THE COMPARATIV REZULTS OF HEMPSEED PRODUCTION OF MONOECIOUS AND DIOECIOUS CULTIVARS (*Cannabis sativa L.*)

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Abstract: *Increased consumption of organic food entails the use of hemp seeds in various food (bakery products, chocolate, beer). But the legislation which places the hemp plant on the severe narcotic list led to the disappearance of almost all the culture of hemp in Romania. Starting from these considerations, the paper proposes a study of the evolution of production values and physical parameters(MMB-1000 grain and HM) recorded in some hemp varieties approved in Romania under the influence of foliar fertilization products and different seeding space.The biological material used is composed of monoecious (Zenit, Diana, Denise) and dioecious (Armaca and Silvana) varieties with THC content of less than 0,2%. Bellow basic fertilization, foliar treatments were applied using the following products: Fertleader Viti, Fertileader Magic and Corona K. Fertileader Viti, leafs fertilizers with P and K, produce a bigger yield of seed in monoecious and dioecious varieties. The 20 cm seeding spacing ensures a proper nutritional area for hemp plants. The study of the impact of foliar fertilization on seed yield of hemp varieties approved in Romania adds novelty and originality to the work*

Key words: *hempseed, foliar fertilization, seeding space, varieties*

INTRODUCTION:

Hemp (*Cannabiss sativa L.*) has the highest capacity of industrialization of all technical plants:everything is used nothing is thrown away. The great economic value of hemp is defined by the multiple possibilities of use: fibre, seeds and oil, wood, manure and chaff in medicine by hypnotic and psychotropic alkaloids blossom.

It kills weeds, fertilizes soil, making the land suitable for cereal crops. Hemp grows without necessitating a large amount of fertilizers and pesticides. It is also good for aerating soil.

Cannabis Sativa is one of the important natural resources finding suitable growing conditions throughout the country.

Along with the variety the two technological links (fertilization and seeding distance) also influence qualitatively and quantitatively hempseed production.

The recommended row spacing for hempseed cultivar is 60-70cm and 10-12cm between plants providing seed density 20-25 seeds/m^2 (SEGĂRCEANU et all., 1982, ŞANDRU et all., 1996, TROTUŞ, E., 2003)

The goal of this paper was to study the influence of foliar fertilization and seeding spacing in the seed yield of monoecious and dioecious hemp.

MATERIALS AND METHODS:

The study follows the adaptation of monoecious (Zenit, Diana and Denise) and dioecious (Armanca and Silvana) hemp varieties on the poorly saturated chernozem of the Agricultural Research and Development Station in Lovrin and the influence of fertilization and seeding spacing by monitoring the seed yield.

The research uses a trifactorial experiment on a divided plot.

A Factor – monoecious and dioecious hemp variety

monocious: a1 Zenit,
a2 Diana,
a3 Denise
dioecious : a1Silvana,
a2 Armanca
B Factor – fertilization level:
b0 N0P0K0
b1 Fertileader Viti BPK=0:6:12;
b2 Fertileader Magic (Ca, Mg);
b3 Corona K (8-11-39+0,1%B+0,1Cu+0,1Fe+0,1Mn+0,1Zn)
C Factor – seeding space: c1 20 cm;
c2 30 cm;
c3 40 cm,
c4 50 cm

The hemp varieties utilized are authorized, according to the Official Catalogue of varieties of crop plants in Romania, edition 2011.

The surface occupied by the cultivar of one hemp variety is 1008 m^2.

The total surface cultivated with monoecious hemp was 4576 m^2 and for the dioecious it was 3159 m^2.

The preceding crops for hemp was corn (non triazinic herbicided).

The autumn-plowing was caried at 20-25 cm, and smoothed finely with a big disk harrow and with small disk.

The seeding of monoecious hemp took place on 01.04.2011, and for dioecious on 15.04.2011.

Monoic hemp varieties were seeded at 5 km distance of the dioic varieties.

