RESEARCH ON THE INFLUENCE OF NUTRITION ON THE PRODUCTION OF SPACE AND QUALITY HERBA *Hyssopus officinalis* L. (HYSSOP) CULTIVATED ECOLOGICAL CONDITIONS IN A.R.D.S. SECUIENI

Cătălina Adina DRUTU[1], Diana Lorena POPA[1], Alexandra BUBURUZ[1], Alexandra LEONTE[1], Simona POCHIŞCANU[1], Margareta NAIE[1], Traian POMOHACI[1], Elvira GILLE[1], Georgiana GAVRIL[1], Camelia STEFANACHE[2], Ana Clara APROTOSOIE[2], Irina MIHALACHE[3], Rodica MARTEA[4]

e-mail: *catalina.drutu@scda.ro*

Abstract

Hyssopus officinalis L. (hyssop) has been known as a medicinal plant since ancient times. Grown for herba contains volatile oil (0.5 and 1.3 % in dry herba between 0.10 and 0.15 % in fresh herba), flavonoids, ursolic and oleanolic acids, carbohydrates, hisopina, tannins, resins, gums, sugars and a substance with antiviral marubiina, which gives a bitter taste. Due to the volatile oil constituents, the plant has antiseptic expectorant action and is bitter tonic (because marubiinei) and slightly astringent (due to tannins). Climatic conditions during the experiment were good, the average temperature in the two years was $9,15^0$ C, the difference from the annual average (8.7ºC) being 0.45ºC. The amount of rainfall was 488.5 mm by 59.4 mm less than the annual average (552.1mm). The average for the two years of experimentation average number of branches per plant ranged from 14.27 branches/plant variant sown at 50 cm between rows and incineration (Mt.) and 23 branches/plant variant sown at 70 cm between rows and incineration. The average length of inflorescence was higher (12.25 cm) in variant sown distance of 70 cm between rows and 20 cm between plants in the row. Regarding the production of dry herba it was influenced by both the distance between rows (average factor A) and the distance between plants in the row (average factor B). The average for the two years of experimentation, production highest (2510 kg/ha) was obtained in the variant sown at a distance of 70 cm between rows and 20 cm between plants in the row. An average production close of 2368 kg/ha was obtained in variant sown at a distance of 70 cm between rows and 30 cm between plants in the row. Highest production of essential oil (80.88 l/ha) was obtained in the variant sown at a distance of 70 cm between rows and 20 cm between plants in the row.

Key words: ecological, hyssop, herba, nutrition, space

Hyssopus officinalis L. (hyssop) has been known as a medicinal plant since the earliest times. Are cultivated for herba that contains the volatile oil (0.5 and 1.3% in dry herba between 0.10 and 0.15% in fresh herba), flavonoids, ursolic and oleanolic acids, carbohydrates, hisopina, tannins, resins, gums, sugars and a substance with antiviral marubiina, which gives a bitter taste (Haban M. et al, 2006, Ion N. et al, 2008). Due to the the volatile oil constituents, the plant has antiseptic expectorant action and is bitter tonic (because marubiinei) and easily astringent (due to tannins), (Muntean L.S. et al., 2007). It is used in treating chronic bronchitis and asthma. It is also used as cicatrizing and hyssop tea help remove water from tissues, facilitates expectoration, sweating and regulates digestive the functions (Roman Ghe. et al, 2008, Verzea M. et al., 2002). The hyssop is an excellent melliferous plant (Păun E. et al, 1986).

MATERIAL AND METHOD

The research was conducted in 2012-2013 at SCDA Secuieni on a cambic chernozem soil in bifactorial experience and was located by the method of parcels subdivided into four repetitions. Experimental factors were:

Factor A - the distance between the rows with the graduations:

- 50 cm; - 70 cm; - 100 cm.

Factor B - distance between plants in the row with the graduations:

- unravalled; - 20 cm; - 30 cm.

