

THE PRODUCTIVITY OF SOME MONOECIOUS HEMP VARIETIES (FOR FIBER AND MIXTE) UNDER THE CENTER OF MOLDAVIA ECOPEDOCLIMATIC CONDITIONS

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Abstract: The present paper presents the results obtained regarding the evolution of stem and fiber production in monoecious hemp, under the pedoclimatic conditions of the Center of Moldova, between 2012 and 2016. The biological material used was represented by four monoecious hemp varieties created at S.C.D.A. Secuieni, respectively, Denise, Diana, Dacia – Secuieni and Ratza. The stems yields achieved, have varied widely, ranging from 7860 kg/ha at Denise variety, in 2016 (a very warm agricultural year from the thermal point of view and rainy from the pluviometric point of view), and 15167 kg/ha, at Dacia - Secuieni in 2014 (a normal agricultural year both from the thermal and pluviometric point of view). On average, during the five years studied, the highest production of fiber was obtained in the Dacia-Secuieni variety in 2014, of 5005 kg/ha, and the lowest of 2279 kg/ha at Denise variety in 2016.

Keywords: monoecious hemp, yield, stems, fiber

1. INTRODUCTION

Cultivated and used for various purposes since 10,000 BC, considered to be the plant with more than 50000 uses, hemp focuses its attention, and today, on the importance and wide variety of its uses.

Hemp can be grown for seeds, fiber or mixed purpose in different geographic and climatic areas [1, 2, 3, 4, 5] being an industrial plant with sustainable yield, that can help meet the increasing demand for fiber worldwide.

The stems wood fibers, can be used for everything from jewelry, animal bedding, plastics to clothing [6, 7, 8, 9, 10]. Hemp fiber can replace glass fiber in some automotive and aviation components, and can also be a perfect substitute for insulated glass fiber.

By presenting high yields of fiber and strains per hectare, with their valuable features, hemp will be a plant of high importance also in the future.

2. EXPERIMENTAL SETUP

The researches were carried out between 2012 - 2016, at S.C.D.A. Secuieni and aimed to establish the most productive monoecious hemp variety under the ecopedoclimatic conditions from Center of Moldova.

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Placement of the experience was done by the randomized block method in three repetitions. The experimental plot had a collectable surface of 10 square meters.

The settlement was carried out in the experimental field of the unit on a medium – textured typical faeoziom (chernozem) cambic soil, characterized as medium supplied in active humus (1.88 %) and nitrogen (16.2 ppm N-NO₃), well supplied in phosphorus (77.6 ppm PAL), Ca (13, 6 meq/100 g sol Ca) and Mg (1.8 meq/100 g soil Mg), poorly supplied in potassium (124.6 ppm K₂O) and slightly acidic, with a water pH of 5.98.

Experimentation was conducted under non-irrigated conditions, and in each year of the analyzed period, the crop was fertilized with 110 kg/ha a.s. N, 40 kg/ha P₂O₅ and 40 kg/ha K₂O₅, and herbicide with 1.0 L/ha Fusilade and 0.5 L/ha Lontrel. The sowing was carried out at the optimum time for this area.

The cultivation technology specific to the ecopedoclimatic conditions in the Center of Moldova was respected and the data obtained were processed and statistically interpreted by the variance analysis method [10].

For the entire growing season of hemp crop (from sowing to physiological maturity), the deviation from the multiannual average temperature varied between 0.4 °C (2014) and 3.3 °C (2016).

From the temperatures point of view, the monoecious hemp vegetation period of the experimental year compared to the multiannual average was characterized as normal (2013, 2014), warm (2015) and very warm (2012, 2016) (Table 1).

Table 1. Temperatures recorded at S.C.D.A. Secuieni meteorological station.

Average temperature °C	Months									Average per vegetation period	Deviation	Vegetation period charact.
	Jan.	Febr.	Mar	Apr	Mai	Jun.	Jul.	Aug	Sept			
2012	-3.4	-10.7	2.2	11.7	16.8	21.1	23.5	21.3	17.7	18.7	2.3	Very warm
2013	-5.0	-1.1	0.8	11.5	17.7	19.9	20.5	20.4	14.2	17.4	1.0	norm.
2014	-2.6	-1.7	7.1	10.0	15.5	18.2	20.8	20.6	15.8	16.8	0.4	norm.
2015	-1.6	-0.2	4.5	9.5	16.6	20.1	22.8	22.4	18.4	18.3	1.9	warm
2016	-3.0	4.2	5.7	13.5	14.9	20.3	31.7	20.6	17.3	19.7	3.3	Very warm
Multiannual average	-3.8	-2.3	2.6	9.4	15,4	18.8	20.3	19.5	14.9	16.4	-	-

In terms of rainfall, the deviation from the precipitation multiannual average ranged between -233.3 mm (2015) and 21.1 mm (2016), and was characterized as normal in 2013 and 2014, drought in 2012, very drought in 2015 and very rainy in 2016 (Table 2).

