

THE INFLUENCE OF SOME TECHNOLOGICAL LINKS ON THE PRODUCTIVITY OF THREE MONOECIOUS HEMP UNISEXUAL FEMALE HYBRIDS AND THE PROVENANCE VARIETY, IN A.R.D.S SECUIENI CULTIVATION CONDITIONS

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Abstract

This paper aims to highlight the combined impact of the cutting method and the distance between plant rows on the monoecious hemp variety for seed – Zenit and on the unisexual female hybrids from three generations of crossbreeding, respectively retro-crossing. The researches were carried out in the Agricultural Research – Development Station Secuieni technological field, during 2017. The experience was of the trifactor type, the performed determinations were focusing on the biometric and productivity characteristics of the studied cultivars. The variety x cutting x distance combination generated remarkable yields for the HUF2 hybrid, sown at a distance of 50 cm between the plants rows, and to which two cuttings were applied (1816.7 kg/ha). Also, production results ensured at statistical level as very significant were obtained from interactions between HUF2 x T2 x 70 cm (1700 kg/ha), HUF3 x T2 x 50 cm (1643.3 kg/ha) and HUF2 x T1 x 70 cm (1626.7 kg/ha).

Key words: productivity, unisexual female hybrid, monoecious hemp

Hemp is one of the oldest and most popular crop plants (Forgo, 1957), with a multitude of uses which covers a range of products derived from fibers or seeds that have been known throughout history (Hillig K., 2005; Small E, Cronquist A., 1976; Salentjin EMJ *et al*, 2014).

Hemp seeds have been a traditional source of food in many countries for thousands of years, and in terms of nutrient content, husked seeds are practically 34.6% protein, 46.5% fat, and 11.6% carbohydrates. In addition to these nutrients, hemp seeds contain essential fatty acids (EFA), in the correct proportion required by the human body, but also all the essential amino acids and dietary fiber required for a good health (Callaway, 2004; Bostwick JM., 2012; Gauca C. *et al*, 2015).

As with many other crops, hemp seeds can be harvested in a conventional way with a combine. Thanks to this modern manipulation and seed husking, contact with leaf resins is minimized, and the husked seeds and oil, butter and other foods made from seeds do not have detectable amounts of THC (Sawler *et al*, 2015; de Meijer EPM *et al*, 2003; Piluzza G. *et al*, 2013; van Bakel H. *et al*, 2011).

In this paper, we aim to present the results regarding the productivity of some monoecious hemp genotypes, due to the combined influence of

Secuieni cultivation method (Popa Diana *et al*, 2015; Leonte Alexasndra *et al*, 2016) with the distance between plant rows.

MATERIAL AND METHOD

The experience was set up in 2017 in the technological field of the Agricultural Research and Development Station of Secuieni, Neamt, being of the trifactor type, in the form of subdivided plots, having the following factors with the respective graduations: A factor - genotype (A1 - Zenit, A2 - HUF1, A3 - HUF2, A4 - HUF3), B factor - cutting type (B1 - uncut, B2 - one cut, B3 – two cuts) and the C factor - the distance between the rows (C1 - 50 cm, C2 - 70 cm).

The biological material used was represented by the Zenit variety (parental form), a monoecious genotype specific for seed and the female unisexed hybrids of the three generations of hybridization (HUF1, HUF2 and HUF3).

In the autumn, after harvesting the pre-plant, the plowing was executed at a depth of 25 cm. In the spring, in the preparation of the germination bed, a leveling with a disc harrow was performed on 19.04.2017, followed by a pass with the combiner (04.05.2017).

Taking into account the fact that the species is pretentious to the nutrient content in the soil, complex fertilizers N:P:K 16:16:16, in an

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amount of 250 kg/ha and NH_4NO_3 , in the amount of 200 kg/ha were delivered to the technological field.

The sowing was done on 05.05.2017, followed on the same day by a 1.5 l / ha Dual Gold herbicide. The sowing norm was of 6 kg/ha, achieving a density of 26 plants/m², the distance between rows being of 50, respectively 70 cm.

During the vegetation period, Fusilade (for monocotyledonate) and Lontrel (for dicotyledonous) herbicides were administered.

The first cut, for T1 and T2, was applied at a height of 27 cm on 12.06.2017. The second cut was made at a height of 43 cm at T2 on 30.06.2017.

As far as the weather conditions are concerned, the 2017 agricultural year can be characterized as a normal year, with deviations compared to the multiannual average of up to 4.4°C (March).

