STUDIES ON GREEN MASS PRODUCTION AT HYSSOPUS OFFICINALIS L

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Abstract.
Hyssop being a plant from which herb is harvested, the objective of the research was how elements that contribute to the production of herb are influenced by the growing conditions, the color variety of hyssop and the year of vegetation. The researches were carried out on the three color varieties, namely: pink-flowered hyssop, blue-flowered hyssop and white-flowered hyssop, existing in the collection of the Phytotechnics discipline within the Faculty of Agriculture of the "King Mihai I" University of Life Sciences in Timișoara, originating from three years of cultivation. The observations were carried out in the flowering phase of the hyssop plants, recommended by the specialized literature. The experience was carried out within SCDA Lovrin, the field of medicinal plants, located on a cambic chernoziom type soil, weakly glazed..

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

INTRODUCTION

The use of medicinal plants for various purposes has been practiced for centuries throughout the world. Among them is hyssop (Hyssopus officinalis L.), which although known since antiquity and mentioned in biblical writings, due to its multiple health benefits passed down from generation to generation as a carminative, tonic, antiseptic, expectorant and cough reliever, is present in the attention of researchers around the world.

Hyssop is a light-loving plant with higher heat requirements. In warm areas and with southern exposure, an increased content of essential oil accumulates. With all these high temperature requirements, hyssop plants survive the winter at temperatures of -25°...-30° if the soil is covered. The requirements for humidity are not high, enduring from the second year and periods of drought. However, for germination, hyssop seeds need 70% water of field capacity. (Ivan, 1982, Muntean, 2007, Hoffmann 2016) Soil requirements for hyssop in general are reduced. The best hyssop results are obtained on soils with high natural fertility, but it can also be grown on calcareous or even eroded soils. (Panzariu, 1986).

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 of the "King Mihai I" University of Life Sciences in Timișoara, originating 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.

RESULTS AND DISCUSSIONS

Results on green mass production/plant, depending on the color variety(factor A), are presented in table 1 and figure 1.

Table 1.
Green mass by color variety (A factor)

A Factor (variety of colors)	Production of green mass/plant (kg)	Difference (kg)	Significance
a1 – v1	1.69	0.02	n.s
a2 – v2	1.52	-0.15	000
a3 – v3	1.80	0.13	***
Average	1.67	Mt	
DL 5% = 0.056 kg; DL 1% = 0.077; DL 0.1% = 0.105			

The results highlight that, depending on the color variety, the highest amount of green mass/plant is obtained in hyssopwith white flowers (1.67 kg/pl), amount exceeding the experience average by 0.13 kg, statistically assured as very significant. In hyssop with pink flowers, the amount of green mass/plant is almost equal to the average of experience (1.65 kg/pl), not being statistically assured. The results regarding the production of green mass/plant in the case of the color variety with blue flowers, show that it was below the average of the experience by 0.15 kg/pl, an amount statistically assured as highly significant in the negative sense.

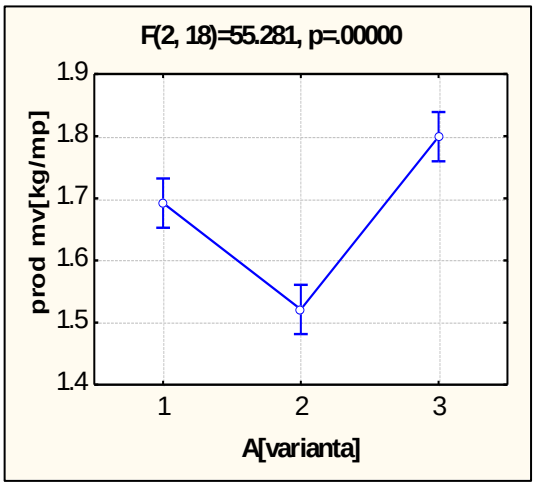


Fig. 1. Variation in green mass/plant by color variety (A factor)

DUNCAN TEST for α5% - factor A DL 5% =0.056 kg

Original data Sister data

a1 1 = 1,690 B a3 3 = 1,800 A

a2 2 = 1.520 C a1 1 = 1.690 B

a3 3 = 1,800 A a2 2 = 1,520 C

Following the three comparisons (C32), classes A - C were obtained. It should be noted that any of the 3 variants differs significantly from the others (they belong to different homogeneity classes).

The production of green mass/plant according to the crop year in the experimental period 2020-2022, is presented in table 2 and figure 2.

Table 3.8.

Green mass/plant by year of crop (B factor)

B Factor (crop year)	Green mass production (kg)	Difference (kg)	Significance
b1 – year 1	1.16	-0.51	000
b2 – year 2	1.65	-0.02	n.s
b3 – year 3	2.20	0.53	***
Mediate	1.67	Mt	
DL 5% = 0.056 kg; DL 1% = 0.077; DL 0.1% = 0.105			

Depending on the crop year, the highest production of green mass/plant was obtained in year 3 (2.2 kg/pl), exceeding the experience average by 0.53 kg/pl.

