MONITORING OF THE *OCIMUM BASILICUM* L. SPECIES IN CONVENTIONAL AGRICULTURE SYSTEM

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Abstract

Basil is one of the oldest spices belonging to the Ocimum genus. The name Ocimum is a latinized version of the Greek plant name okimon.It is used in the perfume industry to obtain cosmetic products and in the food industry for the preservation of meat products and for the preparation of liqueurs. Basil oil is recognized for its bacteriostatic and bactericidal properties.The average weight of the plant, stem, leaves and inflorescences increases from first phase up to the fifth harvesting phase.Herb production increases from the first stage of harvest to the fifth phase, that is, from 3790 kg/ha to 17107 kg/ha.The mixture of soil has a positive influence on the plant emergence. Seedling height is positively influenced by the peat substrate.

Key words: bio-morphological measurements, production potential, substrate.

INTRODUCTION

Basil (*Ocimum basilicum* L.) is a frost-tender annual to perennial herb that is a member of the mint family (*Lamiaceae*). The name "Ocimum" is a latinized version of the Greek plant name okimon. The word basil comes from the Greek basileus, meaning "king". This name was given because the plant was used to perfume the kings' palaces. Basil is still considered the "king of herbs".

Other folk traditions have associated basil with love. When an Italian woman placed potted Basil on her balcony, it signaled that she was ready to receive her lover. In northern Europe lovers exchanged basil twigs as a sign of fidelity. Haitians consider basil as having protective powers.

Basil was reportedly introduced to French cooking by Catherine de Medici when she married the French King Henri II in 1533, and later in the century it arrived in Britain, probably from France.

From *Ocimum basilicum* L. all aerial parts of the plant (*herba Basilici*) are harvested, dry or fresh.

The vegetable product contains essential oil (0.5 - 1.5%). The main component of the oil is linalool (62.75%). With the drying process the content of essential oil increases.

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Basil oil is recognized for its bacteriostatic and bactericidal properties.

MATERIAL AND METHOD

The field trial was carried out at SCDA Jucu (USAMV – Cluj Napoca) on a soil with the following characteristics:

- Soil Type: argic chernozem, slight moderate pseudo-gleyed in depths;
- Relief: old terrace of the Somes Mic, with a slope of 3-5%;
- Parental material: alluvial-colluvial deposits with intercalations of marls and clays;
- Usage: arable;
- Groundwater: less than 5 m depth.

Thought 2009, there have been 2-3 manual hoeing and 2-3 mechanical hoeing processes and 6 watering processes using the Ferticare foliar fertilizer (containing 14-11-25 NPK water soluble complex fertilizer and 1.4 MgO, 2 S and trace elements).

1. Bio-morphological observations made to the *Ocimum basilicum* L. species

In 2009, the phenological harvesting phases were established according to the development dynamics of central and principal inflorescences:

- F1 – when buds appear on verticiles disposed at plants' third basal;
- F2 – open flowers on verticiles disposed at plants' third basal;
- F3 – immature fruits disposed at plants' third basal;
- F4 – mature fruits disposed at plants' third basal;
- F5 – central inflorescence has mature fruits on most of the verticiles.

The biometric approach aimed to determine the shares of the leaves, stems and inflorescences in the total amount of biomass. Ten plants of each phenophase were harvested in order to perform the biometric determinations.

2. Assessment of the production potential of *Ocimum basilicum* L. based on harvest phenophases

The production of herba, leaves, stems and inflorescences has been set in each phenophase.

3. The influence of the substrate on seed germination and plant height of the *Ocimum basilicum* L. species

In the experiment two substrates were used:

- V1 - soil mixture (three parts soil, three parts manure, three parts peat and one part sand)

- V2 - peat (fertilized substrate derived from blond peat, electrical conductivity 30/40 mS/m, NPK fertilizer 14:16:18 1.00/1.05 kg/m^3)

Sowing was done in 27.04.2012; emergence occurred in 15.05.2012 when plant emergence was measured for the 2 substrates. For the assessment of the substrate influence on the plant height two readings were made (in May 3 and May 11, 2012) -3 plants have been chosen/repetition, for measuring their height in cm.

