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INFLUENCES OF SOWING DATES ON THE GENERATIVE AND VEGETATIVE PROPERTIES OF DIFFERENT SWEET BASIL (*Ocimum basilicum* L.) VARIETIES

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Abstract

During the present study the effect of different sowing dates on five sweet basil varieties' ('Aromat de Buzău', 'Serafim', 'Busuioc Dulce', 'Genovese' and 'Grand Verte') parameters which are important from economic point of view (plant height, plant diameter and stem diameter, respectively average plant biomass) were compared between years (2016 and 2017). According to the results, it can be detected that in general, the IVth growth period (sowed on 11 May 2016) and the Vth and VIth growth periods (sowed on 18 May, respective 1 June 2017) had the most influential effects on sweet basil parameters except stem diameters in 2017. Plant biomass also varied between years and sowing dates. Plants of 'Genovese' and 'Serafim' varieties can be characterized with relatively low variation of the average plant weight, on the contrary 'Aromat de Buzău' had higher variations regarding average plant weight. Altogether we can conclude that theVIth period initiated on 1 June had the most positive effects on all plant parameters at all varieties, while theVIIIth period, sowed on 28 June had the most harmful effects, therefore we are not recommending this period as proper for sweet basil cultivation.

Key words*: climate conditions, growth period, plant biomass, plant parameters.*

INTRODUCTION

Ocimum basilicum L. (sweet basil) is an annual aromatic herb from the *Lamiaceae* Family. Native to Iran, Afghanistan and India (Asghari et al., 2012; Saha et al., 2010) it is none-the-less widely cultivated all around the world (Kiferle et al., 2011). Some species such as *Ocimum americanum* L., have insecticidal properties, while others have ornamental qualities with a particular leaf shape, size and colour, e.g. 'Purple Ruffles'(Kintzios et al., 2004; Phippen, 2000). The common sweet basil is of high economic importance because of the essential volatile oil derived from its leaves (Saha et al., 2010; Siddique & Anis, 2008; Sudhakaran & Sivasankari, 2002). These compounds also have valuable pharmaceutical, aromatic and culinary properties (Gopi & Ponmurugan, 2006; Sahoo et al., 1997). Basil is a source of rosmarinic acid but also contains caffeic acid and derivatives of lithospermic acid and lithospermic acid B, which help in healing some renal diseases (Rady & Nazif, 2005). These compounds are also considered to be important due to their stomachic, antihelminthic, antipyretic, diaphoretic and diuretic effects, as well as in the treatment of purulent discharge of the ear and diseases of the heart and brain (Saha et al., 2010; Siddique & Anis, 2008; Singh & Sehgal, 1999). Volatiles are popular ingredients in dental and oral health care products, and the leaf extract is highly effective in inhibiting carcinogen-induced tumor development (Chandramohan & Sivakumari, 2009). Dried leaves of basil are used to flavor stew, sauces, salads, soups, meat and tea (Phippen, 2000; Siddique & Anis, 2008). Due to these high-value characteristics, sweet basil is cultivated and volatile compounds obtained cca 100 t/year (Begum et al., 2002; Daniel et al., 2010). Basil is usually propagated by sowing or by the use of seedlings (Bernáth, 2000). Under temperate climate conditions, the earlier seeding may cause substantial losses due to the negative effect of low temperatures. While all the above parameters are highly important for growers, under temperate climate conditions, and especially when high variations in temperature and precipitations can be predicted year-by-year, one important issue, the effect of sowing date on sweet basil parameters have not been studies until now. This is crucially important for economic point of view to have clear information about the best variety that meant to be cultivated and because of maximization the bioactive compounds quantity and quality. Therefore, two main objectives were defined for this study: 1. to compare between years the effect of different sowing date on five different sweet basil varieties (‘Aromat de Buzău’, ‘Serafim’, ‘Grand Verte’, ‘Genovese’ and ‘Busuioc Dulce’) and 2. to test how different plant parameters (plant height, plant diameter and stem diameter, respectively average plant biomass), that are important from economic point of view, vary with sowing period (early spring, late summer or between these periods), in two consecutive years.

MATERIALS AND METHODS

Experimental site

The field study took place in 2016 and 2017, in the Medicinal and Aromatic Plants Garden belonging to the Didactical and Research Field of the Faculty of Technical and Human Sciences, Târgu Mureş of Sapientia Hungarian University of Transylvania, situated in Târgu Mureş, Mureş County, Romania. The monthly average temperature values, respectively the sums of precipitation of 2016 and 2017 compared to the multiannual values (1971-2000 periods) are presented in Figure 1.