The spacing between rows is 70 cm , but to follow the influence of the nutrition surface on seed yields and their quality, the distance between plants was modified from 20 to 50 cm. Seeding rate was of about 3-5 kg/ha

After harvesting and sampling, the following laboratory analysis were carried out: the weight of 1000 seeds and hectolitric weight.

Thermal regime is present in figure1.

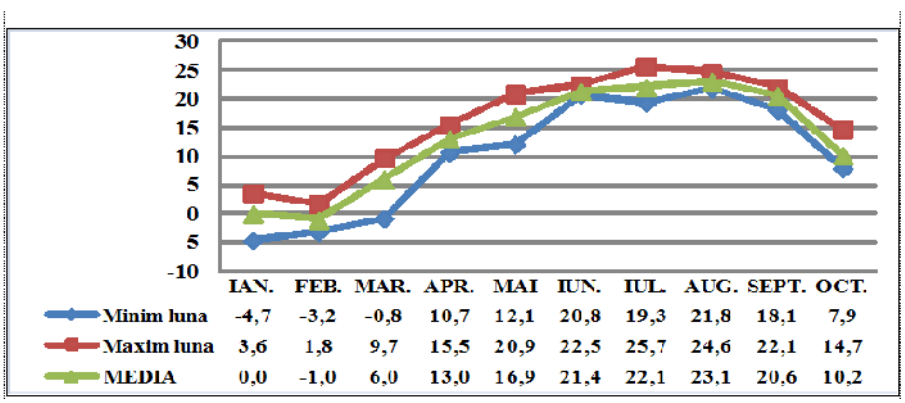


Figure1. Monthly means of temperature in 2011 -SCDA Lovrin-Timis

The best time for hemp sowing is when a temperature of 7-8^{0}C is found in soil.

Precipitations regime

For the agricultural year 2011, after we analyzed the conditions of the monthly precipitation regime (figure2), we can say that the total monthly precipitations in July reached 89.0 mm. In the period of vegetation the level precipitation has been 273.9 mm.

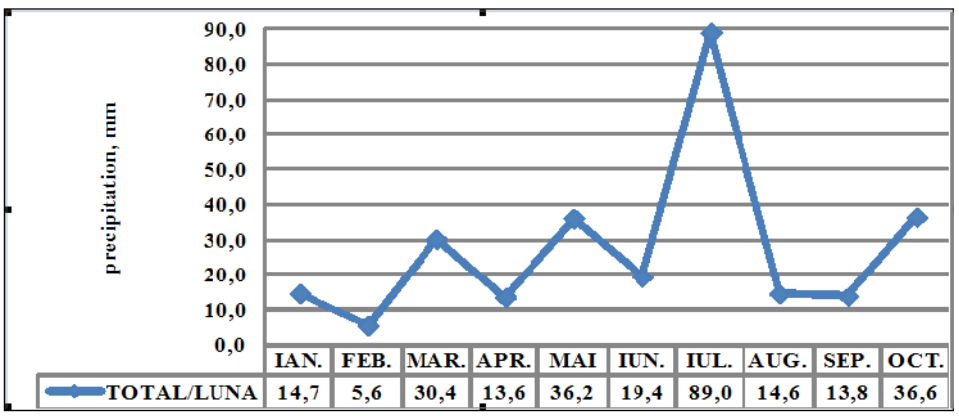


Figure 2. Monthly mean precipitations in 2011-SCDA Lovrin-Timis

RESULTS AND DISCUSSION

Data were processed according to the variance analysis method and test F showing that fertilizing and seeding space has significant effects upon the seed yield.

The fertilization increases seed yield Zenit variety.

According to Lupu, C.,(2008) the application of foliar fertilizers (Microfert U) over the Zenit monoecious hemp cultivar on the cambic chernozem, brought production increases of 7-34%.

Zenit monoecious hemp responds well to the three types of foliar fertilizers and it determines a growth of 31% at most of the average seed yield after Fertileader Viti use of 3.01/ha and 37% with Fertileader Magic, 4.01/ha (table1).