RESULTS AND DISCUSSION

1. Bio-morphological measurements made for the *Ocimum basilicum* L. species

From Table 1, based on biometric determination performed in conventional trial of *Ocimum basilicum* L. species the following conclusions result:

- The plant average weight increases from the first phase up to the fifth (from 37.9 g to 172.8 g);
- The leaves average weight increases from the first phase up to the fifth (from 22.1 g to 35.4 g) and the percentage decreased from first to fifth phase (from 58% to 20%);
- The average weight of the stem increases from first phase up to the fifth phase (from 11.9 g to 73.1 g) and the percentage also increases from 32% to 42%;
- The average weight of inflorescences increases from first phase up to fifth phase (from 3.9 g to 64.3 g), and the percentage increased between first phase and the fourth phase (from 10% to 41%) and decreases in fifth phase to 37%.

Table 1

Biometric analysis performed in *Ocimum basilicum L.* species, cultivated in conventional system (Cluj-Napoca, 2009)

Phenophase	Plant average weight **(g)**	Leaf average weight **(g)**	Stem average weight **(g)**	Inflorescence average weight **(g)**
F_1	37.9 (100%)	22.1 (58%)	11.9 (32%)	3.9 (10%)
F_2	62.2 (100%)	29.8 (48%)	19.9 (32%)	12.5 (20%)
F_3	70.5 (100%)	31.6 (45%)	23.4 (33%)	15.5 (22%)
F_4	130.3 (100%)	33.6 (26%)	42.5 (33%)	54.2 (41%)
F_5	172.8 (100%)	35.4 (20%)	73.1 (43%)	64.3 (37%)

2. Evaluation of the production potential in harvesting phases for the *Ocimum basilicum* L. species

The herbal production increases from the first phase up to fifth harvesting phase, i.e. from 3790 kg/ha to 17107 kg/ha. As shown in Table 2,

the herbal production shows no significant differences in the second harvesting phase (2841 kg/ha), but positive differences in third harvesting phase (9367 kg/ha) and highly positive differences in the fourth (13720 kg/ha) and fifth (17107 kg/ha) phases are recorded compared to control phase, first harvesting phase (3790 kg/ha).

Table 2

The total herbal production by harvesting phases in Ocimum basilicum L. species, cultivated in conventional system (Cluj-Napoca, 2009)

Harvesting phases	Density plants/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F_1 (Control)	100000	3790	100	0	-
F_2	100000	6995	184.6	3205	-
F_3	100000	9367	247.2	5577	x
F_4	100000	13720	362.0	9930	xxx
F_5	100000	17107	451.4	13317	xxx

DL 5%= 4094.92 DL 1%= 5741.16 DL 0.1%= 8114.67

It is observed that the lowest leaf production is recorded at the first harvesting phase (2217 kg/ha) and the highest in the fifth harvesting phase (3682 kg/ha) (Table 3). Note that very significant positive differences are recorded in the second (3219 kg/ha), third (3419 kg/ha), fourth (3516 kg/ha) and fifth (3682 kg/ha) harvesting phases compared to control, the first harvesting phase (2217 kg/ha).

Table 3

The leaves production by harvesting phases in *Ocimum basilicum* L. species, cultivated in conventional system (Cluj Napoca, 2009)

Harvesting phases	Density plants/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F_1 (Control)	100000	2217	100	0	-
F_2	100000	3219	145.2	1003	xxx
F_3	100000	3419	154.2	1202	xxx
F_4	100000	3516	158.6	1299	xxx
F_5	100000	3682	166.1	1465	xxx

DL 5%= 475.20 DL 1%= 666.24 DL 0.1%= 941.67

The stem production shows an increasing tendency from the first harvesting phase (1180 kg/ha) to the fifth harvesting phase (6598 kg/ha). Concerning the significance of the results (Table 4) we find that it recorded no significant difference in second harvesting phase (2274 kg/ha). Positive distinct significant differences in third harvesting phase (3912 kg/ha) and very significant differences in fourth (4609 kg/ha) and fifth (6598 kg/ha)

harvesting phases, compared to control, first phase (1180 kg/ha) were obtained in this trial.