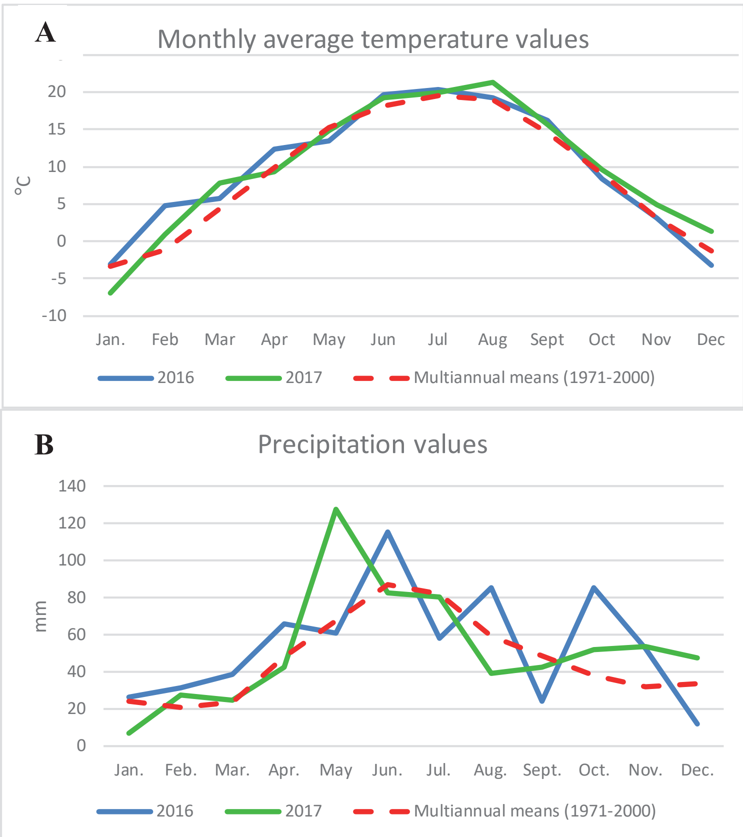

Figure 1. A: Mean daily temperature values and B: mean monthly precipitation sums of the experimental site in 2016 and 2017 compared to the multiannual (1971-2000) mean values of the region.

Considering the sums of precipitations of 2016 and 2017 it can be observed that they remained relatively similar to the multiannual values (1971-2000 periods) during the vegetation period (April-September), small differences being only in May and August. Data concerning the accumulated heat units (also called grower degree days - GDU) and the sum of precipitations during the experiment are presented also in Table 1. The accumulated heat units by each sweat basil variety were calculated by summarizing the mean daily temperature values, starting from the sowing date of each growth period. This was also approximated with the number of days elapsed between two sampling dates. As example if one variety accumulated 9°C in 2016 by six consecutive days until 25 May while in 2017 accumulated approximately the same degree (8.93°C) in nine days until 25 May, we divided the cumulated temperature with elapsed days. Next, correlations between years were computed for each variety and each cumulated temperatures.

Table 1. Sowing and harvesting dates, length of the growth periods and, respectively grower degree-days (GDU's) and the sum of precipitations in the experimental years

Growth period	Experimental year	Sowing date	Date of harvest	Growth period (days)	GDU's (°C)	Sum of precipitations (mm)
I.	2016	4 May	-	-	-	-
	2017	4 April	-	-	-	-
II.	2016	11 May	-	-	-	-
	2017	11 April	-	-	-	-
III.	2016	19 May	29 Sept.	134	1148.1	303.6
	2017	27 April	1 Aug.	97	775.2	290.4
IV.	2016	27 May	29 Sept.	126	1116.5	287.2
	2017	11 May	8 Aug.	90	805.1	No data
V.	2016	10 June	29 Sept.	112	1015.4	247.6
	2017	18 May	22 Aug.	97	948.8	No data
VI.	2016	17 June	29 Sept.	105	967.2	211
	2017	1 June	22 Aug.	83	867.1	200.6
VII.	2016	30 June	28 Sept.	92	801.5	167.4
	2017	13 June	22 Aug.	71	760.5	No data
VIII.	2016	6 July	28 Sept.	86	732.4	164.7
	2017	28 June	27 Sept.	92	869.1	162

Plant material used in the experiment

The seed batches of 'Aromat de Buzău', 'Serafim', 'Busuioc Dulce' and 'Grand Verte' varieties were offered by the Buzău Research Station for Legumiculture (SCDL Buzău), whereas in the case of 'Genovese' variety they were purchased from a local merchant.

