STUDIES ON DRY MATTER CONTENT AT *HYSSOPUS OFFICINALISIT*

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Abstract.
Hyssop is a plant with multiple uses and which, at present, is very little present in the structure of medicinal plant cultures in our country.The aim of this research was to analyze the content of dry matter/hyssop plate, according to the type of hyssop, the year of cultivation and the climatic conditions of the researched area. The researches were carried out on the three color varieties, namely: hyssop with pink flowers, hyssop with blue flowers and hyssop with white flowers, existing in the collection of the Phytotechnics discipline within the Faculty of Agriculture within the University of Life Sciences, the King Mihai I" from Timișoara, originating from three years of cultivation. The observations were carried out in the flowering phenophase of the hyssop plants, recommended by the specialized literature. The experience was carried out within the SCDA Lovrin, the field of medicinal plants, located on a cambic chernozem type soil, weakly glazed. The dry matter (DS) content decreases in value from pink-flowered hyssop to blue-flowered hyssop, then increases. The values of the dry substance content obtained for the three varieties of hyssop were 23.7% for hyssop with pink flowers, 23.3% for hyssop with blue flowers and 23.4% for hyssop with white flowers, so the highest value was obtained for hyssop with flowers pink.

Keywords:*Medicinal plants, hyssop, herb, experimental factors*

INTRODUCTION

The increasing demand for phytotherapeutic remedies causes the expansion of the areas cultivated with the most requested medicinal plants, among which is hyssop [Muntean LS 1995 and 2007, Teleuță 2008, Verzea 2000].

Hyssop (Hyssopus L.) is a species used since antiquity, being mentioned in the Bible as well as in the first works on plant classifications, such as those of Theophrastus (372-287 BC), from Ancient Greece or Dioscorides (40-92 AD) and Pliny (23-79 AD) from Ancient Rome (Munteanu 2007). The name of the species derives from the Hebrew language "ezob" which translates as "sacred grass" [Pirosca 2000, Gonciaruc 2013].

It is already well known the role that hyssop has in the natural treatment of some ailments given its content in biologically active compounds with antimicrobial and anti-inflammatory influences. At the same time, although the effect is known and mentioned even in the Bible, the cultivation of this species on large areas is not known either in our country or worldwide.

MATERIALS AND METHODS

The biological material was represented by three color varieties, namely: hyssop with pink flowers, hyssop with blue flowers and hyssop with white flowers, existing in the collection of the Phytotechnics discipline within the Faculty of Agriculture within the King Mihai University of Life Sciences I" from Timișoara, coming from three years of cultivation.

The experience was a comparative culture with three varieties of hyssop color (pink, blue and white), with the aim of tracking the amount of herb that can be obtained depending on the year of cultivation, hyssop being cultivated as a perennial plant.

In order to be able to track the amount of herb harvested since the first year of cultivation, the establishment of the experience was done by seedling and not by seed. Seedling production was done by sowing the seeds at the beginning of March and planting the seedlings in the field was done after the last decade of May. Planting distance was 50 cm between rows and 25 cm between plants per row.

The preparation of the land for planting the seedlings consisted of plowing at 30 cm. The mineral fertilizers were applied before the preparation of the seed bed of the complex type 15:15:15, achieving a ratio of 45 kg sa/ha nitrogen, 45 kg/ha sa potassium and 45 kg/ha sa phosphorus.

The variety with pink flowers The variety with blue flowers The variety with white flowers

Fig.1. Images from the experimental field at SCDA Lovrin (original)

RESULTS AND DISCUSSIONS

Results on dry matter content/plant, depending on the color variety(factor A), are shown in table 1 and figure 2.

Table 1.

Dry mass by color variety (A factor)

A Factor (variety of colors)	Content of dry mass/plant (%)	Difference (%)	Significance
a1 – v1	23.71	0.25	***
a2 – v2	23.28	-0.18	000
a3 – v3	23.40	-0.06	n.s
Average	23.47	Mt	
DL 5% = 0.07%; DL 1% = 0.096%; DL 0.1% = 0.131%.			

The dry matter content, depending on the color variety, ranged between 23.28% (blue-flowered hyssop) and 23.71% (pink-flowered hyssop). The average of the experience, in terms of dry matter content, according to the color variety, was 23.47%.

