

# Cropping evaluation of white horehound (*Marrubium vulgare* L.), grown from sowing and seedling

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## Summary

The studies were conducted in the years 2004–2008. The available Polish and foreign literature does not devote much attention to the problem of growing white horehound. The cropping of white horehound grown from sowing and seedling was assessed in the experiment, depending on the term when the plantation was established, harvest date and age of the plants. Air dry herb was analyzed in the laboratory, where the essential oil content was determined. On the basis of the studies, it was revealed that seed sowing date and herb harvest term affect white horehound plant cropping. Differences were also found in cropping between plants from one-year and two-year plantation.

*Key words:* white horehound, yield, sowing date, harvest date, essential oil

## INTRODUCTION

White horehound (*Marrubium vulgare* L.) is a perennial medicinal plant. According to literature, the *Marrubium* genus consists of about 40 species [1]. White horehound occurs in Europe, Asia and America [2]. In Poland, in the natural state, it grows on wastelands, near roads and near buildings [3]. It is also cultivated. The herbal raw material is the herb (*Marrubii herba*) containing marrubinum (0.6.–1.0 %) and other diterpene compounds, ursolic acid and essential oil (ca. 0.1%) [4]. White horehound is used as an expectorant in the diseases of upper respiratory passages as well as in liver and gall bladder diseases and in dyspepsia [5-7]. In the available Polish and foreign literature, not much attention is devoted to the

cultivation of white horehound. Thus, the aim of conducted studies was cropping assessment, depending on sowing date, harvest date and age of the plants.

## MATERIAL AND METHODS

The experiment was conducted in 2004–2008 in the Experimental Farm of the Chair of Vegetable Growing and Medicinal Plants at the University of Life Sciences in Lublin. The seeds came from herb farm “Lewandowski” from Kruszynek. The plantations were founded with the use of two methods: through sowing the seeds directly into the field and by producing seedlings. Studies were conducted on one- and two-year plantation. The soil for cultivation was prepared in accordance with the recommendations from Herb Grower Manual [8]. During vegetation of the plants the maintenance procedures were performed – weeding and soil loosening.

Sowing the seeds directly into the field was conducted in two terms: in autumn (in early October) and in spring (in mid April). The seeds sown in autumn germinated next spring, whereas those sown in spring – after three weeks. The seeds were sown in rows, every 30 cm. The experiment was established in four replications. The plot surface was 2.4 m<sup>2</sup>. In the first year of growing, the plants were cut once, in mid July, and on the two-year plantation – in three terms, in intervals of every six weeks: mid June, late July, and early September. The plants were cut on the height of 8 cm, fresh herb yield was determined and then dried in natural conditions, in dry, airy and shaded place. After drying, the air-dried herb yield and the essential oil content were assessed in accordance to Polish Pharmacopoeia VII (2006) [9]. The white horehound seedlings were produced in a glasshouse. The seeds were sown in late March into boxes filled with peat substrate. The seeds germinated after two weeks. Seedlings were thinned into pots. The white horehound seedlings were planted into the field at the end of May, in the space of 30 x 40 cm. The experiment was established in four replications. The plot surface was 2.4 m<sup>2</sup>. In the first year the herb was harvested in the flowering phase – in mid July, and in the second year the raw material was cut three times: in mid June, late July and early September. The plants were cut on the height of 8 cm, fresh herb yield was determined, and after drying in natural conditions, in a dry, airy and shaded place – the dry-aired herb yield was assessed. The essential oil content in the raw material was determined in accordance with the Polish Pharmacopoeia VII (2006) [9].

The results were statistically worked out by means of variance analysis for k-fold cross-classification.

## RESULTS AND DISCUSSION

The conducted studies demonstrated that the seed sowing date significantly influenced the white horehound yield (tab. 1, 2). Spring term turned out to be more advantageous. Fresh herb yield, obtained in the first year of growing from

the plantation established in spring was  $0.71 \text{ kg}\cdot\text{m}^{-2}$ , and in autumn  $0.45 \text{ kg}\cdot\text{m}^{-2}$  (tab. 1). In the second year of growing the fresh herb and air dried herb yield, collected from the plantation established in spring was also significantly greater (tab. 2). On the two-year plantation we also found a significant effect of harvesting time upon cropping. The largest amount of fresh herb was obtained in the first harvesting date ( $1.99 \text{ kg}\cdot\text{m}^{-2}$ ) and the smallest – in the third date ( $0.72 \text{ kg}\cdot\text{m}^{-2}$ ). Similar dependence was found in the air-dry herb yield.