Preparation of the experimental field

In the autumn of 2016, a 25 cm deep plowing was performed and the same design used also in 2017. After the cold season has passed, the terrain was further worked using a roto tiller. The seedbeds were made by manual harrowing. Batches of seeds of each cultivar were sowed in eight different dates, constituting eight growth periods, which are denominated with roman numbers (I-VIII). The dates of sowing for both years, respectively of harvesting and the lengths of the vegetation/growth periods (from sowing to harvesting) are presented in Table 1. Plants of the first two growth periods in each year marked as I and II in the Table 1 did not emerge properly and were not included in data analyses and are not presented in the results part.

Experimental design

The experimental field was divided into six equal parts (15.75 meters long and 5 meters wide), separated by one meter wide pathway, each part representing the parcel for the plants of a particular sowing date.

These parcels then were partitioned into seven plots (5 m long and 2.25 m wide), one for each basil cultivar. This way we gained a total number of 42 plots allocated for the treatments.

The seeds of a particular treatment were sowed in five rows (5 m long) with 45 cm distance in-the-row and 30 cm in-row spacing, the sowing depth being 1.5-2 cm. This way a total number of 85 plants were initiated (multiple seeds in each hole). On the date of 15.06.2016 and in 14.07.2017 the treatments were fertilized using mineral fertilizers. The applied doses were of 250 kg ha^{-1} NPK 15:15:15 (37.5 kg ha^{-1} for each nutrient) and 150 kg ha^{-1} ammonium nitrate fertilizer with 33% (NH_4) (NO_3) content (50.25 kg ha^{-1} N content).

Data collection

Data referring to the development of the plants were collected during each growing period on several times, differences occurring among the number of times of data collecting. Plant height was measured from ground level to the maximum height of the plant and expressed in centimeters. The diameter of the plant/bush was measured at its maximal value and expressed also in centimeters. The diameter of the stem was measured right above ground level and expressed in millimeters. At the end of each vegetation period plants were harvested one by one, the stems being severed at ground level using a pruning shear. The plants biomass harvested from a certain plot were weighted individually and the results were averaged constituting three repetitions. Harvest times were scheduled to fit as much as possible the flowering period of basil plants.

Data analyses

Data analyses were made using Principal Coordinates Analyses (PCoA) in PAST program. This was made because sowing was made on different dates, and plant parameters were collected according to the growing tendency. Therefore, parameters collected under different growth periods can be compared. The same method was used consecutively in 2016 and 2017. This method also allows adding parameters as heat units (GDD-s) and time elapsed between assessments. The presentations are made as bi-dimensional graphics, where different ellipses colors represent different growth periods, and the dimension and the tendency toward a positive or negative direction of axis x or y represents negative or positive associations (growing tendency of the assessed plant parameter, i.e. ramifications) with the parameter tested (heat units in axis y and time elapsed in axis x). Altogether this representation presents graphically the tendency of each plant parameter do increase or decrease in time under different heat units. The highest and lowest values of each parameter assessed for each variety and sowing time are also represented near graphs in tables; lowest values are marked with yellow, highest values with green. Plant parameters were also compared using the similar accumulated GDDs in each year. These data were presented as bar-charts but because approximations between years were necessary because of different number of days elapsing between years to reach the same GDD, data were compared using correlation analyses between years. For these analyses linear correlations in plant parameters growth for each variety and for each GDDs were computed. Significant Rho values were presented in tables. Plants biomass was compared separately for each growth period. For 2016 data from each sowing time were normally distributed, therefore ANOVA and Tukey test were used to compare variables. For 2017 data from IIIrd to VIth sowing time were normally distributed; therefore, ANOVA and Tukey test were used to compare variables. Plant biomass data from VIIth and VIIIth growth periods were not distributed normally; therefore, Man-Whitney test was used to compare data. Results are presented in Tables 6 and 7.