Compared to the control - the average of the experience, for all three color varieties, the following increases were obtained: very significant, for the hyssop with pink and blue flowers, and for the hyssop with white flowers, a statistically uncertain increase. In a2 (blue-flowered hyssop), the value of the dry matter content obtained is below the experience average by -0.18%.

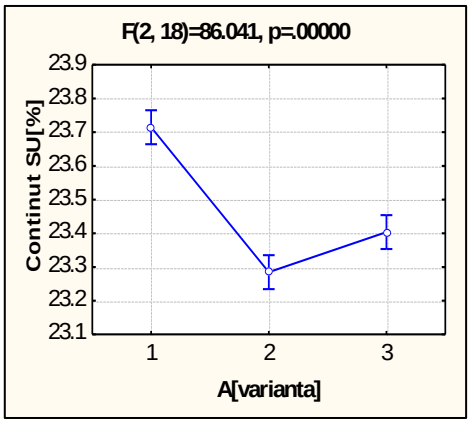

Fig. 2. Variation in dry matter content/plant by color variety (A factor)

TEST DUNCAN pantry α5% - factor A (variant) DL 5% =0.07%

Original data	Sister data
a1 1 = 23.71 A	a1 1 = 23.71 A
a2 2 = 23.28 C	a3 3 = 23.40 B
a3 3 = 23.40 B	a2 2 = 23.28 C

Following the three comparisons (C32), classes A – C were obtained. It should be noted that any of the three variants is significantly different from the others (they belong to different homogeneity classes).

The highest value of 23.71% - class A, was obtained at a1 (hyssop with pink flowers), a value that differs significantly from the other two variants.

The lowest value of 23.28% - class C, was obtained at a2 (hyssop with blue flowers), which differs significantly from the other two variants.

The content of dry substance/plant according to the crop year of the experimental period 2020-2022, is presented in table 2 and figure 3.

Table 2

Dry matter content/plant by year of crop (B factor)

B Factor (crop year)	Dry matter content (%)	Difference (%)	Significance
b1 – year 1	22.36	-1.11	000
b2 – year 2	23.41	-0.05	n.s
b3 – year 3	24.63	1.16	***
Mediate	23.47	0.00	
DL 5% = 0.07%; DL 1% = 0.096%; DL 0.1% = 0.131%.			

Depending on the crop year, the dry matter content was between the value of 23.36%(obtained in the first year of cultivation) and 24.63% (recorded in the third year of cultivation). The average dry matter content over the three years experienced was 23.47%.

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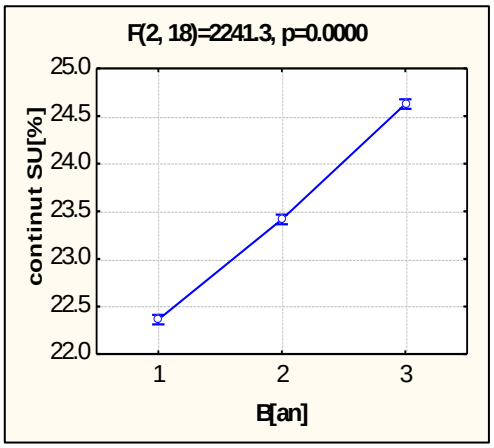


Fig. 3. Variation in dry matter by year of crop (factor B)

Compared to this reference value - the average of the experience, in all three years of production, very significant increases were obtained, in year 1 and year 3, and in year 2 the increase is insignificant. The statistically ensured increases are the following: 1.16% obtained in year 3 and -1.11% obtained in year 1, i.e. the value of the dry matter content obtained in year 1 is below the average of experience, i.e. it is a very significant increase in the sense negative.

DUNCAN'S TEST for α5% - factor B (year) DL 5% =0.07%

Original data	Sister data
b1 1 = 22.36 C	b3 3 = 24.63 A
b2 2 = 23.41 B	b2 2 = 23.41 B
b3 3 = 24.63 A	b1 1 = 22.36 C

Following the three comparisons (C32), classes A - C were obtained. It should be noted that any of the three years of production differ significantly from the other years of production (they are part of different homogeneity classes).