The experimental variants obtained were as follows:

V_1 - 50 cm row/ unravalled;

V_2 - 50 cm row /20 cm between plants in the row;

[1] A.D.R.S. Secuieni
[2] C.C.B. „Stejarul" Piatra Neamţ
[3] U.M.F. Gr. T. Popa Iaşi
[4] Univ. ASM Chisinau

V_3 - 50 cm row /30 between plants in the row;
V_4 - 70 cm row/ unravalled;
V_5 - 70 cm row /20 cm between plants in the row;
V_6 - 70 cm row /30 between plants in the row;
V_7 - 100 cm cm row/ unravalled;
V_8 - 100 cm row /20 cm between plants in the row;
V_9 - 100 cm row /30 between plants in the row;

The seed used in the experiments was received from SCDPMA Fundulea, the population of Cioran biological category basis. Experience was sown by hand on 05.04.2012, at the depth of 1 cm. The size of an experimental variants was 4.5 square meters. Maintenance consisted of four manual hoeing as it was grown organically. Plant harvesting was done manually by cutting plants at ground level at the beginning of flowering. Biometric determinations were made in crop plants. Drying plants for natural herba was made in the shade. Determination of volatile oil was performed at CCB "Stejarul" Piatra Neamt dry herba Clevenger method.

RESULTS AND DISCUSSION

Climatic conditions were favorable experimental period, the average temperature in the two years was 9,15ºC, the difference from the annual average (8.7ºC) being 0.45ºC. The amount of rainfall was 488.5 mm by 59.4 mm less than the annual average (552.1 mm) (*table 1*).

From measurements made at S.C.D.A. Secuieni the harvesting hyssop plant, in 2012, the average height of the hyssop plant ranged from 42.33 cm to version control (sown at 50 cm between rows and unravalled) and 51.62 cm in variant sown at 70 cm between rows and unravalled.

In 2013 (the second year of plant vegetation) average height was between 50.06 cm to control variant (sown at 50 cm between rows and unravalled) and 52.96 cm in the variant sown at 70 cm between rows and unravalled. The average for the two years was greater plant height (52.96 cm) from the same version planted at 70 cm between rows and unravalled. The average for the two years of experimentation average number of branches per plant was between 14.27 branch/plant variant sown at 50 cm between rows and incineration (Mt.) and 23 branches/plant variant sown at 70 cm between rows and unravalled. Average length inflorescence was higher (13.46 cm), in the second year of variant plants sown at a distance of 70 cm between rows and unravalled. All herbei the harvesting hyssop determined that inflorescence length varied between 9.64 cm year I variant sown at 50 cm between rows - unravalled (Mt.) and 11.65 cm in variant sown at a distance of 70 cm between rows and 20 cm between plants in the row and in the second year of the plant vegetation it ranged between 10.22 cm variant sown at 50 cm between rows - unravalled (Mt.) and 13.46 cm in variant sown remote 70 cm between rows and 20 cm between plants in the row. The average for the two years of experimentation, inflorescence length was higher (12.25 cm) in variant sown distance of 70 cm between rows and 20 cm between plants in the row (Table 2). Regarding the production of dry herba it was influenced by both the distance between rows (average factor A) and the distance between plants in the row (average factor B). In the first year of vegetation, the highest production of the dry herba hyssop (2483kg/ha) was obtained in the the variant sown at 70 cm between rows and 20 cm between plants in the row (*figure 1*). Average factor A (distance between rows) was 1892 kg/ha at a distance of 50 cm, 2397 kg / ha at a distance of 70 cm and 1615 kg/ha at a distance of 100 cm between rows. Average B factor (distance between plants in the row) was between 1934 kg/ha (sowing to 30 cm between plants in the row) and 2020 kg/ha in the variant where the distance between plants in the row was 20 cm (*table 3*). In the second year of plant vegetation (2013), the production of dry herba highest (2536 kg/ha) was obtained in variant sown at 70 cm between rows and 20 cm between plants in the row (*figure 2*). Average factor A (distance between rows) was higher in variant sown at a distance of 70 cm (2435 kg/ha), the difference compared to the control (50 cm between rows) is 435 kg/ha. Variant sown at 100 cm production obtained was 1796 kg/ha, the difference compared to the control - sown at 50 cm between rows (1999 kg/ha) being -203 kg/ha. Average B factor (distance between plants in the row) was higher at the distance of 20 cm between plants of 2133 kg/ha, the difference from control unravalled (2063 kg/ha) of 70 kg/ha (*table 4*).

