OPTIMIZATION OF CERTAIN TECHNOLOGICAL MEASURES FOR HYSSOP (*HYSSOPUS OFFICINALIS)* CROPS IN THE ECOLOGICAL CONDITIONS

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The main goal of the study was to optimize cultivation technology by variation of the establishment biological material, plant density and fertilization in the ecological conditions from the Biarom Farm (Iaşi County).

The highest fresh yield (10.54 t/ha) and dried one (3.45 t/ha) were obtained by seedling establishment, using a density of about 180 thousands plants/ha and two times fertilization with 500 l solution of Cropmax 0.2%.

***Key words**: hyssop, ecological conditions*

Spice and aromatic plants present a special interest because they are used in the food domain to prepare salads, to spice dishes, in the canned food industry, the refreshment and alcoholic drink industry, in confectionery, cosmetics or medicine.

This study aimed at evaluating the profitability of hyssop cultivation and optimizing some technological steps for this culture, in the circumstances of the ecologic agriculture from Iaşi County.

To attain our proposed goal, we established the following objectives:

- the study of the possibilities to set up the culture by the nursery transplants and by the direct sowing;
- the study of the influence of culture setting up diagrams (densities) on the yield;
- the study of the fertilization pattern on the harvest quantity.

MATERIAL AND METHOD

The biological material used consisted in hyssop seeds and nursery transplants from the variety De Ciorani.

Researche was conducted at Biarom Farm near Iaşi, in the interval 2007-2008.

The meteorological data registered at the Copou Meteorological Station, in the period when experiments were carried out, are presented in table 1. As for these data, we draw the conclusion that the values fall within the normal limits of the regional climate. The soil is a medium levigated cambic chernozem, well supplied with nutritive elements and a clayish texture. Commenting on the meteorological and climatic conditions registered in the years when the study was conducted, we may say that these were favorable conditions for the hyssop culture.

Table 1

Data pattern in the interval 2007-2008 for the Copou-Iaşi meteorological station

Month	Year 2007			Year 2008		
	average temperature (°C)	UR (%)	precipitations (mm)	average temperature (°C)	UR (%)	precipitations (mm)
April	10.4	60	81.6	9.8	81.6	66.8
May	14.8	65	40.9	17.9	40.9	171.4
June	19.0	63	26.0	19.9	26.0	106.8
July	20.8	72	148.8	22.6	148.8	135.0
August	19.6	76	61,.4	20.9	61.4	68.4
September	15.0	74	41.6	15.9	41.6	38.4
October	10.7	81	21.4	10.3	21.4	37.2

According to the established objectives, we took into account the following experimental factors with different graduations:

– factor A (manner of culture setting up with graduations): a_1- by direct sowing; a_2- by nursery transplants;

– factor B (setting up diagrams and densities with graduations): b_1– four rows per 150 cm wide bed (180 thousand plants/ha); b_2– three rows per bed (130 thousand plants/ha); b_3– two rows per bed (90 thousand plants/ha). In all variants, the distance between plants in a row was 15 cm;

– factor C (fertilization pattern): c_1– unfertilized (blank test); c_2– Cropmax 0.2%; c_3 – Bionat 0.2%; c_4 – Bioforce 0.1%.

Treatments were administered by two foliar sprinklings in amount of 500 l/ha solution.

The poly-factorial experiment of the type (2x3x4) was organized in a split plot design, with three replicates, the surface of the replicate plot being 12 m^2.

The effects of the experimental factors and their graduations, were appreciated by the quantities of fresh and dry harvest. The experimental data of vegetal mass were processed by statistic-mathematic methods (5), and the variance analysis (Fisher test) and the limit differences – LD (Student test).

RESULTS AND DISCUSSIONS

The results regarding the main elements of yield obtained for the hyssop culture are presented in *table 2*.

The fresh vegetative mass varied between 7.66 t/ha (a variant set up by sowing, with the lowest density, blank test, unfertilized, $a_1b_3c_1$) and 10.54 t/ha for the setting up of culture by nursery transplant with the density of 180 thousand plants/ha, fertilized with Cropmax, $a_2b_1c_2$. We may notice the superiority of the culture variant set up by nursery transplant with high density and fertilized with Cropmax. Very close values (10.46 t/ha) were also registered for the variant set up by nursery transplant with the density of 130 thousand plants/ha fertilized with Cropmax:– $a_2b_2c_2$.

Table 2

Results regarding the fresh and dry hyssop yield obtained by the variant set up by direct sowing and nursery transplant