The highest value of dry matter content of 24.63% was obtained at b3 (year 3) – class A, which differs significantly from b2 (year 2) and b1 (year 1).

The lowest value of dry matter content of 22.36% was obtained in b1 (year 1) – class C, it differs significantly from b3 (year 3) and b2 (year 2).

The results regarding the content of dry matter/plant, obtained at the AxB interaction, as well as the significance of the differences compared to the control - the average of the experience, are presented in table 3 and figure 3.

The interaction of the color variety with the year of cultivation determined a minimum value of the dry matter content of 21.78% (white hyssop in the first year of cultivation) and a maximum of the dry matter content of 24.86% (pink hyssop in the 3rd year of culture). The average content of dry matter in the interaction of the color variety with the years of vegetation, recorded the value of 23.47%.

Compared to the control - the average of the experience, the following increases were obtained:

- at a1 (hyssop with pink flowers), statistically assured differences were obtained, as follows:

highly significant in year 1 and year 3 of production, it must be specified that, in the first year of production, the difference is negative and insignificant in year 2 of production.

- in a2 (blue-flowered hyssop), highly significant differences were obtained in all three years. In production year 1 and year 2, the differences are negative; at a3 (hyssop with white flowers) very significant differences were obtained in the 1st and 3rd year of production, and in the 2nd year of production the increase is significant; it must be specified that negative differences were obtained in the 1st year of production.

Table 3.

Dry matter content/plant obtained at AxB interaction

B Factor (crop year)	A Factor (color variety)								
	a1 – pink hyssop			a2 – blue hyssop			a3 – white hyssop		
	Dry matter content (%)	Difference. (%)	Significance.	Dry matter content (%)	Difference. (%)	Significance.	Dry matter content (%)	Difference. (%)	Significance.
b1 – year 1	22.75	-0.72	000	22.55	-0.91	000	21.78	-1.69	000
b2 – year2	23.53	0.06	n.s	23.11	-0.36	000	23.60	0.14	*
b3 – year 3	24.86	1.39	***	24.19	0.72	***	24.83	1.36	***
Average	23.47								
	DL 5% = 0.121%; DL 1% = 0.166%; DL 0.1% = 0.226%.								