RESULTS AND DISCUSSIONS

By comparing the sweet basil varieties diameter variations between years and under different sowing dates and heat units (also known as grower degree-days, GDD-s) high alterations between varieties can be detected. While the ‘Aromat de Buzău’, ‘Serafim’ and varieties have the highest diameter development when sowing was made on 18 May, respective 1 June 2016 (Vth and VIth growth period), and less at VIIIth growth period (sowed on 28 June 2016), ‘Busuioc Dulce’, ‘Genovese’ and ‘Grand Verte’ had a more constant diameter growth when they were sowed on 11 May 2016 (IVth growth period) while the VIIIth growth period (sowing on 28 June 2016) has a relative harmful effect of plant diameters. No clear effect of sowing date on 'Genovese' can be detected, positive tendency toward VIIIth growth period (28 June 2016) however can be detected (Figure 2). Very different trends in 2017 were observed, for 'Aromat de Buzău' and 'Grand Verte' the IVth growth period (11 May 2017) was the most influential, for 'Serafim' and 'Genovese' the Vth and VIth growth periods (18 May, respective 1 June 2017) had significant effect on diameter development, while for 'Busuioc Dulce' the VIth growth period (1 June 2017) was most important for plant diameter variations (Figure 2). While comparisons of plant diameters under cumulated GDD-s were tested between years, the same tendencies of variations were detected (Figure 2). When correlation analyses were made by comparing plant diameters using cumulated and approximated time periods between years, correlations were only detected for variety 'Serafim' (Table 2).

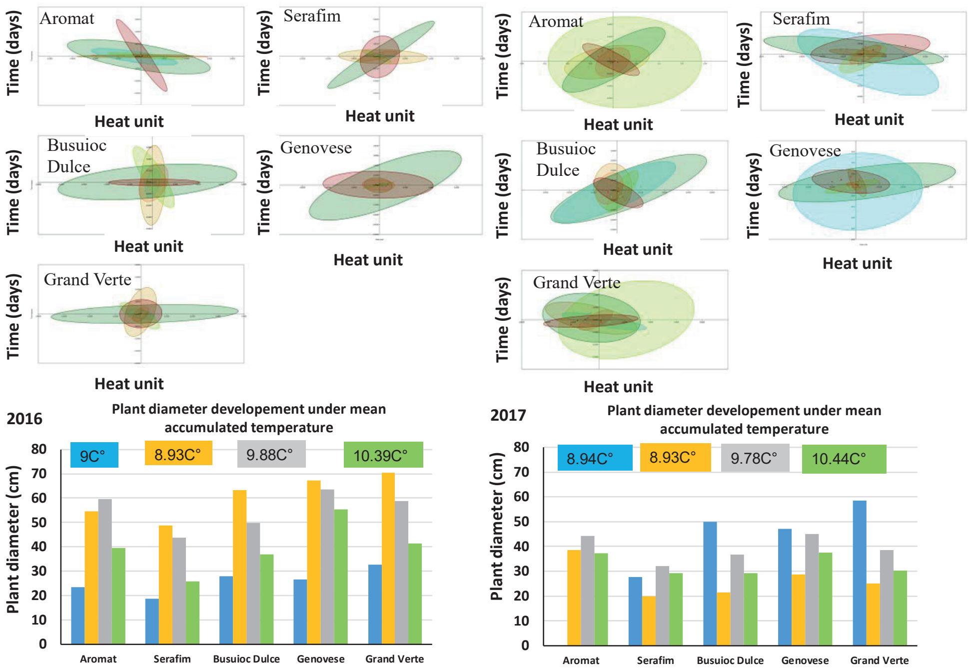

Figure 2. The effect of sowing time on sweet basil diameter variations under different heat units (air temperatures). Different colours refer to different growth periods as follows: Aqua IIIrd growth period, Chartreuse: IVth growth period, Coral Vth growth period, Darkgoldenrod: VIth growth period, Darkgreen: VIIth growth period, Darkred: VIIIth growth period

Table 2. Correlation analyses of sweet basil diameter variations between 2016 and 2017 under similar accumulated GDD-s. Before analyses the cumulated GDD-s were divided with days elapsed until the next sampling period. Bolded values represent significant positive correlations between values

2016	2017	Aromat	Serafim	Busuioc dulce	Genovese	Grand Verte
9°C	**8.94°C**	Rho=-	**Rho=0.92****	Rho=0.32	Rho=0.34	Rho=0.17
8.93°C	**8.93°C**	Rho=0.09	**Rho=0.90****	Rho=0.23	Rho=0.12	Rho=0.34
9.88°C	**9.78°C**	Rho=0.13	**Rho=0.95****	Rho=0.12	Rho=0.41	Rho=0.40
10.39°C	**10.44°C**	Rho=0.24	**Rho=0.87****	Rho=0.31	Rho=0.45	Rho=0.15