Table 2. Rainfall recorded at S.C.D.A. Secuieni meteorological station.

Rainfall (mm)	Months									Suma pe per. de veg.	Deviation	Vegetation period charact.
	Jan.	Febr.	Mar	Apr.	May	Jun.	July	Aug	Sept			
2012	11.0	12.0	28.2	68.0	93.6	53.8	19.0	26.4	24.0	284.8	-101.9	drought
2013	14.2	28.8	33.4	38.2	51.4	146.0	76.4	42.0	42.6	396.6	9.9	norm.
2014	22.6	6.8	26.4	77.8	96.2	66.6	91.1	37.0	9.2	377.9	-8,8	norm.
2015	8.8	16.0	43.4	25.4	5.6	34.0	51.0	12.6	24.8	153.4	-233.3	Very drought
2016	12.0	14.2	29.4	42.0	120.2	161.0	4.0	32.0	48.6	407.8	21.1	Very rainy
Multiannual average	20.5	19.6	25.4	46.8	64.8	84.3	84.0	61.4	45.4	386.7	-	-

3. RESULTS AND DISCUSSION

In 2012, the strain yields of the experienced varieties ranged between 8753 kg/ha (Denise) and 13300 kg/ha (Dacia - Secuieni). Production increases at strains, statistically ensured as very significantly, were obtained in Dacia – Secuieni (2201 kg/ha) and Ratza (2132 kg/ha) varieties, while Denise and Diana varieties have obtained production minuses (-2345 kg/ha, -1991 kg/ha) which were statistically insured and recorded as very significant negative compared to the experience average (control) (Table 3).

The yields obtained in 2013 agricultural year were between 10700 kg/ha (Denise) and 15132 kg/ha (Dacia - Secuieni). Compared with the experience average, two varieties achieved very significant production increases (Dacia – Secuieni and Ratza) and two varieties achieved very significant negative production increases (Table 3).

In the third year of experimentation (2014), the varieties yields ranged from 10660 kg/ha at Denise variety to 15167 kg/ha at Dacia – Secuieni variety. Compared with the experience average, Dacia – Secuieni (2614 kg/ha) and Ratza (774 kg/ha) achieved very significant production increases, while the Denise and Diana varieties obtained production minuses (-1893 kg/ha, -1497 kg/ha) interpreted as negative very significant (Table 3).

In 2015 agricultural year, superior yields were obtained at Dacia – Secuieni (13512 kg/ha) and Ratza (13200 kg/ha) varieties, the production increases being statistically interpreted as very significant, at Dacia – Secuieni (2346 kg/ha) and Ratza (2034 kg/ha) compared to the experience average (Table 3).

In the last year of experimentation (2016), the varieties yields ranged widely between 7860 kg/ha (Denise) and 14200 kg/ha (Dacia – Secuieni). Compared with the experience average, the Dacia – Secuieni (3017 kg/ha) and Ratza (2719 kg/ha) varieties have obtained very significant production increases, while the Denise and Diana varieties obtained production minuses (-3323 kg/ha, -2413 kg/ha) interpreted as negative very significant (Table 3).

On average, during the five years of experimentation, the yields of the studied varieties ranged from 9362 kg/ha at Denise variety up to 14262 kg/ha at Dacia – Secuieni variety. Production increases at strains, statistically ensured as very significantly, were obtained at Dacia – Secuieni (2498 kg/ha) and Ratza (1832 kg/ha) varieties, while the Denise and Diana varieties obtained production minuses (-2402 kg/ha, -1934 kg/ha) which were statistically insured and interpreted as very significant negative compared to the experience average (control) (Table 3).

Regarding the fiber yields obtained at the experienced varieties in 2012 they were between 2538 kg/ha (Denise) and 4389 kg/ha (Dacia – Secuieni). Production increases at fiber, statistically ensured as very significantly, were obtained in Dacia – Secuieni (893 kg/ha) and Ratza (738 kg/ha), while the Denise and Diana varieties obtained production minuses (-958 kg/ha, -673 kg/ha) that were statistically insured and recorded as very significant negative compared to the experience average (control) (Table 4).

The yields obtained in 2013 agricultural year had values ranging from 3103 kg/ha (Denise) and 4994 kg/ha (Dacia – Secuieni). Compared with the experience average, two varieties achieved very significant production increases (Dacia – Secuieni and Ratza) and two varieties achieved very significant negative production increases (Table 4).

In the third year of experimentation (2014), the varieties yields ranged from 3091 kg/ha at Denise variety to 5005 kg/ha at Dacia – Secuieni variety. In comparison to the experience average, Dacia – Secuieni (1058 kg/ha) and Ratza (318 kg/ha) have obtained very significant production increases, while the Denise and Diana varieties obtained production minuses (-856 kg/ha, -520 kg/ha) interpreted as negative very significant (Table 4).

