flowers:

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- f_1 - when the flower buds appear on the basal third;
- f_2 - open flowers in verticiles located on the basal third;
- f_3 -immature fruits in verticiles located on the basal third;
- f_4 - mature fruits in verticiles located on the basal third;
- f_5 - central inflorescence has mature fruits in majority of verticiles.

The biometric approach aimed to determine the shares of the inflorescences, leafs and stem from biomass volume.

Ten plants of each phenophase were harvested in order to perform the biometric determinations.

II. Establishing of the vegetation period in *Ocimum basilicum* L. during 2009

In February 2009, the *Ocimum basilicum* L. seeds were germinated in greenhouse hotbeds. After emergence, when plants had a real leaf, they were placed on plastic glasses (about 6 cm diameter and 10 cm height), filled with mixture of 3 parts soil, 3 parts manure, 3 parts peat and one part sand.

The nursery transplant was suitable for plantation when it had 15 cm height and number of leaves between 8-10/plant. The *Ocimum basilicum* L. filed nursery transplant was planted in organic culture - 16.05.2009. Five phenophases were established in *Ocimum basilicum* L.:

- plantation - appearance of floral buds
- appearance of the floral buds - opening flowers in basal third
- flowering in basal third - immature fruits in basal third
- immature fruits in basal third - mature fruits in basal third
- mature fruits in basal third - maturity

III. The settlement of the production potential by harvesting phenophases in *Ocimum basilicum* L.

In *Ocimum basilicum* L. we settled five variants, function of harvesting time:

- V1 - when the flower buds appear on the basal third;
- V2 - open flowers in verticiles located on the basal third;
- V3 - immature fruits in verticiles located on the basal third
- V4 - mature fruits in verticiles located on the basal third;

- V5 - central inflorescence has mature fruits in majority of verticiles.

The nursery transplant plantation was performed at 50 cm row distance and 20 cm between plants by row. The variant area was of 4 m², three repetitions were performed, and total trial area was of 60 m².

In 2008, when culture was founded 40 t/ha manure was administered. During 2009, 3 manual hoeing and 6 sprinklings with foliar fertilizer - 0.2% Bionat (product accepted in organic cultures). The used foliar fertilizer have a biostimulating effect, and contains: natural plant extract with auxin and gibberellin content, stimulating organic compounds, main nutritional elements - N, K, P; secondary nutritive elements - Ca, Mg, S; oligoelements - B, Zn, Fe, Mn, Cu. Bionat plus is no a soil fertilizer but a stimulation ingredient destined to plants, with very fast reaction, being almost instantaneously absorbed by plant leaves.

IV. The settlement of the triterpeic acids production potential in *Ocimum basilicum* L.

By phenophases 2 and 3, the triterpenic acids content was determined in *Ocimum basilicum* L.

3. Results and discussions

I. Biomorphological determinations in *Ocimum basilicum* L.

From table 1, based on biometric determination performed in organic trial carried out in cu *Ocimum basilicum* L. the following conclusions results:

- The plant average weight increases from the first phase up to the fifth (from 60.8 g to 150.1 g);
- The leaves average weight decreases from the first phase up to the fourth (from 32.1 g to 37.2 g), and decreases in fifth phase to 30.6 g percent also decreases from first to fifth phase (from 53% to 20%);
- The average weight of the stem increases from the first phase up to the fifth (from 21.4 g to 72.9 g), and the percent also increases from 35% to 49%;
- The average weight of the inflorescences increases from the first phase up to the fourth (from 7.3 g to 55 g), and decreases in fifth phase to 46.6 g, and this percent also increases from the first phase up to the forth (from 12% to 37%) and decreases in fifth phase to 31%.

