

Effect of sowing date on the quantity and quality of the yield of summer savory (*Satureja hortensis* L.) grown for a bunch harvest

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S u m m a r y

The aim of the study was to estimate the influence of the sowing date (10 April, 25 April and 10 May) on the quantity and quality of summer savory cv. 'Saturn' grown for a bunch harvest. It was proved that sowing date made a significant influence on the yield quantity. Higher yield was obtained when seeds were sown on 25 April, but only according to yield collected from the plots where the earliest sowing date (10 April) was used. There was no significant effect of earlier sowing date on the plant mass. However, the highest participation of leaves in the yield was noted for sowing on 10 April. The obtained yield was characterized by high content of mineral compounds. The content of essential oil in the aerially dried herb amounted 1.05–1.55%.

Key words: summer savory, bunch harvest, yield, macro- and microelements content, essential oil

INTRODUCTION

The summer savory (*Satureja hortensis* L.) is an annual spice from *Lamiaceae* family. It is characterized by an expressive taste and aroma [1], and also perfectly corresponsive for cultivation in our weather conditions [2]. The raw material of savory is herb (*Herba Satureja*), harvested at the time of plant blooming [3]. Savory herb contains essential oil (0.5–2.0%), tans (4–9%), resins, carotenoids, flavonoids (up to 40 mg%) and vitamin C [4]. The raw material contains 28.1% dry matter, 5.6% protein, about 20.4% carbohydrates, 1.6% lipids and 2.1% ash [3].

Plants of the summer savory grow to height of 40–60 cm. The main stem is strongly arborescent, lateral stems are thick leaved. The leaves are lanceolate and edge-full. Additionally, there is big amount of short shoots on the plant stem, which make

the plant mass greater. The quantity of leaves, flowers and short shoots decide on the quality of the raw material [4]. Fresh leaves, which keep their original taste and aroma also as frozen, preserved in oil or vinegar, are most valuable [5–7].

MATERIAL AND METHODS

The experiment was carried out in 2004–2006 at the Department of Vegetable Crops of the Agricultural University of Szczecin. The aim of this study was to estimate the effect of sowing date on the quantity and quality of the yield of savory cv. 'Saturn' grown for a bunch harvest. Three dates of sowing were examined: 10 April, 25 April and 10 May. Sowing ration was 10 kg/ha⁻¹. The experiment was established in randomized blocks with four replications. The field was prepared according to agrotechnique proper for this species. Mineral fertilization was quantified according to the results of chemical analysis of the soil. During the growing season the crop management was carried out. It included mainly irrigation, weeding and soil cultivation.

The savory plants harvest was done when they attained height about 25 cm (plants were uprooted). Plants from one date were harvested simultaneously. The yield of following sowing dates was harvested in 2004: 30 June, 12 and 20 July; in 2005: 29 June, 7 and 12 July; in 2006: 26 June, 6 and 12 July.

After the harvest the quantity of the marketable yield was assessed. It included healthy and not damaged plants of an aesthetical appearance. After the harvest, measurements of the following morphological features were taken: plant height, leaf length, mass of 10 plants, leaf mass from 10 plants (a bunch) and the participation of leaf mass in the yield mass.

The laboratory part of the experiment was based on the representative sample consisting of joined all sowing dates. Dry matter was determined after drying samples at 105°C to constant weight, total nitrogen according to Kjeldahl's method, phosphorus by colorimetric method, potassium, calcium and sodium by flame photometry method and copper, zinc, manganese, iron, magnesium using the method of atomic absorption spectrophotometry (AAS) [8]. The essential oil content was determined in the aerially dried herb with use of distillation of the sample together with water in Deryng's apparatus.

The obtained results of the yield quantity were statistically evaluated by the analysis of variance. Significance of the differences was tested by Tuckey's test at $p=0.05$.

RESULTS AND DISCUSSION

Results of savory yielding are presented in Table 1. Statistical analysis showed a significant effect of the sowing dates tested in the experiment on the quantity of the yield. In 2004 significantly lower yield (19.27 t/ha⁻¹) was estimated when the earliest sowing date was used. The yield obtained as a result of sowing on 25 April and 10 May was significantly higher and amounted 60.60 and 53.85 t·ha⁻¹, respec-

tively. Significantly higher yield was obtained next year, when the savory seeds were sown on 25 April ($41.21 \text{ t}\cdot\text{ha}^{-1}$), however, only in accordance to yield obtained after earliest sowing date. The difference between objects was $13.84 \text{ t}\cdot\text{ha}^{-1}$. In 2006 sowing dates analyzed did not have a significant effect on the quantity of savory yield, which amounted $23.13\text{--}35.40 \text{ t}\cdot\text{ha}^{-1}$. Mean results obtained from all of the years of the study proved that significantly higher yield was assessed for the sowing date of 25 April. However, significant difference was only between two of sowing dates: 25 April and 10 April and averaged $15.63 \text{ t}\cdot\text{ha}^{-1}$.

Table 1.

The yield quantity of summer savory grown for a bunch harvest.

sowing date	yield ($\text{t}\cdot\text{ha}^{-1}$)			mean (2004–2006)
	2004	2005	2006	
10 IV	19.27	27.37	35.40	27.35
25 IV	60.60	41.21	27.13	42.98
10 V	53.85	36.21	30.27	40.11
mean	44.57	34.93	30.93	36.81
LSD _{0.05}	17.60	11.70	n.s.	13.82

n.s. – non significant differences

Also weather conditions influenced on the savory yielding. Irrespectively of sowing dates, the mean yield obtained in 2004 was by 27.6% higher than that collected in 2005 and by 44.1% than in 2006.