The average of the vegetation period was close to normal, recording a deviation of 0.81°C, while, from a pluviometrical point of view, the period was highlighted as excessively drought.

The months of June and August were warm and very dry, while September was very warm and rainy. The remaining months of the vegetation period were normal, both thermal and pluviometrical.

Data on weather conditions registered in 2017 at A.R.D.S. Secuieni are listed in *table 1*.

The sampling was done manually, on 31.08.2017, the area harvested being of 10 square meters.

Morphological, biometric and productivity determinations were performed, the recorded data being subsequently processed by statistical methods specific to the polyfactorial experiences, their interpretation being performed by the analysis of the variants (Ceapoiu N., 1968).

Table 1

		Months									Average of veg. period
		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	
Average temp. (°C)	2017	-5,7	-1,8	7,0	9,1	15,8	20,3	20,4	21,2	16,3	17.18
	multiannual average	-3.8	-2.3	2.6	9.4	15.4	18.8	20.3	19.5	14.8	16.37
	deviation	-1.9	0.5	4.4	-0.3	0.4	1.5	0.1	1.7	1.5	0.81
	characterization	chilly	normal	very warm	normal	normal	warm	normal	warm	warm	normal
Rainfalls (mm)	2017	7.3	17.0	101.6	54.4	59.4	49.4	72.2	23.0	55.2	313.6
	multiannual average	20.5	19.6	25.4	46.8	64.8	84.3	84.0	61.4	45.4	386.7
	deviation	-13.2	-2.6	76.2	7.6	-5.4	-34.9	-11.8	-38.4	9.8	-73.1
	characterization	very dry	normal	very rainy	normal	normal	very dry	normal	very dry	rainy	excessively dry

RESULTS AND DISCUSSIONS

Both the type of cutting and the distance between rows influenced the morphology and biometry of the determined characters in the crop experiment, as shown in *table 2*.

Thus, plant size and diameter decrease with increasing the number of cuts, while the number

of branches is in direct correlation with applied cuttings. As for factor C grading, both the stem height and their diameter indicate the highest values for the 70 cm distance. Instead, the number of branches decreases with increasing the distance between rows.

Table 2

Morphological and biometric characteristics of the studied hemp genotypes					
Genotype	Cutting type	Distance between rows	Size	Number of ramifications	Average diameter
Zenit	NT	50	210	-	7.5
		70	220	-	8.5
	T1	50	150	52	5.4
		70	160	40	6.4
	T2	50	140	68	4.8
		70	146	56	5.0

Table 2, continued

HUF1	NT	50	225	-	8.6
		70	240	-	9.8
	T1	50	160	48	6.0
		70	170	39	6.4
	T2	50	143	51	4.6
		70	160	50	5.6
HUF2	NT	50	220	-	8.0
		70	230	-	8.6
	T1	50	140	52	5.0
		70	156	38	5.7
	T2	50	133	62	4.0
		70	150	51	4.6
HUF3	NT	50	206	-	7.6
		70	223	-	8.5
	T1	50	146	58	5.0
		70	152	48	5.9
	T2	50	136	64	4.5
		70	146	57	5.0

The influence of the used genotypes revealed yields ranging from 1196.7 kg/ha (Zenit variety – control variant) and 1577.2 kg/ha (HUF2 hybrid). Productions with very significant differences at the statistical level were obtained in

the hybrids of the second and third generation hybrids (380.6 kg/ha, respectively 254.4 kg/ha) compared to the Zenit parental form, while the hybrid of the first generation (HUF1) makes a significant increase of 7.66% (table 3).

Table 3

The genotype influence on seed production

Genotype	Seed production		
	kg/ha	% vs. control	differences from control (kg/ha)
Zenit	1196.7	100.00	Mt
HUF1	1288.3	107.66	91.7*
HUF2	1577.2	131.80	380.6***
HUF3	1451.1	121.26	254.4***

DL 5% = 78.4 kg/ha
DL 1% = 118.7 kg/ha
DL 0.1% = 190.6 kg/ha

The Secuieni cultivation method generated yields ranging from 1196.7 kg/ha in the case of the uncut variant and 1545.4 kg/ha in the case of the two cuttings variant (table 4). Very significant

differences were recorded for both graduations of the cutting factor (T2 – 1545.4 kg/ha, T1 – 1392.9 kg/ha) compared to the uncut variant (control variant).