Table 4

The stem production by harvesting phases in *Ocimum basilicum* L. species, cultivated in conventional system (Cluj Napoca, 2009)

Harvesting phases	Density plants/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F_1 (Control)	100000	1180	100	0	-
F_2	100000	2274	192.7	1094	-
F_3	100000	3912	331.5	2732	xx
F_4	100000	4609	390.6	3429	xxx
F_5	100000	6585	558.1	5405	xxx
DL 5%= 1650.57		DL 1%= 2314.13		DL 0.1%= 3270.84	

Table 5 shows that between the five studied variants, concerning the inflorescence production, very significant positive differences compared to control were recorded only in the fourth and fifth variants. The inflorescence production increased from the first harvesting phase (393 kg/ha) to the fifth (6839 kg/ha). In the second (1501 kg/ha) and the third (2069 kg/ha) harvesting phases no significant differences are noted, and in the fourth (5595 kg/ha) and the fifth (6839 kg/ha) harvesting phases very significant positive differences are recorded compared to control, first harvesting phase (393 kg/ha).

Table 5

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

Harvesting phases	Density plants/ha	The herbal production		± Difference	Significance
		kg/ha	%		
F_1 (Control)	100000	393	100	0	-
F_2	100000	1501	381.6	1108	-
F_3	100000	2069	525.9	1675	-
F_4	100000	5595	1422.5	5202	xxx
F_5	100000	6839	1738.8	6446	xxx
DL 5%= 2154.58		DL 1%= 3020.77		DL 0.1%= 4269.61	

3. The influence of substrate on seed germination and seedling height in *Ocimum basilicum* L. species

It is observed that the percentage of plant emergence is higher in variant 1 compared to variant 2 (Table 6). In the first variant, the percentage of germination (88.33%) is with 17.5% higher than in the control (average), recording very significant positive differences compared to control variant (75.17%). The percentage of emerged plants in variant 2 (62%) is with 17.5% lower than in the control variant and with 35% lower than variant 1.

Variant 2 records distinct significant negative values compared to the control variant.

In conclusion, the soil mixture has a positive influence on the emergence of basil plants.

Table 6

The influence of substrate on seed germination (Cluj-Napoca, 2012)

Variant	Seed germination		± Difference	Significance
	Plant emergence %	%		
Average (Control)	75.17	100	-	-
Soil mixture	88.33	117.5	13.17	XX
Peat	62.00	82.5	- 13.17	00

DL (5%)=3.79 DL (1%)=8.76 DL (0.1%)=27.87

The height of the seedlings is affected by the substrate type. At the first reading (Table 7), the seedling height (5.55 cm) in variant 1, is with 20.7% lower than the control variant (7 cm) and with 41.4% lower than variant 2 (8.45 cm), recording significant negative value compared to the control variant. Variant 2 values are significantly positive compared to the control variant.

Table 7

The influence of substrate on seedling height - first reading (Cluj-Napoca, 2012)

Variant	Seedling height		± Difference	Significance
	cm	%		
Average (Control)	7.00	100	-	-
Soil mixture	5.55	79.3	- 1.45	0
Peat	8.45	82.5	1.45	X

DL (5%)=1.26 DL (1%)=2.92 DL (0.1%)=9.28

At the second reading (Table 8), seedling height (15.66 cm) in variant 2 is with 80.8% higher than in the control variant (8.66 cm), recording significant positive values compared to the control variant.

In conclusion, seedling height, at both the first and the second reading is positively influenced by the peat substrate.

Table 8

The influence of substrate on seedling height - second reading (Cluj-Napoca, 2012)

Variant	Seedling height		± Difference	Significance
	cm	%		
Soil mixture (Control)	8.66	100	-	-
Peat	15.66	180.8	7.00	X

DL (5%)=5.97 DL (1%)=13.79 DL (0.1%)=43.90

CONCLUSIONS

1. Regarding the biometric measurements of the *Ocimum basilicum* L. species

The average weight of the plant, stem, leaves and inflorescences increases from the first phase up to the fifth harvesting phase.

2. Regarding the production potential evaluation based on harvesting phenophases for the *Ocimum basilicum* L. species.

Herba production increases from the first phase up the fifth phase, from 3790 kg/ha to 17107 kg/ha.

The lowest production of leaves is recorded in the first harvesting phase (2217 kg/ha) and the highest production takes place in the fifth phase (3682 kg/ha).

The stem production increases from the first phase up to the fifth harvesting phase, from 1180 kg/ha to 6585 kg/ha.

Production of inflorescences increases also from the first harvesting phase (393 kg/ha) to the fifth phase (6839 kg/ha).

3. Regarding the effect of substrates on seed germination and plant height for the *Ocimum basilicum* L. species

The mixture of soil has a positive influence on plant emergence.

Seedling height is positively influenced by peat substrate, at both the first and second readings.

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