The average for the two years of experimentation, the highest average production (2510 kg/ha) was obtained in variant sown at a distance of 70 cm between rows and 20 cm between plants in the row. An average production close of 2426 kg/ha was obtained in variant sown at a distance of 70 cm between rows and unravalled (continuous row), (*figure 3*). Average factor A (distance between rows) was higher in variant sown at a distance of 70 cm (2416 kg/ha), the difference compared to the control (50 cm between rows) were 470 kg/ha. Average B factor (distance between plants in the row) was higher at the distance of 20 cm between plants of 2072 kg/ha, the difference from control unravalled (2016 kg/ha) is 60 kg/ha. (*tab. 5*). The highest production of essential oil (80.88 l/ha) was obtained in the variant sown at a distance of 70 cm between rows and 20 cm between plants on row (*figure 4*).

Table 1

Climatic conditions in 2012-2013

Specification	Average, annual amount		
	20011-2012	2012-2013	AVERAGE 2012-2013
THERMAL REGIME (°C)			
Average annual air temperature (°C)	9,2	9,1	9,15
Annual average (°C)	8,7	8,7	8,7
Difference (°C)	0,5	0,4	0,45
PLUVIOMETRIC REGIME (mm)			
The amount annual rainfall (mm)	429	548	488,5
Annual average (mm)	548	548	548
Difference (mm)	-118,8	0,0	59,4

Table 2

Determinations to *Hyssopus officinalis* L. herba harvest crops

Variant / Determ.	The average height per plant at harvest (cm)			Average number of branches/plants			Average length inflorescence (cm)		
	2012	2013	Average	2012	2013	Average	2012	2013	Average
V_1	42,33	50.06	42,33	13,13	15.4	14,27	9,64	10.22	9,93
V_2	45,09	51.70	48,40	13,15	15.9	14,53	9,88	10.78	10,33
V_3	46,52	52.41	49,47	14,73	16.3	15,52	9,85	10.96	10,41
V_4	51.62	52.96	52,96	19,20	26.8	23,00	11,04	13.46	12,25
V_5	50.75	52.30	52,30	17,33	25.3	21,32	10,76	12.71	11,74
V_6	48.64	51.73	51,73	15,40	24.7	20,05	11,65	12.26	11,96
V_7	48.35	51.26	51,26	15,27	23.2	19,24	11,43	12.33	11,88
V_8	47,81	51.07	49,44	14,93	22.0	18,47	10,32	11.49	10,91
V_9	47,50	50.47	48,99	14,83	21.9	18,37	10,46	11.63	11,05

Table 3

The influence of nutrition on the production of space dry herba *Hyssopus officinalis* L. in the first year of vegetation

Variants	Year 2012			
	kg/ha	%	Dif.	Semn.
Row spacing (A)				
a_1 – 50 cm	1892	100	Mt.	
a_2 – 70 cm	2397	127	505	***
a_3 – 100 cm	1615	85	-277	00
DL 5% = 140 kg/ha	**1% = 231 kg/ha**		**0,1% = 433 kg/ha**	
Distance between plants per row (B)				
b_1- unravalled	1960	100	Mt.	
b_2 – 20 cm	2010	103	50	
b_3 – 30 cm	1934	99	-26	
DL 5% = 60 kg/ha	**1% = 84 kg/ha**		**0,1% = 119 kg/ha**	

Table 4

The influence of nutrition on the production of space dry herba *Hyssopus officinalis* L. in the second year of vegetation

Variants	Year 2013			
	kg/ha	%	Dif.	Semn.
Row spacing (A)				
a_1 – 50 cm	1999	100	Mt.	
a_2 – 70 cm	2435	123	435	***
a_3 – 100 cm	1796	88	-203	00
DL 5% = 99 kg/ha	**1% = 164 kg/ha**		**0,1% = 307 kg/ha**	
Distance between plants per row (B)				
b_1- unravalled	2063	100	Mt.	
b_2 – 20 cm	2133	103	70	**
b_3 – 30 cm	2034	98	-29	
DL 5% = 48 kg/ha	**1% = 68 kg/ha**		**0,1% = 95 kg/ha**	

Table 5

The influence of nutrition on the production of space average on herba *Hyssopus officinalis* L. (2012-2013)

Variants	Average 2012-2013			
	kg/ha	%	Dif.	Semn.
Row spacing (A)				
a_1 – 50 cm	1946	100	Mt.	
a_2 – 70 cm	2416	124	470	***
a_3 – 100 cm	1705	88	-241	00
DL 5% = 120 kg/ha	**1% = 198 kg/ha**		**0,1% = 370 kg/ha**	
Distance between plants per row (B)				
b_1- unravalled	2012	100	Mt.	
b_2 – 20 cm	2072	103	60	*
b_3 – 30 cm	1984	99	-28	
DL 5% = 54 kg/ha	**1% = 76 kg/ha**		**0,1% = 107 kg/ha**	