Clear positive effect of the VIIth growth period (sowed on 13 June 2016) on 'Aromat de Buzău', 'Serafim', 'Busuioc Dulce' and 'Grand Verte' height can be detected and in all cases again temperature has harmful effect on plant height if sowing was made at 27 April. Again no clear effect on 'Genovese' height can be detected at different growth periods, only a tendency of positive effect at VIIth (13 June 2016) and VIIIth growth period (28 June 2016) can be observed (Figure 3). Again very different tendencies in 2017 were detected. More influential effect on plant height variations were detected when plants were sowed in Vth and VIth growing periods (Figure 3). Again, the plant height development under cumulated GDD-s presented a high variations between years (Figure 3) while positive correlations between plant height were detected at four three ('Aromat de Buzău', 'Serafim' and 'Grand Verte') (Table 3).

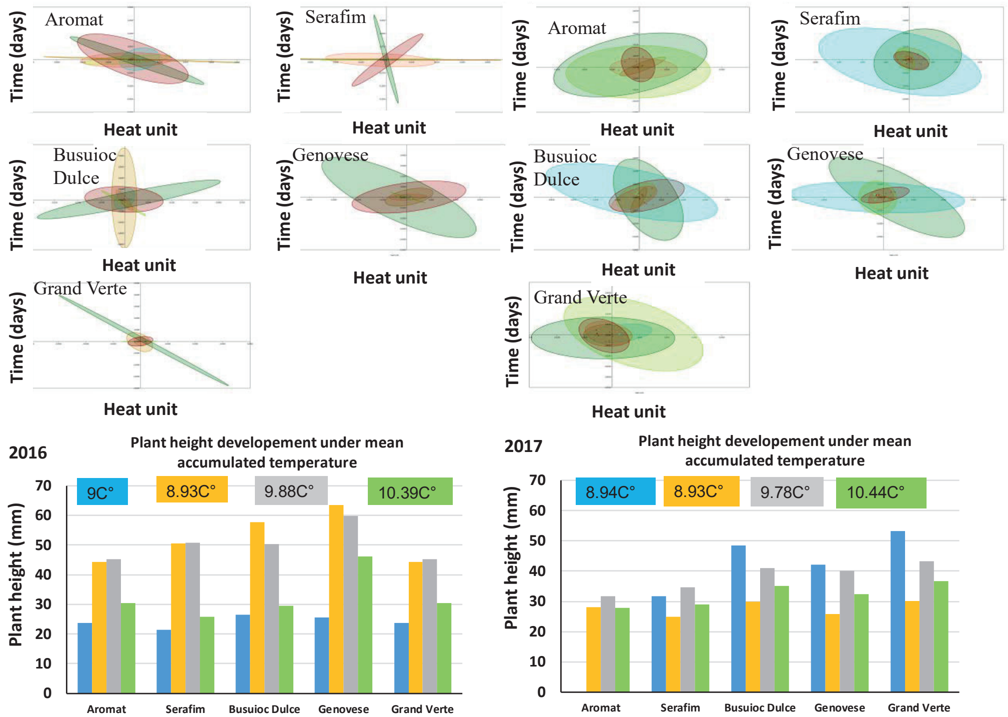

Figure 3. The effect of sowing time on sweet basil height variation under different heat units (air temperatures). Different colours refer to different growth periods as follows: Aqua IIIrd growth period, Chartreuse: IVth growth period, Coral Vth growth period, Darkgoldenrod: VIth growth period, Darkgreen: VIIth growth period, Darkred: VIIIth growth period

Table 3. Correlation analyses of sweet basil height variations between 2016 and 2017 under similar accumulated GDD-s. Before analyses the cumulated GDD-s were divided with days elapsed until the next sampling period. Bolded values represents significant positive correlations between values

2016	2017	Aromat	Serafim	Busuioc dulce	Genovese	Grand Verte
9°C	**8.94°C**	Rho=-	Rho=**0.91****	Rho=0.33	Rho=0.32	Rho=**0.75***
8.93°C	**8.93°C**	Rho=**0.80****	Rho=**0.90****	Rho=0.24	Rho=0.24	Rho=**0.78***
9.88°C	**9.78°C**	Rho=**0.78***	Rho=**0.80****	Rho=0.31	Rho=0.21	Rho=**0.72***
10.39°C	**10.44°C**	Rho=**0.81****	Rho=**0.87***	Rho=0.30	Rho=0.38	Rho=**0.70***