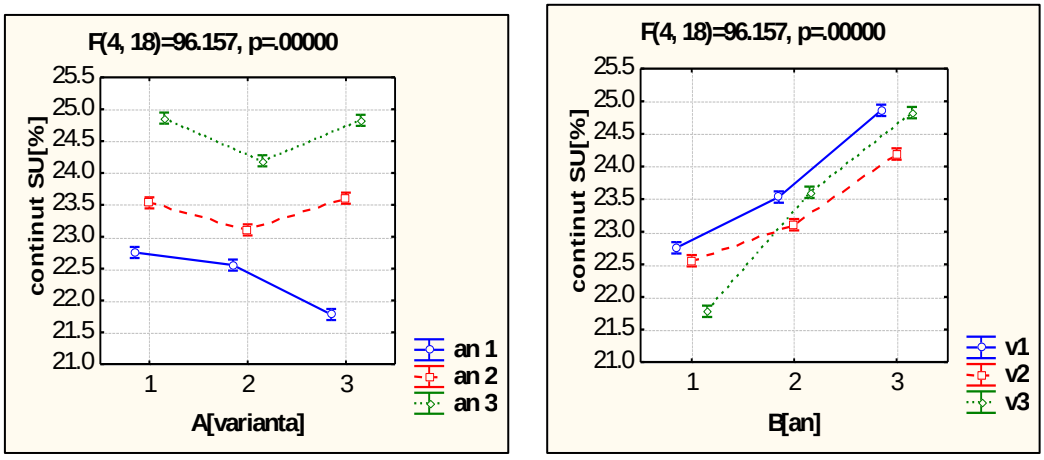


Fig. 4. Variation in dry matter content/plant obtained at AxB interaction

DUNCAN'S TEST for α5% - INTERACTION AxB DL 5% =0.097 kg

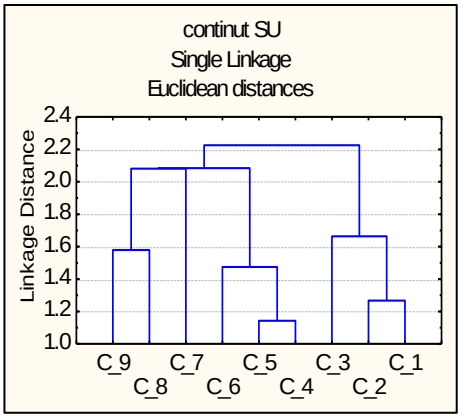
Original data

Mean 1 = 22.75 E
Mean 2 = 23.53 C
Mean 3 = 24.86 A
Mean 4 = 22.55 F
Mean 5 = 23.11 D
Mean 6 = 24.19 B
Mean 7 = 21.78 G
Mean 8 = 23.60
Mean 9 = 24.83

Sister data

Mean 3 = 24.86 A
Mean 9 = 24.83 A
Mean 6 = 24.19 B
Mean 8 = 23.60 C
Mean 2 = 23.53 C
Mean 5 = 23.11 D
Mean 1 = 22.75 E
C Mean 4 = 22.55 F
A Mean 7 = 21.78 G

Mean 1 – a1b1
Mean 2 – a1b2
Mean 3 – a1b3
Mean 4 – a2b1
Mean 5 – a2b2
Mean 6 – a2b3
Mean 7 – a3b1
Mean 8 – a3b2
Mean 9 – a3b3



C 1 – a1b1
C 2 – a1b2
C 3 – a1b3
C 4 – a2b1
C 5 – a2b2
C 6 – a2b3
C 7 – a3b1
C 8 – a3b2
C 9 – a3b3

Fig. 5. Dry matter content dendogram for the 9 AxB combinations

Following the 36 comparisons (C92), grades A – G were obtained.

The highest value of the dry matter content, of approximately 24.86% - 24.83%, is obtained in the combination: a1b3 and a3b3 (hyssop with pink flowers and hyssop with white flowers in the 3rd year of production) – class A, which differs significantly from all other combinations.

The lowest value of the dry matter content, around 21.78% - class G, is obtained at a3b1 (hyssop with white flowers in the 1st year of production), the value of the dry matter content obtained is significantly different from all the others combinations.

It should be noted that, in the combination: a3b2 and a1b2 (hyssop with white flowers and hyssop with pink flowers in the 2nd year of production) – class C, similar values of approximately 23.6% are obtained. So with the two combinations, a homogeneous dry matter content value is obtained, which differs from all other combinations.

The contribution of factors A (color variety), B (year) and the interaction AxB to the realization of the content of dry matter/plant, is presented in figure 6.

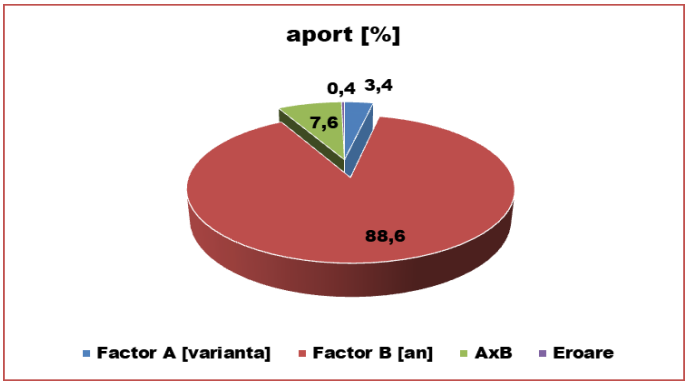


Fig. 6. Contribution of factors A (color variety), B (year), and AxB interaction

Factor A (variety of color), contributes to the achievement of the dry substance content in proportion to 3.4%; factor B (crop year) contributes 88.6%, interaction AxB 7.6%. So, factor B (crop year) has the biggest contribution, followed by AxB interaction and factor A (color variety).

CONCLUSIONS

The dry matter (DS) content decreases in value from pink-flowered hyssop to blue-flowered hyssop, then increases. The values of the dry substance content obtained for the three varieties of hyssop were 23.7% for hyssop with pink flowers, 23.3% for hyssop with blue flowers and 23.4% for hyssop with white flowers, so the highest value was obtained for hyssop with flowers pink.

Depending on the crop year, the dry matter content values varied between 22.4% (year 1) and 24.6% (year 3). Differences between years are highly significant [$p<0.001$]

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