**Table 1.**

Relationship between seed sowing date and white horehound cropping in the first year of growing

year	sowing date	yield of fresh herb [ $\text{kg}\cdot\text{m}^{-2}$ ]	yield of air dry herb [ $\text{kg}\cdot\text{m}^{-2}$ ]	essential oil content in the air dry herb [%]
2005	Autumn 2004	0.58 ab	0.15 ab	0.05 a
	Spring 2005	1.13 c	0.25 c	0.05 a
	$\bar{X}$	0.85 c	0.20 b	0.05 a
2006	Autumn 2005	0.34 a	0.09 ab	0.06 a
	Spring 2006	0.25 a	0.06 a	0.06 a
	$\bar{X}$	0.29 a	0.07 a	0.06 a
2007	Autumn 2006	0.44 ab	0.14 ab	0.06 a
	Spring 2007	0.75 bc	0.18 bc	0.06 a
	$\bar{X}$	0.59 b	0.16 b	0.06 a
Mean	Autumn	0.45 a	0.13 a	0.06 a
	Spring	0.71 b	0.16 a	0.06 a
	$\bar{X}$	0.58	0.14	0.06

**Table 2.**

Relationship between seed sowing date and white horehound cropping in the second year of growing

year	sowing date	yield of fresh herb [ $\text{kg}\cdot\text{m}^{-2}$ ]				yield of air dry herb [ $\text{kg}\cdot\text{m}^{-2}$ ]				essential oil content in the air dry herb [%]			
		1 <sup>st</sup> harvest	2 <sup>nd</sup> harvest	3 <sup>rd</sup> harvest	$\Sigma$	1 <sup>st</sup> harvest	2 <sup>nd</sup> harvest	3 <sup>rd</sup> harvest	$\Sigma$	1 <sup>st</sup> harvest	2 <sup>nd</sup> harvest	3 <sup>rd</sup> harvest	$\bar{X}$
2006	Autumn 2004	1.34	1.09	0.52	2.95 a	0.42	0.29	0.16	0.87 a	0.04	0.06	0.06	0.05 a
	Spring 2005	0.98	1.16	1.08	3.22 a	0.25	0.37	0.26	0.88 a	0.02	0.05	0.05	0.04 a
	$\bar{X}$	1.16 ab	1.12 ab	0.80 a	3.08 a	0.33 ab	0.33 ab	0.21	0.87 a	0.03 a	0.05 a	0.05 a	0.04 a
2007	Autumn 2005	2.17	1.14	0.39	3.70 a	0.62	0.39	0.12	1.13 c	0.03	0.08	0.06	0.06 a
	Spring 2006	2.54	1.33	0.92	4.79 a	0.72	0.41	0.25	1.38 d	0.03	0.06	0.06	0.05 a
	$\bar{X}$	2.35 c	1.23 ab	0.65 a	4.24 b	0.67 c	0.40 b	0.18 a	1.25 b	0.03 a	0.07 a	0.06 a	0.05 a
2008	Autumn 2006	2.30	1.16	0.65	4.11 a	0.48	0.40	0.18	1.06 c	0.03	0.08	0.06	0.06 a
	Spring 2007	2.59	1.77	0.79	5.15 a	1.01	0.52	0.20	1.73 e	0.03	0.08	0.06	0.06 a
	$\bar{X}$	2.44 c	1.46 b	0.72 a	4.63 b	0.74 c	0.46 b	0.19 a	1.39 c	0.03 a	0.08 a	0.06 a	0.06 a
mean	Autumn	1.94 c	1.13 a	0.52	3.59 a	0.51 a	0.36 a	0.15 a	1.02 a	0.03 a	0.07 a	0.06 a	0.07 b
	Spring	2.04 a	1.42 a	0.93	4.39 b	0.66 a	0.43 a	0.24 a	1.33 b	0.03 a	0.07 a	0.06 a	0.05 a
	$\bar{X}$	1.99 c	1.27 b	0.72 a	3.99	0.58 c	0.39 b	0.19 a	1.17	0.03 a	0.07 c	0.06 b	0.06