Table 1

Zenit monoic hempseed yield (kg/ha) at SCDA Lovrin - 2011

Fertilization	Yield, kg/ha				Yield, kg/ha (average)	%	Difference (kg/ha)	The signification
	c1	c2	c3	c4				
b0	188.0	298.5	143.7	159.8	197.5	100	-	
b1	244.5	261.2	264.5	166.9	234.3	119	36.8	
b2	318.2	364.8	246.8	150.0	269.9	137	72.4	
b3	335.7	289.9	174.1	235.0	258.7	131	61.2	

$DL_{5\%\ fertilization}$=75kg/ha, $DL_{5\%\ seeding\ space}$=75kg/ha, $DL_{5\%\ fertilization\ x\ seeding\ space}$=153kg/ha

Zenit monoecious hemp produced the largest seed yield from the studied varieties. At the seeding spacing of 20 cm by the use of leaf fertilizers, growths of over 50% occur.

The 30 cm distance inside the rows brings increased yields of Zenit monoic hempseed in the fertilized rows and unfertilized rows.

The Diana monoic variety maintains a relatively constant seed yield through solid leaf fertilization.The very low yields in hemp rows from Diana from the second repetition have a bad impact on the entire yield after fertilization and seed spacing growth. (table 2).

Leaf fertilization with Fertileader Magic (4.01/ha) and the enlargement of the seeding space to 30 cm increases the seed yield (146.0 kg/ha).

Table 2.

Diana monoic hempseed yield (kg/ha) at SCDA Lovrin - 2011

Fertilization	Yield, kg/ha				Yield, kg/ha (average)	%	Difference (kg/ha)	The signification
	c1	c2	c3	c4				
b0	138,2	94.9	195.1	157.7	146.4	100	-	-
b1	94.9	146.0	81.2	53.0	93.8	64	-52.7	000
b2	131.2	82.2	61.7	92.2	91.8	63	-54.6	000
b3	132.1	138.0	139.6	129.2	134.7	92	-11.7	000

$DL_{5\%\ fertilization}$=48kg/ha, $DL_{5\%\ seeding\ space}$=48kg/ha, $DL_{5\%\ fertilization\ x\ seeding\ space}$=97kg/ha

An increase of 35% of the average yield after the first use of leaf fertilizers b1 are registered at the monoic variety Denise. (table 3).

Seeding space can't be considered a positive factor for the seed yield of this variety.

Table 3.

Denise monoic hempseed yield (kg/ha) at SCDA Lovrin - 2011

Fertilization	Yield, kg/ha				Yield, kg/ha (average)	%	Difference (kg/ha)	The signification
	c1	c2	c3	c4				
b0	221.,2	139.1	52.4	33.7	111.6	100		
b1	209.5	171.5	119.7	100.0	150.2	135	38.6	
b2	184.5	136.0	14.0	22.6	89.3	80	-22.3	000
b3	155.8	101.3	89.8	16.6	90.8	81	-20.8	000

$DL_{5\%\ fertilization}$=78kg/ha, $DL_{5\%\ seeding\ space}$=78kg/ha, $DL_{5\%\ fertilization\ x\ seeding\ space}$=155kg/ha

Analyzing table 4 and 5 coresponding to the production of dioic hempseed, it can be observed that it much lesser than the monoic production obtained in 2011.

The decrease of the seed yield in dioic varieties are due to the rodents attack (like the mole and black hamster). Leaf fertilizing with Fertilidear Magic (4,01/ha) and the seeding distance of 30 cm increases the seed yield with 13% for the Armanca dioic variety (table 4).

Table 4.

Armanca dioecious hempseed yield (kg/ha) at SCDA Lovrin - 2011

Fertilization	Yield, kg/ha				Yield, kg/ha (average)	%	Difference (kg/ha)	The signification
	c1	c2	c3	c4				
b0	80.5	51.6	38.7	42.6	53.4	100	-	
b1	53.3	68.8	59.1	44.8	56.5	106	3.1	
b2	54.2	52.8	31,5	24.0	40.6	76	-12.8	000
b3	57.2	28.6	21.8	28.1	33.9	64	-19.5	000

$DL_{5\%\ fertilization}$=16kg/ha, $DL_{5\%\ seeding\ space}$=16kg/ha, $DL_{5\%\ fertilization\ x\ seeding\ space}$=31kg/ha

The use of liquid leaf fertilizers determines a better seed yield for the Silvana dioic hemp variety with up to 18.5 kg/ha. The seeding spacing of 30 cm produces a growth of 14% of the yield.