Analyzing the stem diameter, similar tendency can be detected with plant height variations, positive effect of the VIIth growth period (13 June 2016) on stem diameters of 'Aromat de Buzău', 'Serafim', 'Busuioc Dulce', 'Genovese' and 'Grand Verte' were detected, while also the IIIrd growth period (24 April 2016) has positive effect on, 'Genovese' and 'Grand Verte' stem diameter. 'Genovese' and 'Grand Verte' has relative stable and continuous stem diameter development both at IIIrd (24 April 2016), VIIth (13 June 2016) and

VIIIth growth periods (28 June) (Figure 4). For 2017 the most significant effect on stem diameters had the VIIth growth period. High variations between years can also be detected considering by comparing the cumulated GDD-s (Figure 4). Correlations between stem diameter development were only observed at 'Busuioc Dulce' (Table 4).

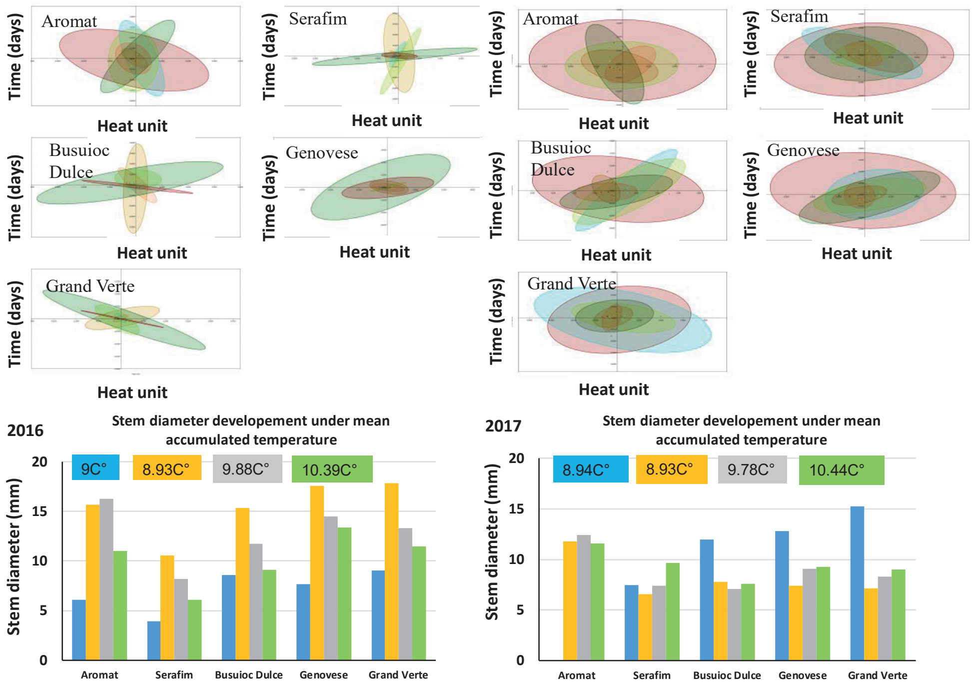

Figure 4. The effect of sowing time on sweet basil stem diameter variations under different heat units (air temperatures). Different colours refer to different growth periods as follows: Aqua IIIrd growth period, Chartreuse: IVth growth period, Coral Vth growth period, Darkgoldenrod: VIth growth period, Darkgreen: VIIth growth period, Darkred: VIIIth growth period

Table 4. Correlation analyses of sweet basil stem diameter variations between 2016 and 2017 under similar accumulated GDD-s. Before analyses the cumulated GDD-s were divided with days elapsed until the next sampling period. Bolded values represents significant positive correlations between values

2016	2017	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
9°C	**8.94°C**	Rho=-	Rho=0.33	Rho=**0.74***	Rho=0.08	Rho=0.09
8.93°C	**8.93°C**	Rho=0.08	Rho=0.21	Rho=**0.71***	Rho=0.06	Rho=0.23
9.88°C	**9.78°C**	Rho=0.13	Rho=0.43	Rho=**0.77***	Rho=022	Rho=0.12
10.39°C	**10.44°C**	Rho=0.32	Rho=0.04	Rho=**0.68***	Rho=0.18	Rho=0.32

The average fresh aboveground plant weights are presented in Table 5.