Table 4

The cuttings influence on seed production

Cutting type	Seed production		
	kg/ha	% vs. control	differences from control (kg/ha)
NT	1196.7	100.00	Mt
T1	1392.9	116.40	196.3***
T2	1545.4	129.14	348.8***

DL 5% = 73.7 kg/ha
DL 1% = 101.4 kg/ha
DL 0.1% = 139.7 kg/ha

Regarding the distance between the rows, the two graduations of factor C do not significantly influence the obtained results, the difference compared to the control variant being very small (less than 1%), according to the table 5.

In 2017 experimental year, the combined genotype x cutting influence determined productions with different meanings, the differences recorded compared to the control variant were positive, except for the combination (HUF1 x NT).

Table 5

The distance between rows	The distance between rows influence on seed production		
	Seed production		
	kg/ha	% vs control	differences from control (kg/ha)
50	1384.7	100.00	Mt
70	1371.9	99.08	-12.8

DL 5% = 66.0 kg/ha

DL 1% = 89.6 kg/ha

DL 0.1% = 120.1 kg/ha

Thus, productions statistically insured at a very significant level have recorded the combinations of factors HUF2 x T2 (1758.3kg/ha), HUF3 x T2 (1598.3 kg/ha), HUF2 x T1 (1590.0 kg/ha), HUF1 x T2 (1471.7 kg/ha), HUF3 x T1 (1460.0 kg/ha) and HUF2 x NT (1383.3 kg/ha). Distinctly significant production

differences were obtained by the HUF1 hybrid to which a cutting has been applied and the Zenit variety combined with two cuts. The uncut variant in the third - generation hybrid determined significant increases compared to the Zenit x NT control variant (1068.3 kg / ha), according to the *table 6*.

Table 6

Genotype x cutting		Influence of genotype x cutting interaction on seed production		
		Seed production		
		(kg/ha)	% vs. control	differences from control (kg/ha)
Zenit	NT	1068.3	100.00	Mt
	T1	1168.3	109.36	100.0
	T2	1353.3	126.68	285.0**
HUF1	NT	1040.0	97.35	-28.3
	T1	1353.3	126.68	285.0**
	T2	1471.7	137.76	403.4***
HUF2	NT	1383.3	129.49	315.0***
	T1	1590.0	148.83	521.7***
	T2	1758.3	164.59	690.0***
HUF3	NT	1295.0	121.22	226.7*
	T1	1460.0	136.67	391.7***
	T2	1598.3	149.61	530.0***

DL 5% = 164.7 kg/ha

DL 1% = 226.8 kg/ha

DL 0.1% = 312.3 kg/ha

Genotype x sowing distance influenced hemp production, ranging from 1185.6 kg / ha (HUF2 x 50 cm) and 1590.0 kg / ha (HUF3 x 50 cm). Two of the genotypes, HUF1 and HUF2, produced very significant yields for both distances

(50 and 70 cm) compared with the Zenit x 50 cm (1207.8 kg / ha). However, the HUF1 x 50 cm and HUF2 x 50 cm combinations with 31.64% and 29.52% respectively are noted (*table 7*).

Table 7

Genotype x distance		Influence of genotype x distance interaction on seed production		
		Seed production		
		(kg/ha)	% vs. control	differences from control (kg/ha)
Zenit	50	1207.8	100.00	Mt
	70	1288.9	106.71	81.1
HUF1	50	1564.4	129.52	356.6***
	70	1477.8	122.35	270.0**
HUF2	50	1185.6	98.16	-22.2
	70	1287.8	106.62	80.0
HUF3	50	1590.0	131.64	382.2***
	70	1424.4	117.93	216.6**

DL 5% = 147.5 kg/ha

DL 1% = 200.4 kg/ha

DL 0.1% = 268.5 kg/ha

The combinations of cutting and sowing distance factors have highlighted the importance

of cuttings on seed production, the two graduations of factor B (one cut and two cuttings)

achieving statistically assured productions at a very significant level (table 8). However, the higher yields recorded in the case of two cuttings

were noted, the gains being of 31.53% (T2 x 50 cm) and 27.13% (T2 x 70 cm).

