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EFFECT OF SOWING DATE ON THE YIELDING OF SWEET BASIL CULTIVATED FOR A BUNCH HARVEST IN CLIMATIC CONDITIONS OF WESTERN POMERANIAN REGION OF POLAND

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Abstract

In the experiment possibility of cultivation of sweet basil for a bunch harvest through the whole vegetation period was assessed. The experimental factors were: seed sowing date (22 IV, 6 V, 19 V, 2 VI, 16 VI, 30 VI, 14 VII and 28 VII) and sweet basil cultivar ('Kasia' and 'Italiano Classico').

Sweet basil harvest was conducted when the plants attained height of 25-30 cm (entire plants, with the roots, were harvested). After the harvest, measurements of the following features were taken: number of days from sowing to the plant harvest, yield quantity expressed as total weight and bunch weight (each bunch consisted of 10 plants), weight of a single bunch, weight of stems and leaves per a bunch, and leaf participation in a bunch weight.

On the base of obtained results it was found that sweet basil cultivar 'Kasia'was characterized by significantly higher yield (26.74%) in comparison with cultivar 'Italiano Classico'. Moreover, it was proved that cultivation of basil for a bunch harvest from sowing seeds directly into the field, in climatic conditions of Western Pomeranian Region of Poland, is possible for the sowing period from May 6 to June 30. The highest yield was obtained when the seeds were sown on June 2 - yield quantity was 59.13 kg·100 m^{-2}.

The sowing date had also an influence on the single bunch weight and the weight of individual parts of the plants in the bunch. The highest participation of leaves in a bunch weight was found for basil cv. 'Kasia'grown from seeds sown on 30th June (61.3%), while the least for the same cultivar grown from seeds sown on 2nd June. Plants grown from seeds sown on 6th May were characterized by the longest vegetation period which lasted on average 83 day - from sowing to plant harvest date. The shortest vegetation period was noted for plants grown from seeds sown on 16th June.

Key words: *Ocimum basilicum L., sowing date, bunch harvest, yield*

1. INTRODUCTION

Sweet basil (*Ocimum basilicum* L.) belongs to Lamiaceae family. It is herbaceous, annual plant with a pleasant, spicy aroma. Sweet basil is native to Asia regions (India and Sri Lanka). This species is grown in the tropics, as well as in the warm and temperare climate of Europe, and North and South America. In Europe, it is cultivated on a large scale in the countries of the Mediterranean Basin, Ukraine, Hungary, Germany and Bulgaria (Golcz and Seidler-Łożykowska 2008, Nurzyńska-Wierdak 2012). Within the *Ocimum* L. genus there are described about 200 species, which are characterized by a very high morphological, physiological and biochemical variability. The herbal material of sweet basil is herb (*Basilici herba*), which contains essential oil (0.5–2.5%), flavonoids, tannins, phenolic compounds, saponins, anthocyanins and mineral compounds. Herb and essential oil of sweet basil are characterized by high biological activity (Nurzyńska-Wierdak 2012). Sweet basil is primarily irreplaceable spice crop in Greek, Italian, French, Spanish, Portuguese, Turkish and Georgian cuisine, and it is also very popular in India, Thailand, Indonesia, North and South America, and nowadays iceasingly used in Poland (Senderski 2004). This species is especially valued for its relaxing, carminative, anti-inflammatory and antibacterial activity (Jadczak and Grzeszczuk 2005).

The aim of the study was assessment of the quantity and quality of yield of two cultivars of sweet basil, and estimation of possibility of its cultivation for a bunch harvest in climatic conditions of Western Pomeranian Region of Poland.

2. MATERIAL AND METHODS

In the study the possibility of basil cultivation for a bunch harvest through the whole vegetation period was assessed, aimed to establish so-called „green tape". The two factorial experiment was established in randomized blocks with three replications. The experimental plot area was 5.76 m^2 (2.4 m × 2.4 m).

Experimental factors:

1. Seed sowing date: 22 IV, 6 V, 19 V, 2 VI, 16 VI, 30 VI, 14 VII and 28 VII;
2. Sweet basil cultivar: 'Kasia' (IRiPZ, Poznań, Poland) and 'Italiano Classico' ('Franchi Sementi', Italy).

The seeds of the two sweet basil cultivars were sown at a distance of 20 cm between rows. Sowing rate amounted 10 kg·ha^{-1}. The experimental field was prepared according to agrotechnique proper for the spice plants. During the growing season the crop management was carried out, which included mainly irrigation, weeding and soil cultivation.