Plant biomass analyses revealed that the majority of varieties had higher plant weight from the earlier sowing dates and lower values if sowed later during the years. 'Genovese' varieties had the highest values from the IIIrd growth period, 'Busuioc Dulce' and 'Grand Verte' from the IVth period, 'Aromat de Buzău' from the Vth, while 'Serafim' from the VIth growth period. Plants of 'Genovese' and 'Serafim' varieties can be characterized with relatively low variation of the average plant weight, on the contrary 'Aromat de Buzău' had higher variations regarding average plant weight (Tables 6 and 7). Differences can be observed between varieties only at IIIrd, IVth and Vth growth periods. At IIIrd growth period, significantly higher biomass at 'Genovese' variety was observed, followed by 'Busuioc Dulce' and 'Grant Verte' varieties. Very similar trend at IVth growth period were detected, while at V^{th} growth period, the highest biomass at 'Aromat' were detected, followed by 'Grant Verte' and 'Serafim'. No other differences in plant biomass were detected at any other growth periods (Tables 6 and 7).

Table 5. The average fresh aboveground weight of sweet basil plants of the different growth periods of the experimental years expressed in g

Growth period	Experimental year	Sowing date	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
III.	2016	19 May	259.60	121.77	247.25	519.31	355.66
	2017	27 April	-	109.6	235.01	325.4	224.4
IV.	2016	27 May	372.65	153.20	343.95	547.55	737.20
	2017	11 May	193	83.45	392.2	277.5	494
V.	2016	10 June	401.21	153.34	295.21	332.19	388.69
	2017	18 May	406.8	113.9	181.7	230.3	185.94
VI.	2016	17 June	270.33	176.11	348.68	551.33	334.00
	2017	1 June	272.7	171.7	122.7	223.6	169.7
VII.	2016	30 June	152.15	41.94	22.08	5.67	47.47
	2017	13 June	157.5	75.2	166.4	245.3	125.9
VIII.	2016	6 July	242.79	83.42	158.52	109.72	82.63
	2017	28 June	76.5	-	98.7	56.9	79.3

Table 6. Biomass comparison by sowing dates of sweet basil varieties in 2016, using ANOVA and Tukey and Mann-Whitney test

3rd growth period

	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
Aromat		0.44	0.99	0.04↓	0.74
Serafim	2.48		0.53	0.003↓	0.08
Busuioc Dulce	0.22	2.25		0.03↓	0.65
Genovese	4.67	7.15	4.89		0.29
Grand Verte	1.72	4.20	1.95	2.94	

4th growth period

	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
Aromat		0.04	0.99	0.13	0.001↓
Serafim	4.73		0.09	0.009↓	0.001↓
Busuioc Dulce	0.61	4.11		0.06	0.001↓
Genovese	3.77	8.50	4.38		0.09
Grand Verte	7.85	12.59	8.47	4.08	

5th growth period

	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
Aromat		0.001↑	0.14	0.47	0.99
Serafim	8.59		0.03	0.009↓	0.001↓
Busuioc Dulce	3.67	4.91		0.88	0.22
Genovese	2.39	6.19	1.28		0.64
Grand Verte	0.43	8.15	3.24	1.95	

6th growing period

	Serafim	Busuioc Dulce	Genovese	Grand Verte
Serafim		0.11	0.002↓	0.15
Busuioc Dulce	3.67		0.06	0.99
Genovese	7.99	4.31		0.04↑
Grand Verte	3.36	0.32	4.62	

7th growth period

	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
Aromat		0.001↑	0.001↑	0.001↑	0.001↑
Serafim	10.38		0.68	0.18	0.99
Busuioc Dulce	12.25	1.87		0.80	0.48
Genovese	13.79	3.41	1.54		0.10
Grand Verte	9.85	0.52	2.39	3.93	

8th growth period

	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
Aromat		0.001↑	0.06	0.003↑	0.001↑
Serafim	8.44		0.10	0.85	1
Busuioc Dulce	4.46	3.98		0.40	0.09
Genovese	7.05	1.39	2.58		0.84
Grand Verte	8.49	0.04	4.02	1.43	

Data above line represents P values, significant values are marked with grey. Data below line represents F values. ↑ represents highest significances at 0.01 confidential intervals.