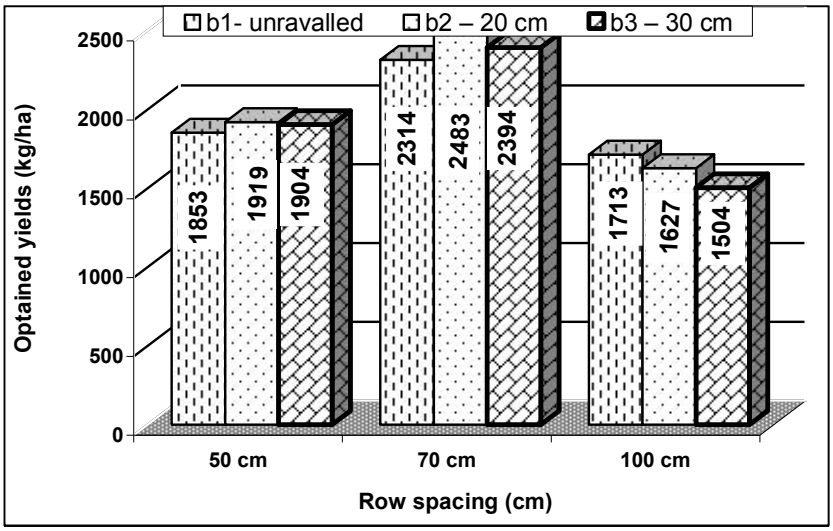

Figure 1 **The influence of nutrition on the production of space dry herba *Hyssopus officinalis* L. in the first year of vegetation**

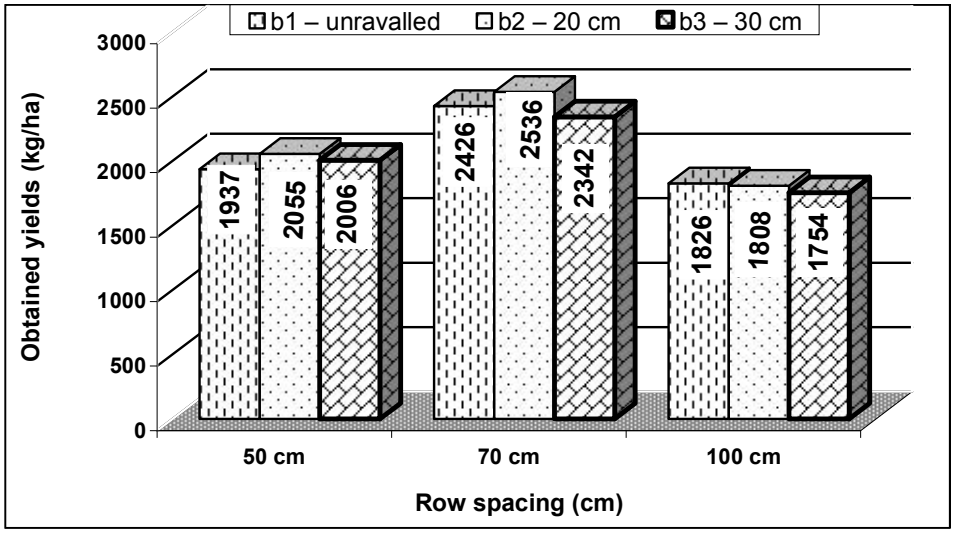

Figure 2 **The influence of nutrition on the production of space dry herba *Hyssopus officinalis* L. in the second year of vegetation**