Variant		Fresh vegetative mass				Dry vegetative mass			
no crt	specification	yield		difference as comp. to average	difference signification	yield		difference as comp. to average	difference signification
		t/ha	% as compared to $\bar{x}$			t/ha	% as compared to $\bar{x}$		
1	$a_1b_1c_1$	8.37	90	-0.93	oo	2.99	93.73	-0.20	
2	$a_1b_1c_2$	8.79	94.51	-0.51		3.13	98.11	-0.06	
3	$a_1b_1c_3$	8.53	91.72	-0.77	o	3.03	94.98	-0.16	
4	$a_1b_1c_4$	8.65	93.01	-0.65		3.07	96.23	-0.12	
x	b_1 average	8.58	92.95	-0.72	o	3.05	95.61	-0.14	
5	$a_1b_2c_1$	8.18	87.95	-1.13	oo	2.89	65.76	-0.30	o
6	$a_1b_2c_2$	8.42	90.53	-0.88	o	2.91	91.22	-0.28	
7	$a_1b_2c_3$	8.36	89	-0.94	oo	2.93	19.84	-0.26	
8	$a_1b_2c_4$	8.39	90.21	-0.91	oo	2.94	92.16	-0.25	
x	b_2 average	8.33	89.56	-0.97		2.91	91.22	-0.28	
9	$a_1b_3c_1$	7.66	82.36	-1.64	ooo	2.39	74.92	-0.80	ooo
10	$a_1b_3c_2$	8.77	94.30	-0.53		3.14	98.43	-0.05	
11	$a_1b_3c_3$	8.51	91.50	-0.73	o	3.00	94.04	-0.19	
12	$a_1b_3c_4$	8.58	92.25	-0.72	o	3.03	94.98	-0.16	
x	b_3 average	8.37	90	-0.93		2.89	90.59	-0.30	
x	a_1 average	8.42	90.66	-0.88		2.95	86.12	-0.24	
1	$a_2b_1c_1$	9.79	105.26	0.49		3.45	108.15	0.26	
2	$a_2b_1c_2$	10.54	113.33	1.24	xxx	3.79	118.80	0.60	xxx
3	$a_2b_1c_3$	10.49	112.79	1.19	xxx	3.76	117.86	0.57	xxx
4	$a_2b_1c_4$	10.39	111.72	1.09	xx	3.58	112.22	0.39	xx
x	b_1 average	10.30	110.75	1.00		3.64	114.10	0.45	
5	$a_2b_2c_1$	9.53	102.47	0.23		3.36	105.32	0.17	
6	$a_2b_2c_2$	10.46	112.47	1.16	xx	3.72	116.61	0.53	xxx
7	$a_2b_2c_3$	10.33	111.07	1.03	xx	3.62	113.47	0.43	xx
8	$a_2b_2c_4$	10.43	112.15	1.13	xx	3.65	114.42	0.46	xx
x	b_2 average	10.18	109.46	0.88		3.58	112.22	0.39	xx
9	$a_2b_3c_1$	9.43	101.32	0.13		2.85	89.34	-0.34	o
10	$a_2b_3c_2$	10.35	111.29	1.05	xx	3.01	94.35	-0.10	
11	$a_2b_3c_3$	10.28	110.53	0.98	xx	3.20	100.31	0.01	
12	$a_2b_3c_4$	10.31	111.72	1.08	xx	3.23	101.25	0.04	
x	b_3 average	10.09	108.49	0.79		3.07	96.23	-0.12	
x	a_2 average	10.19	109.65	0.89		3.43	107.64	0.24	
x	$a_1 + a_2$ average	9.30				3.19			
				LSD 5% = 0.67 LSD 1% = 0.89 LSD 0.1% = 1.17				LSD 5% = 0.30 LSD 1% = 0.38 LSD 0.1% = 0.52	

Research has proved that the determining factor in terms of yield is the manner of culture setting up, the variants set up by nursery transplant registering significantly higher values due to the fact that they benefited from a larger interval between sowing and harvesting and better growing conditions in the first vegetative state, namely in a protected space.

The influence of the culture setting up diagram on the vegetal mass yield was best highlighted when using the culture diagram with four rows /bed what demonstrates the fact that productivity in this case is directly correlated to a higher density.

From the viewpoint of the influence of "c" factor (fertilizer application) on the dry and fresh vegetative mass yield, research has shown the superiority of Cropmax fertilizer as compared to others fertilizers used, all variants which used this product registering highly significant yield increases as compared to the experimental average. The variant $a_2b_2c_4$, fertilized with Bioforce also registered distinctly positive values.

The dry plant yield was in direct correlation with the mass of fresh plant for the variants from which it was obtained. Thus the maximum yield of dry plant of 3.79 t/ha was obtained for the variant $a_2b_1c_2$, and the lowest was signaled for the variant $a_2b_3c_1$ –2.85 t/ha. Very close values to the maximum yield were registered by the variant $a_2b_2c_2$ – 3.72 t/ha set up by nursery transplant with the density of 130 thousands plants/ha, fertilized with Cropmax.

The culture diagram significantly influenced yield both in case of culture setting up by direct sowing and by nursery transplant. Thus the highest yield of fresh vegetal substances was signaled for the diagram with four rows/bed, 8.79 t/ha ($a_1b_1c_2$) and 10.54 t/ha ($a_2b_1c_2$), and the lowest for the diagram with two rows/bed 7.66 t/ha ($a_1b_3c_1$) and 9.43 t/ha ($a_2b_3c_1$).

CONCLUSIONS

The meteorological-pedological conditions in which the experiments were effectuated at Biarom Farm from Iaşi County were favourable to the hyssop culture, in the circumstances of ecologic agriculture.

The variants set up by nursery transplant register superior net yield as compared to those set up by direct seeding.

Due to the fact that the values of fresh and dry vegetal mass yield of the variants set up by nursery transplant with the density 180 thousands plants/ha and fertilized with Cropmax were close, we recommend the variant with 130 thousands plants/ha both for economic reasons (less quantity of material to be planted/ha) and a less disease frequency (due to the less plant density).

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