Table 1. Biometric analyse performed in the end of culture phenophases *Ocimum basilicum* L. within organic trial (Cluj-Napoca, 2009)

Phenophase	Plant average weight (g)	Leaf average weight (g)	Stem average weight (g)	Inflorescence average weight (g)
F ₁	60.8 (100%)	32.1 (53%)	21.4 (35%)	7.3 (12%)
F ₂	101.8 (100%)	33.4 (33%)	35.6 (35%)	32.8 (32%)
F ₃	112.9 (100%)	36.2 (32%)	40.1 (36%)	36.6 (32%)
F ₄	148.7 (100%)	37.2 (25%)	56.5 (38%)	55.0 (37%)
F ₅	150.1 (100%)	30.6 (20%)	72.9 (49%)	46.6 (31%)

II. The settlement of the vegetation period in *Ocimum basilicum* L. by 2009

The field plantation of the *Ocimum basilicum* L.. nursery transplants was performed in organic culture – 16.05.2009.

The harvesting of the fifth phenophases was performed in both conventional and organic cultures in the following dates:

- plantation – appearance of floral buds - 08.07.2009;
- appearance of the floral buds – opening flowers in basal third – 16.07.2009;
- flowering in basal third – immature fruits in basal third - 01.08.2009
- immature fruits in basal third - mature fruits in basal third - 20.08.2009

- mature fruits in basal third - maturity - 18.09.2009.

The vegetation period was of 126 days in 2009 in *Ocimum basilicum* L. cultivated in organic system (table 2), and phenophases lasted:

- plantation – appearance of floral buds was of 54 days (43%);
- appearance of the floral buds – opening flowers in basal third was of 8 days (6%);
- flowering in basal third – immature fruits in basal third was of 16 days (13%);
- immature fruits in basal third - mature fruits in basal third was of 19 days (15%)
- mature fruits in basal third - maturity was of 29 days (23%).

Table 2. The determination of the vegetation period in *Ocimum basilicum* L., in organic culture (Cluj-Napoca, 2009)

Year/Phenophases	Plantation – appearance of floral buds	appearance of the floral buds – opening flowers in basal third	flowering in basal third – immature fruits in basal third	immature fruits in basal third - mature fruits in basal third	mature fruits in basal third - maturity	TOTAL
2008	16.05.08-08.07.08	09.07.08-16.07.08	17.07.08-01.08.08	02.08.08-20.08.08	21.08.08-18.09.08	
No. days, %	54	8	16	19	29	126

III. The settlement of the production potential by harvesting phenophases in *Ocimum basilicum* L.

The herbal production increased from the first harvesting phase up to the forth meaning from 5910 kg/ha to 16113 kg/ha and decreases in fifth phase (14241 kg/ha). As table 3 shows, the herbal

production recorded positive distinct significant differences in the second harvesting phase (10415 kg/ha) and positive very significant in the third (13711 kg/ha), forth (16113 kg/ha) and fifth (14241 kg/ha) harvesting phases compared to control, first harvesting phase (5910 kg/ha).

Table 3. The total herbal production by harvesting phases in *Ocimum basilicum* L., cultivated in organic system (Cluj Napoca, 2009)

Harvesting phases	Density pl/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F ₁ (C)	100000	5910	100	0	-
F ₂	100000	10415	176.2	4505	xx
F ₃	100000	13711	232.0	7801	xxx
F ₄	100000	16113	272.6	10203	xxx
F ₅	100000	14241	241.0	8331	xxx
DL 5%= 3107.71		DL 1%= 4357.07	DL 0.1%= 6158.37		

Table 4 shows that the lowest leaves production was recorded in the first harvesting phase (2710 kg/ha) and the biggest in the fourth phase (4672 kg/ha), while in the fifth phase it decreases to 3003 kg/ha. We found no significant

differences between the second (3242 kg/ha) and fifth (3003 kg/ha) phases, while between the third (4450 kg/ha) and fourth (4672 kg/ha) harvesting phases very significant differences were recorded compared to first (control) phase (2710 kg/ha).

Table 4. The total leaves production by harvesting phases in *Ocimum basilicum* L., cultivated in organic system (Cluj Napoca, 2009)

Harvesting phases	Density pl/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F ₁ (C)	100000	2710	100	0	-
F ₂	100000	3242	119.6	532	-
F ₃	100000	4450	164.2	1740	xxx
F ₄	100000	4672	172.4	1962	xxx
F ₅	100000	3003	110.8	293	-
DL 5%= 744.71		DL 1%= 1044.1	DL 0.1%= 1475.75		

The stem production recorded an increasing tendency from the first harvesting phase (2170 kg/ha) to the fifth harvesting phase (6598 kg/ha). Concerning the results significance, from the table 5 we find that it recorded positive significant differences in second (3925 kg/ha) harvesting phase,

distinct significant differences in third harvesting phase (4415 kg/ha).