Compared to the control - the average of the experience, in all three years of production, very significant increases were obtained, in year 1 (b1) and year 3 (b3), as well as an insignificant increase in year 2 (b2). The increase obtained in year 1 is negative, the value of green mass production is below the experience average.

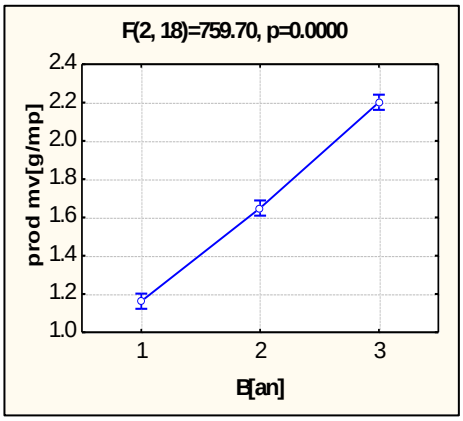


Fig. 2. Variation in green mass/plant by year of crop (B factor)

DUNCAN'S TEST for α5% - factor B DL 5% =0.056 kg

Original data Sister data

b1 1 = 1,160 C b3 3 = 2,200 A
b2 2 = 1,650 B b2 2 = 1,650 B
b3 3 = 2,200 A b1 1 = 1,160 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 because they are part of different homogeneity classes.

The highest production of green mass/plant, of 2.2 kg was obtained at b3 (year 3) – class A, which differs significantly from b2 (year 2) and b1 (year 1).

The lowest value of green mass production/plant, of 1.16 kg, was obtained at b1 (year 1) – class C, which is significantly different from b3 (year 3) and b2 (year 2).

The results related to the production of green mass/plant, obtained with 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.

Table 3.

Green mass/plant obtained at AxB interaction

B Factor (crop year)	A Factor (color variety)								
	a1 – pink hyssop			a2 – blue hyssop			a3 – white hyssop		
	Green table (kg)	Diff. (kg)	Sem.	Green table (kg)	Diff. (kg)	Sem.	Green table (kg)	Diff. (kg)	Sem.
b1 – year 1	1.16	-0.51	000	1.14	-0.53	000	1.19	-0.48	000
b2 – year2	1.65	-0.02	n.s	1.46	-0.21	000	1.84	0.17	**
b3 – year 3	2.27	0.60	***	1.96	0.29	***	2.37	0.70	***
Average	1.67								
	DL 5% = 0.097kg; DL 1% = 0.133; DL 0.1% = 0.181								

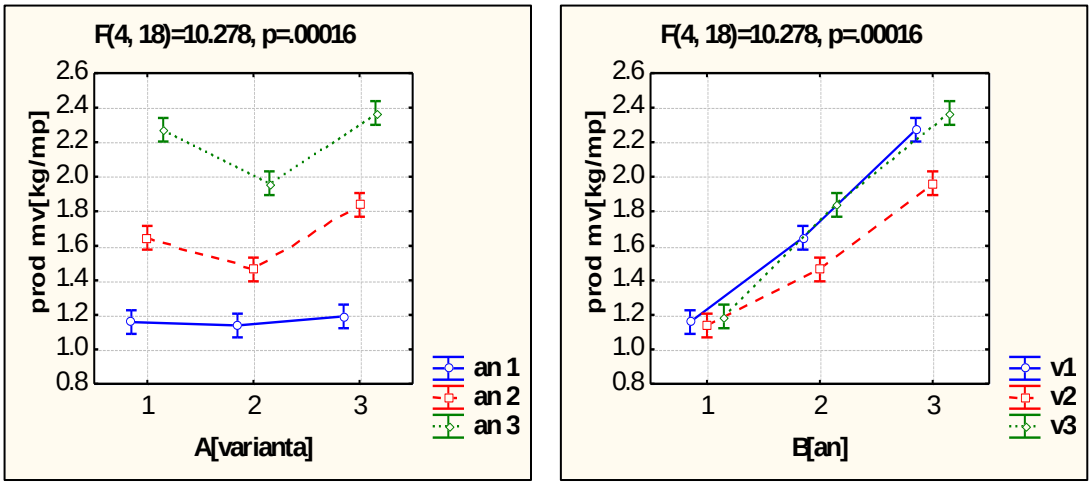


Fig. 3. Variation in green mass/plant obtained at AxB interaction

It is worth noting that, regarding the production of green mass/plant according to the crop year and the color variety, the highest values were obtained in the 3rd crop year, for all three color varieties studied.