In 2015 agricultural year, superior yields were obtained at Dacia – Secuieni (4459 kg/ha), Ratza (4224 kg/ha) and Diana (2826 kg/ha) varieties, the production increases being statistically interpreted as very significant, at Dacia – Secuieni (941 kg/ha) and Ratza (706 kg/ha) varieties compared to the experience average (Table 4).

Table 3. Stalk yields obtained at the monoecious hemp varieties during 2012 – 2016.

Variety	2012			2013			2014			2015			2016			Period average		
	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.
Denise	8753	-2345	000	10700	-2113	000	10660	-1893	000	8836	-2330	000	7860	-3323	000	9362	-2402	000
Diana	9107	-1991	000	11101	-1712	000	11056	-1497	000	9117	-2049	000	8770	-2413	000	9830	-1934	000
Dacia – Secuieni	13300	2201	***	15132	2319	***	15167	2614	***	13512	2346	***	14200	3017	***	14262	2498	***
Ratza	13230	2132	***	14320	1507	***	13327	774	***	13200	2034	***	13902	2719	***	13596	1832	***
Average	11098	Mt.	-	12813	Mt.	-	12553	Mt.	-	11166	Mt.	-	11183	Mt.	-	11763	Mt.	-
DL	5%	4.37		13,95	5.81		19.37	3.09		28.18	4.51		3.82			5.55		
	1%	6.35		20.29	8.46		42.27	6.76		8.33								
	0,1%	9.53		30.44	12.68													

Table 4. Fiber yields obtained at the monoecious hemp varieties during 2012 – 2016.

Variety	2012			2013			2014			2015			2016			Period average		
	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.	Prod. kg/ha	Diff. kg/ha	Sign.
Denise	2538	-958	000	3103	-927	000	3091	-856	000	2562	-955	000	2279	-1254	000	2715	-990	000
Diana	2823	-673	000	3441	-589	000	3427	-520	000	2826	-692	000	2719	-814	000	3047	-658	000
Dacia – Secuieni	4389	893	***	4994	964	***	5005	1058	***	4459	941	***	4686	1153	***	4707	1002	***
Ratza	4234	738	***	4582	552	***	4265	318	***	4224	706	***	4449	916	***	4351	646	***
Average	3496	Mt.	-	4030	Mt.	-	3947	Mt.	-	3518	Mt.	-	3533	Mt.	-	3705	Mt.	-
DL	5%	10.5		48.7	3.1		5.7	10.2		5.7	10.2		12.2			12.2		
	1%	15.2		70.9	4.5		8.4	17.8		8.4	17.8		22.2			26.7		
	0.1%	22.9		106.4	6.7		12.5	26.7		12.5	26.7							

In the last year of experimentation (2016), the varieties yields ranged widely between 2279 kg/ha (Denise) and 4686 kg/ha (Dacia – Secuieni). Of the 4 studied varieties, compared with the experience average, Dacia – Secuieni (1153 kg/ha) and Ratza (916 kg/ha) have achieved very significant production increases, while the Denise and Diana varieties obtained production minuses (-1254 kg/ha, -814 kg/ha) interpreted as a very significant negative (Table 4).

On average, during the experimentation period, the yields of the studied varieties ranged from 2715 kg/ha at Denise variety and up to 4707 kg/ha at Dacia – Secuieni variety. Production increases at fiber, statistically insured as very significant, were obtained at Dacia – Secuieni (1002 kg/ha) and Ratza (646 kg/ha) varieties, while the Denise and Diana varieties obtained production minuses (-990 kg/ha, -658 kg/ha) which were statistically insured and interpreted as very significant negative compared to the experience average (control) (Table 4).

4. CONCLUSIONS

The average production of strains of the four varieties experienced at S.C.D.A. Secuieni was between 9362 kg/ha at Denise and 14262 kg/ha at Dacia – Secuieni.

On average, during the five years of experimentation, compared to the experience average (control), two varieties (Dacia – Secuieni and Ratza) have obtained production increases (2498 kg/ha, 1832 kg/ha) statistically insured as very significant, while the other two varieties (Denise and Diana) have obtained production minuses (-2402 kg/ha, -1934 kg/ha) which were statistically insured and interpreted as negative very significant.

The average fiber production of the four varieties experienced at S.C.D.A. Secuieni was between 2715 kg/ha at Denise and 4707 kg/ha at Dacia – Secuieni.

During 2012 – 2016, compared to the experience average (control), two varieties (Dacia – Secuieni and Ratza) have achieved production increases (1002 kg/ha, 646 kg/ha) statistically insured as very significant, while the other two varieties (Denise and Diana) have obtained production minuses (-990 kg/ha, -658 kg/ha) which were statistically insured and interpreted as negative very significant.

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