Table 5.

Silvana dioecious hempseed yield (kg/ha) at SCDA Lovrin - 2011

Fertilization	Yield, kg/ha				Yield, kg/ha (average)	%	Difference (kg/ha)	The signification
	c1	c2	c3	c4				
b0	44.7	51.1	24.2	17.9	34.5	100	-	
b1	67.7	60.7	48.9	34.7	53.0	154	18.5	*
b2	38.5	43.8	39.1	17.4	34.7	101	0.22	
b3	11.9	26.0	15.7	9.1	15.7	46	-18.8	000

$DL_{5\%\ fertilization}$=16kg/ha, $DL_{5\%\ seeding\ space}$=16kg/ha, $DL_{5\%\ fertilization\ x\ seeding\ space}$=33kg/ha

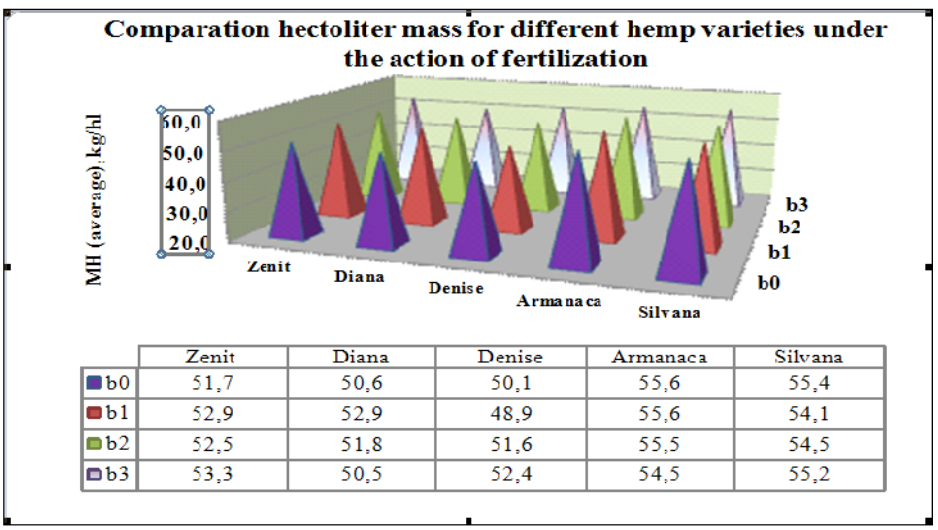
Hectoliter mass

MH depends on variety, moisture content, degree of development of seed and content of reserve materials. There exists no correlation between MH and MMB for hemp.

The hectoliter mass range of hemp is 48-59 kg/ha (ŞANDRU at all., 1996).

As showed in figure 3 the hectoliter mass is mostly influenced by the hemp variety.

From analyzing the results concerning the hectoliter weight it can be noticed that the variety has an influence upon that character.



	Zenit	Diana	Denise	Armanaca	Silvana
b0	51,7	50,6	50,1	55,6	55,4
b1	52,9	52,9	48,9	55,6	54,1
b2	52,5	51,8	51,6	55,5	54,5
b3	53,3	50,5	52,4	54,5	55,2

Figure3. Hectoliter mass (average values) variation depending on hemp varieties

Hectoliter mass from monocieous hemp variety is presented in table 6

Hectoliter weight under the action of foliar fertilizing and seeding spacing can produce a growth of up to 3% for the Zenit variety and 5% for the Denise variety.

The seeding space doesn't produce significant changes of MH neither for monoic nor dioic varieties.

The presence of empty seeds determines a lower value of MH of 44.5kg/ha for Denis variety.

Hectoliter mass of the dioic hemp seeds doesn't modify significantly after the use of leaf fertilization, neither from the seeding space variability (table7), the maximum value MH, reached by dioic varieties is of 58.1 kg/hl.