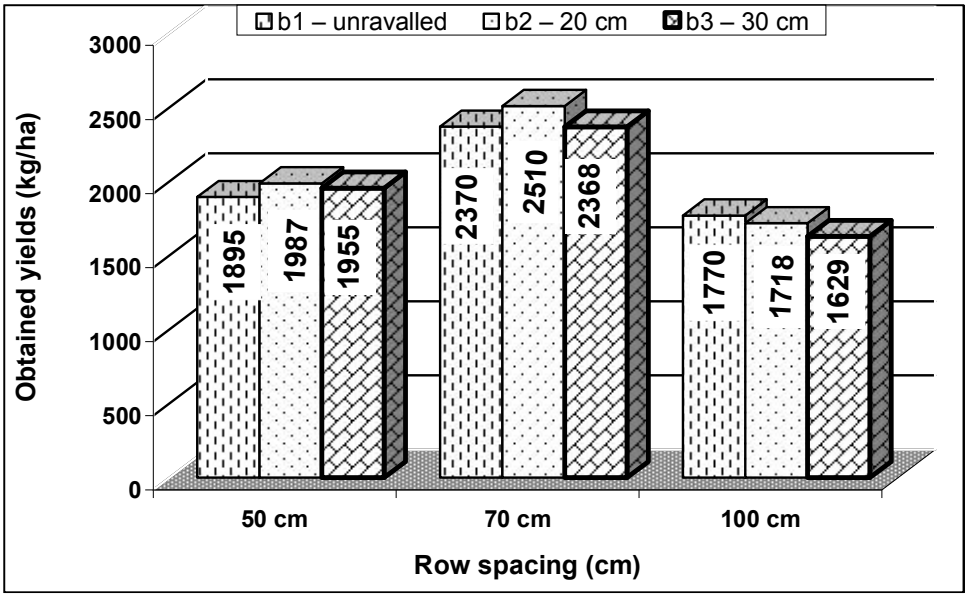

Figure 3 **The influence of nutrition on the production of space average on herba *Hyssopus officinalis* L. (2012-2013)**

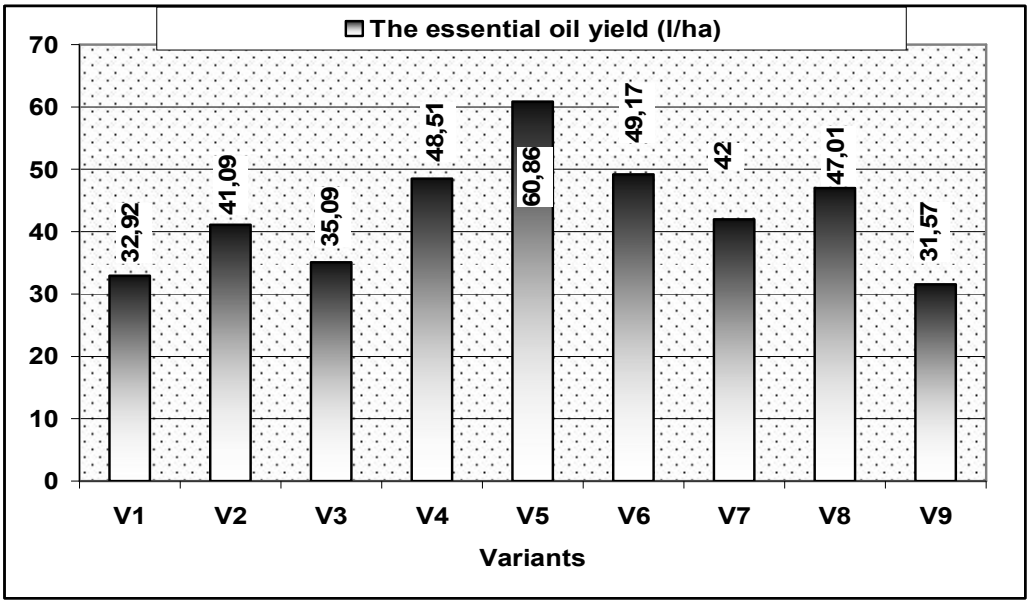

Figure 4 **The influence of nutrition on the production space of the volatile oil from the species *Hyssopus officinalis* L.**

CONCLUSIONS

Following research in S.C.D.A. Secuieni, averaged over the two years, plant height (52.96 cm), number of branches (23 branches/plant) and the inflorescence length (12.25 cm) had higher value of variant plants sown at 70 cm between rows and 20 cm between plants in the row.

Regarding the production of dry herba it was influenced by both the distance between rows (average factor A) and the distance between plants in the row (average factor B).

Averaged over in that years of experimentation, the average dry herba highest (2510 kg/ha) was obtained at variant sown at a distance of 70 cm between rows and 20 cm between plants in the row.

Production of highest essential oil (60.86 l/ha) was obtained at variant sown at a distance of 70 cm between rows and 20 cm between plants in the row.

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