Very significant differences in fourth (4798 kg/ha) and fifth (6598 kg/ha) harvesting phases, compared to phase one, (2170 kg/ha) were obtained in this trial.

Table 5. The total stem production by harvesting phases in *Ocimum basilicum* L., cultivated in organic system (Cluj Napoca, 2009)

Harvesting phases	Density pl/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F ₁ (C)	100000	2170	100	0	-
F ₂	100000	3925	180.9	1755	x
F ₃	100000	4415	203.5	2245	xx
F ₄	100000	4798	221.1	2628	xxx
F ₅	100000	6598	304.1	4428	xxx
DL 5%= 1274.19		DL 1%= 1786.45	DL 0.1%= 2525.00		

Table 6 shows that between the five studied variants, concerning the inflorescence production, distinct and very significant differences compared to control were recorded. The inflorescence production increased from the first harvesting phase (730 kg/ha) to the fourth harvesting phase. In the second

phase (3249 kg/ha) positive distinct significant differences were recorded, and in the third (4845 kg/ha), fourth (6644 kg/ha) and fifth (4639 kg/ha) harvesting phases, positive very significant differences were recorded compared to first (control) harvesting phase (730 kg/ha).

Table 6. The inflorescence production by harvesting phases in *Ocimum basilicum* L., cultivated in organic system (Cluj Napoca, 2009)

Harvesting phases	Density pl/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F ₁ (C)	100000	730	100	0	-
F ₂	100000	3249	445.0	2519	xx
F ₃	100000	4845	663.7	4115	xxx
F ₄	100000	6644	910.1	5914	xxx
F ₅	100000	4639	635.5	3909	xxx
DL 5%= 1706.33		DL 1%= 2392.31	DL 0.1%= 3381.34		

IV. The settlement of the triterpenic acids production potential

The triterpenic acids production was biggest in the second harvesting phase 22.4 kg/ha compared to 13.1 kg/ha recorded in the third harvesting phase (table 7).

Table 7. The total triterpenic acids from herbs production by harvesting phases in *Ocimum basilicum* L., cultivated in organic system (Cluj Napoca, 2009)

Harvesting phase	The herbal production Kg/ha	g% triterpenic acids	The production of the triterpenic acids kg/ha
F ₂	10415	2.1462	22.4
F ₃	13711	0.956	13.1

4. Conclusions

Concerning the biomorphological determinations in *Ocimum basilicum* L.

We find the followings:

- The leaves percent decreased from the first phase (53%) to the fifth (20%);
- The stem percent increased from the first (35%) up to the fifth phase (49%);
- The inflorescence percent increases from the first phase (12%) up to the fourth (37%) and decreased in the fifth harvesting phase (31%).

Concerning the possibility of settlement of the vegetation period in *Ocimum basilicum* L. in 2009

The vegetation period was of 126 days (16.05 – 18.09).

Concerning the settlement of the production potential by harvesting phenophases in *Ocimum basilicum* L.

The herbal production increased from the first harvesting phase to the fourth harvesting phase, meaning from 5910 kg/ha to 16113 kg/ha and decreased on the fifth phase (14241 kg/ha).

The lowest leaves production was recorded in the first harvesting phase (2710 kg/ha) and the biggest in the fourth harvesting phase (4672 kg/ha), and in the fifth harvesting phase decreases to 3003 kg/ha.

The stem production recorded increased tendency from the first harvesting phase (2170 kg/ha) to the fifth (6598 kg/ha)

The inflorescence production increased from the first harvesting phase (730 kg/ha) the fourth (6644 kg/ha) and decreased in the fifth harvesting phase (4639 kg/ha).

Concerning the settlement of the triterpenic acids production

Because the biggest triterpenic acids production is recorded in second phase (2.1462 g%), we recommend this phase - F₂ (opened flowers on the verticiles placed in the basal third) as optimal harvesting time *Ocimum basilicum* L.

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