Table 6.

Hectoliter mass average values (MH – kg/hl) depending on fertilization and seeding space for monocieous hemp varieties

Nr crt	Fertilization-B factor	MH (kg/hl) Seeding space- C factor				MH-kg/hl average		
		c1	c2	c3	c4	average	MH relative value %	Dif. ±
Monocieous hemp variety								
Zenit								
1.	b0	52.0	52.2	51.3	51.2	51.7	100	
2.	b1	53.0	53.4	51.0	54.2	52.9	102	1.2
3.	b2	52.2	53.6	52.3	51.9	52.5	102	0.8
4.	b3	53.2	54.,9	50.7	54.2	53.3	103	1.6
5.	Average seeding space	52.6	53.5	51.3	52.9			
6.	MH relative value (%)	100	102	98	101			
7.	Difference ±	-	0.9	-1.3	0.3		-	
Diana								
8.	b0	54.6	49.2	50.1	48.7	50.6	100	-
9.	b1	50.6	54.7	56.2	49.9	52,9	104	2,2
10.	b2	54.0	47.5	52.8	53.1	51.8	102	1,2
11.	b3	51.9	50.4	52.3	48.8	50.9	99.7	-0.2
12.	Average seeding space	52,8	50,4	52,8	50,1			
13.	MH relative value (%)	100	96	100.1	96			
14.	Difference ±	-	-2,0	0,4	-2,2		-	
Denise								
15.	b0	51.9	49.2	52.0	47.2	50.1	100	
16.	b1	46.2	48.7	52.9	47.7	48.9	98	-1.2
17.	b2	51.9	54.9	44.5	55.0	51.6	103	1.5
18.	b3	52.0	49.8	51.8	55.9	52.4	105	2.3
19.	Average seeding space	50.1	53.1	50.3	51.5			
20.	MH relative value (%)	100	100	99.6	102			
21.	Difference ±	-	0.2	-0.2	1.3		-	

Table 7.

Hectoliter mass average values (MH – kg/hl) depending on fertilization and seeding space for dioecious hemp varieties

Nr crt	Fertilization-B factor	MH (kg/hl) Seeding space- C factor				MH-kg/hl average		
		c1	c2	c3	c4	average	MH relative value %	Dif. ±
Diocieous hemp variety								
Armanca								
1.	b0	54.5	57.5	55.3	55.0	55,6	100	
2.	b1	55.4	58.1	55.5	54.8	55.6	100	0.0
3.	b2	54.1	54.0	58.1	55.7	55.5	99.8	-0.1
4.	b3	54.8	55.2	53.8	54.0	54.5	98	-1.1
5.	Average seeding space	54.7	55.9	55.7	54.9			
6.	MH relative value (%)	100	102	102	100.3			
7.	Difference ±	-	1.1	1.0	0.2		-	
Silvana								
8.	b0	55.2	53.7	55.2	57.3	55.4	100	
9.	b1	52.6	56.3	53.7	53.7	54.1	98	-1.3
10.	b2	54.9	55.0	54.4	53.5	54.5	98	-0.9
11.	b3	54.6	55.4	54.2	56.4	55.2	99.6	-0.2
12.	Average seeding space	54.3	55.1	54.4	55.2			
13.	MH relative value (%)	100	101	100	102			
14.	Difference ±	-	0.8	0.05	0.9		-	

MMB value is presented in table 8 and table 9 .

Southern roumanian middle late hemp varieties have the mass of 1000 grains 16-23g (ŞANDRU at all., 1996, TABĂRĂ, 2005).