The yield of white horehound herb grown from seedlings on the two-year plantation was almost twice as big as on the one-year plantation and it was  $3.10 \text{ kg}\cdot\text{m}^{-2}$  – fresh herb yield and  $0.92 \text{ kg}\cdot\text{m}^{-2}$  – air dry herb yield (tab. 3). In the Polish and foreign available literature not much attention was devoted to white horehound cropping. According to Mikołajczyk and Wierzbicki [5] as well as Senderski [3], on average 2–3 t of dry raw material is obtained from 1 ha. Wolski et al. [1] report that in the first growing year herb yield is  $1.5\text{--}2 \text{ t}\cdot\text{ha}^{-1}$ , whereas in next years it is  $2\text{--}3 \text{ t}\cdot\text{ha}^{-1}$ . On the plantation established from sowing seeds, mean air dry herb yield in the first growing year was  $0.14 \text{ kg}\cdot\text{m}^{-2}$ , and on the two-year plantation –  $1.17 \text{ t}\cdot\text{ha}^{-1}$  (tab. 1, 2).

On the basis of laboratory tests it was demonstrated that the essential oil contents in the herb from one-year plantation, established from sowing seeds was from 0.05 to 0.06%, like in the raw material collected from plants grown from seedlings (tab. 1 and tab. 3). These results are consistent with the reports of Bradley [10], Jänicke [11] and Wolski et al. [1]. In the studies conducted by Khanavi et al. [12] the essential oil content in herb from *Marrubium vulgare* L. was slightly greater and equaled 0.09%.

Table 3.

Cropping of white horehound grown from seedlings in the first and second growing year

year	yield of fresh herb [ $\text{kg}\cdot\text{m}^{-2}$ ]	yield of air dry herb [ $\text{kg}\cdot\text{m}^{-2}$ ]	essential oil content in the air dry herb (%)
first year of cultivation			
2006	1.71 a	0.41 a	0.05 a
2007	2.04 a	0.60 b	0.05 a
2008	1.54 a	0.38 a	0.06 a
$\bar{x}$	1.76 a	0.46 a	0.05 a
second year of cultivation			
2006	2.55 a	0.76 b	0.06 a
2007	3.59 a	1.02 c	0.06 a
2008	3.16 a	0.99 c	0.05 a
$\bar{x}$	3.10 b	0.92 c	0.06 a
mean			
2006	2.13 a	0.58 a	0.05 a
2007	2.81 b	0.81 c	0.05 a
2008	2.35 ab	0.68 b	0.05 a
$\bar{x}$	2.43	0.69	0.05

The white horehound herb from the two-year plantation established from sowing seeds had different oil content, depending on harvest date (tab. 2). The smallest amount of oil was found during the first harvest (0.03%), and more than twice as much in the herb cut in the second term (0.07%). Other horehound species also contain small amounts of oil. The herb of *Marrubium velutinum* Sm. contains from 0.02 to 0.04% of oil [13], *Marrubium peregrinum* L. – 0.07%, *Marrubium parviflorum* Fisch & C.A. Mey. – 0.08% [12], *Marrubium cuneatum* – 0.15% [14].

## CONCLUSIONS

1. Seed sowing term significantly affected white horehound cropping. A much larger fresh herb yield was obtained from the plantation established in spring than from that established in autumn.
2. The harvest date significantly influenced white horehound cropping in the second growing year. The largest fresh and air-dry herb yield was obtained in the first harvest term (in mid June).
3. No significant differences were found in essential oil content in the herb from one-year and two-year plantations.

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## OCENA PŁONOWANIA SZANTY ZWYCZAJNEJ (*MARRUBIUM VULGARE* L.) UPRAWIANEJ Z SIEWU I ROZSADY

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### **Streszczenie**

Badania przeprowadzono w latach 2004–2008. Dostępna literatura krajowa i zagraniczna poświęca niewiele uwagi problemowi uprawy szanty zwyczajnej. W doświadczeniu oceniono plonowanie szanty zwyczajnej uprawianej z siewu i rozsady w zależności od terminu zakładania plantacji, terminu zbioru oraz wieku roślin. Analizom laboratoryjnym poddano powietrznie suche ziele, gdzie oznaczono zawartość olejku eterycznego. Na podstawie badań wykazano, iż termin siewu nasion oraz termin zbioru ziela ma wpływ na plonowanie roślin szanty zwyczajnej. Stwierdzono także różnice w plonowaniu między roślinami z plantacji jednorocznej a dwuletniej.

*Słowa kluczowe:* szanta zwyczajna, plon, termin siewu, termin zbioru, olejek eteryczny