Sowing dates used in the experiment influenced the plant height (Table 2). The plants from the earliest sowing date had a bit lower height but they had higher leaf length and also higher participation of leaf mass in the yield mass (48.8%). There was no significant effect of the sowing date on the plant mass. Analyzing the results of the leaf mass, higher one was obtained for the earliest sowing date but only in comparison to 25 April.

Table 2.

Biometrical characteristics of summer savory plants grown for bunch harvest.

sowing date	plant height (cm)	leaf length (cm)	bunch mass (10 plants) (g)	leaf mass (10 plants) (g)	participation of leaf mass in the herb mass (%)
10 IV	23.5	3.99	126.0	61.5	48.8
25 IV	24.5	3.34	133.2	52.4	39.3
10 V	27.3	3.52	109.2	41.4	37.9
mean	25.1	3.62	122.8	51.8	42.2
LSD _{0.05}	-	-	n.s.	12.66	-

n.s. – non significant differences

Mean results of the studied years showed that leaf mass of 10 plants (a bunch) amounted 51.8 g, which was 42.2% of the whole plants mass. Usually, herbs are accessible on the Polish market as a dried product. In general, its value is much lower than this of fresh herbs [9]. The reason is aroma of the essential oils situated on the leaf surface and also changes of vitamins, mineral compounds, enzymes, colors and other biological active compounds content [10]. One of the main factors deciding on the raw material quality is percentage participation of leaf mass in the herb mass [7]. In the experiment carried out on the Agricultural University in Szczecin it was proved that leaves contained much more microelements in comparison with stems [11].

Macro- and microelements content in herbs depends on type, kind and pH of soil, fertilization, field location and also on the species [12]. Data given in Table 3 show that level of the analyzed elements was similar in all years of the research. The highest differences were found in potassium content: in 2005 it was two times higher than in first year of the research. Moreover, in 2004 higher contents of iron (by 130.3%), manganese (by 25.7%) and zinc (by 34.5%) were noted. The results obtained were close to other authors' data [13, 14]. In the research of Suchorska-Orłowska et al. [11] higher level of manganese, iron and copper was obtained for the plants harvested at height about 20 cm. Only copper content was higher in plants cut just before their blooming.

Table 3.

The content of dry matter, macro- and microelements in the yield of summer savory grown for a bunch harvest.

years of the study	dry matter (%)	macroelements (% d.m.)						microelements (mg/kg-1 d. m.)				
		N	P	K	Mg	Ca	Na	Mn	Zn	Fe	Cu	
2004		2.43	0.34	2.41	0.25	1.50	0.02	32.49	57.51	512.10	7.0	
2005	18.85	2.61	0.32	4.35	0.25	2.48	0.05	25.84	42.76	222.35	8.8	
mean		2.52	0.33	3.38	0.25	1.99	0.04	29.17	50.14	367.23	7.5	

Content of essential oil in aerially dried herb varied on the average of the study years from 1.05 to 1.55% (Table 4). The lowest amount of essential oil was noted for plants which had grown at the earliest sowing date. Obtained results are slightly lower in comparison to data given by Dzida and Jarosz [15].

Table 4.

The content of essential oil in aerially dried herb of summer savory.

sowing date	essential oil content (%)			Mean
	2004	2005	2006	
10 IV	1.05	1.0	1.10	1.05
25 IV	1.12	1.5	1.50	1.37

sowing date	essential oil content (%)			
	2004	2005	2006	Mean
10 V	1.20	1.75	1.70	1.55
mean	1.12	1.42	1.43	1.32

CONCLUSIONS

1. Analyzed sowing dates had significant influence on the yield quantity of summer savory grown for a bunch harvest. Significantly higher yield was obtained when seeds were sown on 25 April, but only according to the yield collected from earliest sowing date (10 April).
2. There was no significant effect of sowing date on the mass of savory plants. The highest participation of leaf mass in the yield was noted for the sowing seeds on 10 April.
3. The obtained yield of savory had a high content of mineral compounds. The content of essential oils was 1.05–1.55%.

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WPŁYW TERMINU SIEWU NA WIELKOŚĆ I JAKOŚĆ PŁONU CZĄBRU OGRODOWEGO
(*SATUREJA HORTENSIS* L.) UPRAWIANEGO NA ZBIÓR PĘCZKOWY

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Streszczenie

Badano wpływ terminu siewu nasion (10 i 25 kwietnia oraz 10 maja) na wielkość i jakość plonu cząbrów ogrodowych odm. 'Saturn', uprawianego na zbiór pęczkowy. Wykazano, iż badane terminy siewu miały istotny wpływ na wielkość plonu, który był większy przy siewie nasion 25 kwietnia, lecz tylko w odniesieniu do plonu zebranego przy zastosowaniu najwcześniejszego terminu siewu (10 kwietnia). Nie stwierdzono istotnego wpływu terminu uprawy na masę roślin, natomiast największy udział liści w plonie odnotowano przy uprawie cząbrów z siewu nasion 10 kwietnia. Zebrany plon charakteryzował się wysoką zawartością składników mineralnych, a zawartość olejku eterycznego w powietrznie suchym ziele otartym kształtowała się na poziomie 1.00–1.75%.

Słowa kluczowe: cząbrów ogrodowy, uprawa na zbiór pęczkowy, plon, zawartość makro- i mikrośladników, olejek eteryczny