Table 8

MMB depending on fertilization and seeding space for monoecious hemp varieties

Nr crt	Fertilization-B factor	MMB (g) Seeding space- C factor				MMB-g average		
		c1	c2	c3	c4	average	MMB relative value %	Dif ±
Monocieous hemp variety								
Zenit								
22.	b0	15.6	16.4	16.3	16.0	16.1	100	
23.	b1	15.8	15.7	15.2	15.5	15.6	97	-0.5
24.	b2	15.7	14.5	16.0	15.7	15.5	96	-0.6
25.	b3	15.2	15.4	15.2	15.7	15.4	96	-0.7
26.	Average seeding space	15.6	15.5	15.7	15.7			
27.	MMB relative value (%)	100	99.5	101	101			
28.	Difference ±	-	-0.1	0.1	0.2	MMB initial=18.0g		
Diana								
29.	b0	17.4	15.8	17.2	17.6	17.0	100	
30.	b1	17.6	17.2	16.8	15.0	16.7	98	-0.4
31.	b2	17.6	15.8	16.4	15.7	16.4	96	-0.6
32.	b3	17.8	16.2	16.7	16.8	16.9	99	-0.1
33.	Average seeding space	17.6	16.3	16.8	16.3			
34.	MMBrelative value (%)	100	92	95	93			
35.	Difference ±		-1.4	-0.8	-1.3	MMB initial =19.2 g		
Denise								
36.	b0	16.9	15.4	16.7	16.4	16.4	100	
37.	b1	17.9	15.6	16.0	17.1	16.6	102	0.3
38.	b2	16.7	15.0	16.0	16.5	16.1	98	-0.3
39.	b3	16.2	15.8	15.4	16.5	16.0	98	-0.4
40.	Average seeding space	16.9	15.5	16.0	16.6			
41.	MMB relative value (%)	100	94	95	98			
42.	Difference ±		-1.5	-0.9	-0.3	MMB initial =17.2 g		

The biggest value of MMB average for monoecious hemp varieties has been Diana 17.8 g

From the experimented cultivars the biggest value of MMB average has been achieved in Silvana (Lovrin 200) with 21.6 g (table 9).

From analyzing the results concerning the MMB it can be noticed that the agrofond has no influence upon that character.

CONCLUSIONS

The maximum seed yield of 238 kg/ha was reached for the monoic hemp, the Zenit variety. Drought and pests have decimated the seed yield of doiecious varieties.

The presence of K in the leaf fertilizer Fertileader Viti increases the seed yield with up to 35% for Denise hemp and 53% for Silvana hemp.

The hectoliter mass of the monoic varieties studied fits in the range of 51.6 +/- 2.57 g, and for the dioecious in the range of 55.0 +/- 1.24g.

MMB varies depending on the variety, cultivar lines and has lower values than the initial ones due to a decrease in precipitation.

The mass of 1000 grains varies depending on the variety and has values between 14.5÷17.8 for monoecious hemp and 19.2 ÷21.6 for dioecious hemp..

The application of fertilizers has increased the values of 1000-grain weight up to 2% and of Hectoliter mass up to 5%

Table 9

MMB depending on fertilization and seeding space for dioecious hemp varieties

Nr crt	Fertilization-B factor	MMB, g Seeding space- C factor				MMB, g average		
		c1	c2	c3	c4	average	MMB relative value %	Dif. ±
Diocieous hemp variety								
Armanca								
15.	b0	20.8	20.4	20.4	20.8	20.6	100	-
16.	b1	20.6	19.6	21.4	20.8	20.6	100	0.0
17.	b2	20.4	21.0	20.4	21.2	20.8	101	0.1
18.	b3	20.0	20,4	19,2	20,0	19,9	97	-0,7
19.	Average seeding space	20.5	20.4	20.4	20.7			
20.	MMB relative value (%)	100	99.5	99.5	101			
21.	Difference ±	-	-0.1	-0.1	0.2	MMB initial =22.29g		
Silvana								
22.	b0	20.6	20.2	19.6	21.0	20.4	100	-
23.	b1	20.0	19.8	19.8	21.6	20.3	99.8	-0.1
24.	b2	20.6	20.0	20.2	21.4	20.6	101	0.2
25.	b3	20.2	20.2	19.2	21.0	20.2	99	-0.2
26.	Average seeding space	20.4	20.1	19.7	21.3			
27.	MMB relative value (%)	100	99	97	104			
28.	Difference ±	-	-0.3	-0.6	0.9	MMB initial =23.64g		

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