Basil harvest was conducted when the plants attained height of 25-30 cm (entire plants, with the roots, were harvested and bundled in bunches of 10 plants). After the harvest, yield quantity expressed as a total weight and a bunch weight (each bunch consisted of 10 plants) was assessed. Moreover, measurements of the following features were taken: weight of a single bunch, weight of stems and leaves per a bunch, leaf participation in a bunch weight, and number of days from sowing to the plant harvest.

The results concernig yield quantity of sweet basil were subjected to an analysis of variance, and the means were separated by the Tukey's test at p=0.05.

3. RESULTS AND DISCUSSION

In the basil cultivation for a bunch harvest, from all compared in the experiment sowing dates (Table 1), the highest yield was obtained when the seeds were sown on 2nd June (59.13 kg·100 m^{-2}). The yield of basil obtained from other sowing dates amounted from 25.28 to 50.72 kg·100 m^{-2}. Moreover, it was found that cultivar 'Kasia' was characterized by higher yielding (26.74%) in comparison with cultivar 'Italiano Classico'. Similar results were obtained by Jadczak and Grzeszczuk (2008). In their study, the yield of tarragon herb was significantly affected by the sowing date. Higher yield was obtained when the seeds were sown on 10th May (424.5 kg·100 m^{-2}). Jadczak (2007a) has received the highest yield of savory grown for a bunch harvest sowing the seeds on 25th April (42.98 t·ha^{-1}). On the other hand, in the study of Ziombra and Sas-Golak (2000), the sowing date did not affect the yield of basil. However, the most profitable according to the essential oil content were later sowing dates - 17th and 22nd May. Furthermore, Ziombra (2001), assessing basil cultivation from sowing seeds from 7th to 22nd May, found that the seed sowing date had no significant effect on the yield of basil herb and amounted on average from 116.1 to 123.6 kg·100 m^{-2}.

On the base of the data given in Table 2, it was proved that used id the experiment sowing dates had a significant effect on the weight of bunch, and on the weight of leaves and stems per a single bunch. Significantly higher buch weight was noted for the plants which were grown from sowing seeds on 2nd June (351.91 g), while significantly lower from sowing seeds on 6th May and 30th June (respectively: 205.53 and 218.73 g). Significantly higher bunch wieght was obtained from cultivar 'Kasia' cultivation - 299.45 g. Jadczak (2007a) reported that according to the sowing date mean weight of savory bunch amounted 122.8 g. According to the tarragon grown for a bunch harvest, mean weight of a bunch amounted 125.7 g (Jadczak and Grzeszczuk 2008).

In the presented study it was proved that plants grown from sowing seeds on 19th May and 2nd June were characterized by the highest leaf weight in the bunch weight (respectively: 169.13 and 179.12 g). Significantly higher leaf weight was noted for cultivar 'Kasia' cultivated from seed sowing on 6th May, 16t June and 30th June. Moreover, it was assessed that the leaf participation in a bunch weight was on average 52.97%. Similar result was obtained by Rosłon et al. (2011) - leaf participation in basil herb amounted 53.85%. Jadczak (2007b) determined perticipation of leaves in the herb of basil cultivated for a bunch harvest at different seed sowing dates - it ranged between 49.8 and 56.9%, and according to savory - between 37.9 and 48.8% (Jadczak 2007a).

Analysis of the obtained results showed that the weight of stems was significantly higher when basil seeds were sown on 19th May and 2nd June (respectively: 98.93 and 102.93 g). Moreover, the interaction between experimental factors was found. Significantly higher stem weight was assessed for cultivar 'Kasia', in case of all compared in the experiment sowing dates. Seidler-Łożykowska et al. (2008) reported that amount of stems in the basil herb yield amounted from 33 to 41%, depending on harvest date.

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On the base of the results presented in Table 3, it was found that plants of sweet basil grown from seeds sown on 6th May were characterized by the longest vegetation period (83 days), while by the shortest - the ones which were cultivated from seeds sown on 16th June (65 days). In the study of Ziombra et al. (2000), the period from sowing (8th May) to the harvest of basil plants was 111 and 89 days, depending on the year of cultivation.