Table 7. Biomass comparison by sowing dates of sweet basil varieties in 2017, using ANOVA and Tukey and Mann-Whitney tests

3rd growth period - Tukey test

	Serafim	Busuioc Dulce	Genovese	Grand Verte
Serafim		0.16	0.01↓	0.18
Busuioc Dulce	3.34		0.34	0.99
Genovese	5.87	2.52		0.30
Grand Verte	3.21	0.13	2.65	

4th growth period

	Serafim	Busuioc Dulce	Genovese
Serafim		0.05	0.22
Busuioc Dulce	4.24		0.53
Genovese	2.65	1.59	

5th growth period

	Aromat	Serafim	Busuio Dulce	Genovese	Grand Verte
Aromat		0.001↑	0.001↑	0.002↑	0.001↑
Serafim	12.31		0.30	0.03↓	0.28
Busuioc Dulce	9.40	2.90		0.64	1
Genovese	7.42	4.88	1.97		0.68
Grand Verte	9.30	3.00	0.09	1.87	

6th growth period

	Serafim	Busuio Dulce	Genovese	Grand Verte
Serafim		0.70	0.70	1
Busuioc Dulce	1.55		0.20	0.69
Genovese	1.55	3.10		0.71
Grand Verte	0.02	1.57	1.52	

7th growing period – Mann Witney test

	Aromat	Serafim	Busuioc Dulce	Genovese	Grand Verte
Aromat		0.38	0	0.19	0.66
Serafim	0.38		0.08	0.08	0.19
Busuioc Dulce	0	0.08		0.38	0.38
Genovese	0.19	0.08	0.38		0.08
Grand Verte	0.66	0.19	0.38	0.08	

8th growth period

	Aromat	Busuioc Dulce	Genovese	Grand Verte
Aromat		0.08	0.08	0.38
Busuioc Dulce	0.08		0.08	0.38
Genovese	0.08	0.08		0.08
Grand Verte	0.38	0.38	0.08	

Data above line represents P values, significant values are marked with grey. Data below line represents F values. ↑ represents highest significances at 0.01 confidential intervals.

CONCLUSIONS

Little research studies regarding the effect of sowing date in temperate climatic conditions of sweet basil on vegetative parameters are published (Kosecka et al., 2014; Sadeghi et al., 2009). More studies are made regarding the influence upon the bioactive compounds (micro and macro elements, phenolics and volatile oils) (Majkowska-Gadomska et al., 2014; Muráriková et al., 2017; Sims, 2014). For this reason, the data obtained in the present study are of great importance for the plant growers. According to the results, it can be concluded that in general the IVth growth period sowed on 11 May 2016 and the Vth and VIth growth periods (sowed on 18 May, respective 1 June 2017) had the most influential effects on sweet basil parameters except stem diameters in 2017, when the VIIIth growth period seems to be more significant. Clear positive effect of the VIIth growth period (13 June 2016 and 2017) on 'Aromat de Buzău', 'Serafim', 'Busuioc Dulce' and 'Grand Verte' plant height can be detected and in all cases again temperature has harmful effect on plant height if sowing was made on 27 April. While analyzing the stem diameter, similar tendency can be detected with plant height variations, positive effect of the VIIth growth period (13 June) on stem diameters of 'Aromat de Buzău', 'Serafim', 'Busuioc Dulce', 'Genovese' and 'Grand Verte' were detected. Altogether we can conclude that the VIth period initiated on 1 June had the most positive effects on all plant parameters at all varieties, while the VIIIth period, sowed on 28 June had the most harmful effects, therefore we are not recommending this period as proper for sweet basil cultivation. Relative low performance and high sensitivity to temperature at ‘Genovese’ and ‘Busuioc Dulce’ varieties were detected, while the most constant development and less sensitivity to temperature variations at ‘Aromat de Buzău’, ‘Serafim’ and ‘Grand Verte’ varieties were detected at VIth growth period (1 June).

Plant biomass also varied between years and the sowing time. Plants of ‘Genovese’ and ‘Serafim’ varieties can be characterized with relatively low variation of the average plant weight, on the contrary ‘Aromat de Buzău’ had higher variations regarding average plant weight. The mean precipitation variation may also be an important factor that can influence sweet basil development. In our cases the highest precipitation value in 2016 were detected in June, while in 2017 in May (Figure 1). Further analyses are carried out to detect the cumulative effect of precipitations, temperature and sowing data. Altogether it can be concluded that the present experiment is the first study that links the date of sowing of different varieties of basil, with the growth performances of the plants, following the same climatic conditions. Our experiment was also performed in 2018, but no analyses can be made on these data as a fungal disease compromised the crop during August. This can also be considered as important factor because it looks as several other parameters (pathogens, precipitations) may have significant influence on sweet basil cultivation. Further researches are necessary to detect the influence of these factors.

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