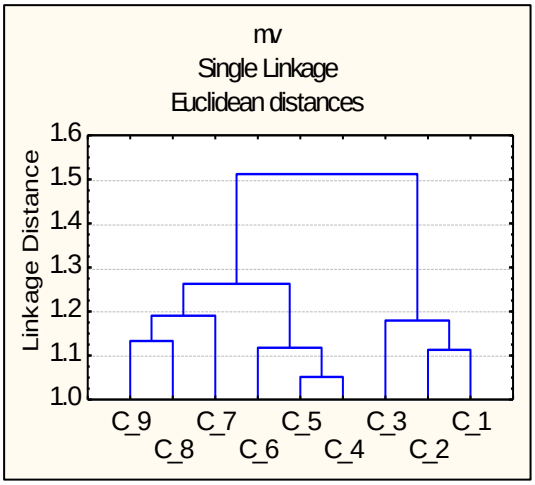
Compared to the control - the average of the experience, the results show the following increases:

- in a2 (blue-flowered hyssop), very significant differences were obtained in all three experimental years, with the specification that, in the first two years, the production of green mass/plant is below the average of the experience;
- in a3 (hyssop with white flowers), statistically assured differences were obtained as follows:
  - in year 1 and year 3 of production, the increase is very significant; it must be specified that in the 1st year of production a negative increase was obtained;
- in a1 (hyssop with pink flowers), very significant differences were obtained in b1 (year 1) and b3 (year 3), and in b2 (year 2), the growth is negative.

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

Original data Sister data
Mean 1 = 1,160 G Mean 9 = 2,370 A
Mean 2 = 1,650 E Mean 3 = 2,270 B
Mean 3 = 2.270 B Mean 6 = 1.960 C
Mean 4 = 1.140 G Mean 8 = 1.840 D
Mean 5 = 1.460 F Mean 2 = 1.650 E
Mean 6 = 1,960 C Mean 5 = 1,460 F
Mean 7 = 1,190 G Mean 7 = 1,190 G
Mean 8 = 1.840 D Mean 1 = 1.160 G
Mean 9 = 2.370 A Mean 4 = 1.140 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. 4 Green mass/plant dendogram for the 9 AxB combinations

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

The highest value of green mass production/plant, 2.37 kg, is obtained in combination a3b3 – class A, which is significantly different from all other combinations.

The lowest value of the production of green mass/plant, around 1.19 – 1.14 kg- class G, is obtained at: a3b1, a1b1 and a2b1 (that is, at the three variants in the 1st year of production), the value of the production of green mass obtained at the three combinations is significantly different from all other combinations.

The contribution of factors A (color variety), B (year) and the interaction AxB to the production of green mass/plant, is presented in figure 5.

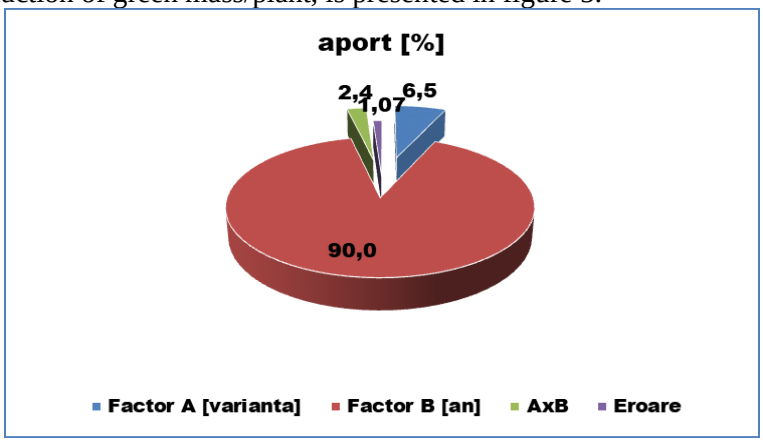


Fig. 5. Contribution of factors A (color variety), B (year), and AxB interaction

Factor A (color variety) contributes 6.5% to the production of green mass/plant, factor B (year of cropping) contributes 90%, and the AxB interaction 2.4%. So, factor B (year) has the biggest contribution, followed by factor A (color variety) and the AxB interaction.

CONCLUSIONS

Green mass production/plant decreases in value from pink-flowered hyssop to blue-flowered hyssop, then increases. So we have a downward trend from v1 (pink-flowered hyssop) to v2 (blue-flowered hyssop) and an upward trend from v2 (blue-flowered hyssop) to v3 (white-flowered hyssop). The green mass/plant production values obtained in the three color varieties were as follows: 1.7 kg in v1 (pink-flowered hyssop), 1.52 kg in v2 (blue-flowered hyssop) and 1.8 kg in v3 (white-flowered hyssop). The highest amount of green mass/plant is obtained in white-flowered hyssop.

Analyzing the crop year, the production of green mass increases from year 1 to year 3, so we have an upward trend depending on the year of production. The values of green mass production/plant varied between 1.2 g (year 1) and 2.2 g (year 3). Differences between years are statistically assured as highly significant ($p<0.001$)

In the three experimental years, the production of green mass/plant has an upward trend, regardless of the color variety. The highest value of green mass production/plant. it is obtained at v3 (white-flowered hyssop), and the lowest at v2 (blue-flowered hyssop). It should be noted that, in hyssop with pink and white flowers, the production of green mass/plant has close values.

Comparing the years of cultivation, it can be deduced that the highest amount of green mass/plant was obtained in the 3rd year of production, and the lowest in the 1st year of cultivation.

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