Table 1. Total yield quantity of sweet basil according to the cultivar and seed sowing date

Sowing date	Cultivar	Total yield (kg·100 m^{-2})			
		2009	2010	2011	2009-2011
22 IV*	'Kasia'	-	2.43	22.70	-
	'Italiano Classico'	-	6.77	10.59	-
6 V	'Kasia'	18.17	30.61	47.16	31.98
	'Italiano Classico'	14.29	9.14	32.35	18.60
19 V	'Kasia'	36.52	77.43	59.43	57.79
	'Italiano Classico'	20.25	58.62	52.20	43.69
2 VI	'Kasia'	18.06	135.30	35.42	62.92
	'Italiano Classico'	16.96	111.46	37.56	55.32
16 VI	'Kasia'	16.96	71.06	21.06	36.36
	'Italiano Classico'	17.13	47.80	23.84	29.59
30 VI	'Kasia'	58.68	88.19	6.08	50.98
	Italiano Classico'	40.05	61.86	24.65	42.19
14 VII*	'Kasia'	69.79	-	-	-
	'Italiano Classico'	56.90	-	-	-
28 VII*	'Kasia'	23.78	-	-	-
	'Italiano Classico'	21.70	-	-	-
Mean		25.71	69.15	33.98	42.94

Table 1. cont.

Mean for sowing date	22 IV*	-	4.60	27.99	-
	6 V	16.23	19.87	39.75	25.28
	19 V	28.38	67.96	55.81	50.72
	2 VI	17.51	123.38	36.49	59.13
	16 VI	17.04	59.43	22.45	32.97
	30 VI	49.36	75.02	15.36	46.58
	14 VII*	63.34	-	-	-
	28 VII*	22.74	-	-	-
Mean for cultivar	'Kasia'	29.68	80.52	33.83	48.01
	'Italiano Classico'	21.74	57.78	34.12	37.88
$LSD_{0.05}$ for:					
sowing date (A)		1.908	3.339	2.362	21.872
cultivar (B)		0.610	1.880	n.s.	7.771
interaction A/B		n.s.	n.s.	n.s.	n.s.
interaction B/A		n.s.	n.s.	n.s.	n.s.

* Sowing dates not included in statistical calculations

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Table 2. The effect of sowing date and cultivar of sweet basil on the bunch weight, and the weight of individual parts of the plants per a bunch (mean values from the years 2009–2011)

Sowing date	Cultivar	Bunch weight [g]	Leaf weight [g]	Stem weight [g]	Leaf participation in a bunch weight [%]
6 V	'Kasia'	265.47	141.63	86.40	53.4
	'Italiano Classico'	154.60	86.99	38.59	56.3
19 V	'Kasia'	309.48	160.51	102.23	51.9
	'Italiano Classico'	307.60	177.76	95.64	57.8
2 VI	'Kasia'	34.69	167.52	101.87	41.9
	'Italiano Classico'	356.14	190.73	103.99	53.6
16 VI	'Kasia'	355.40	181.62	106.97	51.1
	'Italiano Classico'	236.22	129.50	77.57	54.8
30 VI	'Kasia'	219.70	134.69	68.18	61.3
	'Italiano Classico'	217.76	104.16	63.77	47.8
Mean		277.01	161.03	84.52	52.97

Table 2. cont.

Mean for sowing date	6 V	205.53	114.31	62.49	54.85
	19 V	308.54	169.13	98.93	54.85
	2 VI	351.91	179.12	102.93	47.75
	16 VI	295.81	155.56	92.27	52.95
	30 VI	218.73	119.42	65.97	54.55
Mean for cultivar	'Kasia'	299.45	157.19	93.13	51.92
	'Italiano Classico'	254.46	137.82	75.91	54.06
$LSD_{0.05}$ for:					
sowing date (A)		69.771	38.536	22.660	
cultivar (B)		33.262	n.s.	10.957	
interaction A/B		98.671	54.449	32.046	
interaction B/A		62.614	34.583	20.336	

Table 3. Vegetation period length of sweet basil according to the cultivar and sowing date

Cultivar	Sowing date	Harvest date			Vegetation period - from sowing to harvest (days)			
		2009	2010	2011	2009	2010	2011	mean
'Kasia'	6 V	23 VII	21 VII	6 VIII	79	77	93	83
'Italiano Classico'								
'Kasia'	19 V	29 VII	29 VII	5 VIII	72	72	79	74
'Italiano Classico'								
'Kasia'	2 VI	5 VIII	5 VIII	17VIII	65	65	77	69
'Italiano Classico'								
'Kasia'	16 VI	17 VIII	11 VIII	31VIII	63	57	77	65
'Italiano Classico'								
'Kasia'	30 VI	25VIII	2 IX	21 IX	57	65	84	68
'Italiano Classico'								

4. CONCLUSIONS

1. In the sweet basil cultivation for a bunch harvest, the highest yield was obtained for cultivar 'Kasia' in comparison with cultivar 'Italiano Classico'.
2. It was proved that cultivation of basil for a bunch harvest in climatic conditions of Western Pomeranian Region of Poland, is possible when sowing dates ranged between 6th May and 30th June. The highest yield was obtained when the seeds were sown on 2nd June.

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