Table 8

Cutting x distance		Influence of cutting x distance interaction on seed production		
		(kg/ha)	% vs. control	differences from control (kg/ha)
NT	50	1593.3	100.00	Mt
	70	1597.8	100.28	4.5
T1	50	1850.0	116.11	256.7***
	70	1864.4	117.02	271.1***
T2	50	2095.6	131.53	502.3***
	70	2025.6	127.13	432.3***

DL 5% = 109.3 kg/ha
DL 1% = 149.5 kg/ha
DL 0.1% = 202.7 kg/ha

For the year 2017, the combined effect of genotyping, cutting and distance between rows generated yields ranging from 1033.3 kg / ha (Zenit x NT x 70 cm) and 1816.7 kg / ha (HUF2 x T2 x 50 cm). Compared with the control variant (Zenit x NT x 50 cm – 1103,3 kg/ha), statistically significant production gains were obtained for interactions between the HUF2 genotype with a distance of 70 cm for both T1 and T2 (HUF2 x T2 x 70 cm –

1700.0 kg/ha, HUF2 x T1 x 70 cm – 1626.7 kg/ha). At the same time, very significant differences were registered at the combinations of HUF2 x T2 x 50 cm (1816.7 kg / ha) and HUF3 x T2 x 50 cm (1643.3 kg/ha). Distinctly significant differences were obtained in the case of two cuttings, both at 50 cm and 70 cm, in the HUF1 hybrid, and in the single-cut variant, set at 50 cm between the rows, for HUF2 and HUF3 hybrids (table 9).

Table 9

Genotype x cutting x distance			Influence of genotype x cutting x distance interaction on seed production		
			(kg/ha)	% vs. control	differences from control (kg/ha)
Zenit	NT	50	1103.3	100.00	Mt
		70	1033.3	93.66	-70.0
	T1	50	1176.7	106.65	73.3
		70	1160.0	105.14	56.7
	T2	50	1343.3	121.75	240.0**
		70	1363.3	123.56	260.0**
HUF1	NT	50	1040.0	94.26	-63.3
		70	1040.0	94.26	-63.3
	T1	50	1343.3	121.75	240.0**
		70	1363.3	123.56	260.0**
	T2	50	1483.3	134.44	380.0***
		70	1460.0	132.33	356.7***
HUF2	NT	50	1323.3	119.94	220.0*
		70	1443.3	130.82	340.0***
	T1	50	1553.3	140.79	450.0***
		70	1626.7	147.43	523.3***
	T2	50	1816.7	164.65	713.3***
		70	1700.0	154.08	596.7***
HUF3	NT	50	1313.3	119.03	210.0*
		70	1276.7	115.71	173.3*
	T1	50	1476.7	133.84	373.3***
		70	1443.3	130.82	340.0***
	T2	50	1643.3	148.94	540.0***
		70	1553.3	140.79	450.0***

DL 5% = 164.7 kg/ha
DL 1% = 226.8 kg/ha
DL 0.1% = 312.3 kg/ha

CONCLUSIONS

The type of cutting and the distance between rows influenced the biometric and morphological characters of the studied genotypes. Thus, both the plant size and the stem diameter recorded lower values with the increase in the number of cuts, while also revealing higher values for the distance of 70 cm between rows compared to the distance of 50 cm. The number of branches varied in an ascending direction with the increase in the number of cuttings applied, while at the same time a decrease in the case of variants set at a distance of 70 cm between rows.

The influence of the used genotype revealed seed production ensured at statistical level as very significant for HUF2 (1577.2 kg/ha) and HUF3 (1451.1 kg/ha) hybrids compared to Zenit their parental form (1196.7 kg/ha). The highest production, according to the obtained values, was recorded by the female unisexual hybrid belonging to the second generation of hybridization.

The influence of the applied cuttings generated significant production increases (T2 - 1545.4 kg/ha, T1 - 1392.9 kg/ha) compared to uncut variant (1196.7 kg/ha).

The experimental variant of HUF2 genotype and to which two cuts were applied recorded the highest seed production (1758.3 kg/ha), the difference following the comparison with the control variant (Zenit x NT - 1068.3 kg/ha) being very significant.

Production results ensured at statistical level as very significant, due to the interaction between genotype and distance, were obtained by first and third generation hybrids for both graduations of the distance factor (HUF3 x 50 cm - 1590.0 kg/ha, HUF1 x 50 cm - 1564.4 kg/ha, HUF1 x 70 cm - 1477.8 kg/ha, HUF3 x 70 cm - 1424.4 kg/ha).

The interaction between cutting x distance has generated very significant production increases for both types of cutting, irrespective of the experimented distance between rows, compared with the control (NT x 50 cm - 1593.3 kg/ha).

Due to the interaction between genotype, cutting and distance, the HUF2 genotype was noted to which two cuts (T2) were applied at a distance of 50 cm between rows. The combination highlighted the highest seed production (1816.7 kg/ha), assured at statistical level as very significant compared to the control (Zenit x NT x 50 cm - 1103.3 kg/ha).

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