

„SUCCESIV” – A NEW MONOECIOUS HEMP CULTIVAR CREATED AT ARDS SECUIENI, NEAMŢ COUNTY

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ABSTRACT

„Succesiv” is a monoecious hemp cultivar created at the Agricultural Research & Development Station Secuieni, registered in 2017 and obtained by isolation, complex hybridization on families (2011 - Z 7x4, M x 7, M 3x3, M 6x5, C x 9) and repeated selection. The new variety is characterized by long fibers with a length of 1.3-1.5 m in stem culture and 1.3-2.2 m in seed culture. The yield in the main crop is 4.2-5 t/ha fibers and 900-1200 kg/ha of seed, while in successive crops the seed yield reaches 800-1100 kg/ha.

Keywords: monoecious hemp, vegetation period, yield, genetic resources, selection, new cultivar.

INTRODUCTION

The monoecious hemp breeding program from ARDS Secuieni has had as a priority the increase of the yielding capacity associated with the reduction of the THC content.

Unlike other plants undergoing the amelioration process, the monoecious hemp suffers from a progressive genetic and biological degeneration, which is manifested by the decrease of seed production due to the reduction of the female flowers percentage and masculinization of the inflorescences (Găucă, 1995; Meijer, 1995). This phenomenon is caused by numerous physiological and chemical factors such as: temperature, light quality and intensity, soil nutrients, soil type, etc.

In hemp, the sex heredity is controlled by polygenes, which is why the selection can only be made on phenotypes, continuously, since the recombination would constantly alter the composition of polygenic complexes (Găucă et al., 1997).

In order to obtain monoecious cultivars, a selection and improvement process for genotypes is required, which must meet certain quality and productivity characteristics, resistance to biotic and abiotic stress factors, and in particular a low content of

tetrahydrocannabinol (THC), below 0.2%, the maximum allowed in some EU countries (Berea et al., 1996; Bocşa, 2011; Găucă et al., 2012).

MATERIAL AND METHODS

The breeding method of the monoecious hemp cultivar „Succesiv”, consisted of processes of isolation, complex hybridization on families (2011 - Z 7x4, M x 7, M 3x3, M 6x5, C x 9) and repeated selection. The families that participated in the creation of this cultivar were chosen from the genetic resources of the monoecious hemp breeding laboratory of ARDS Secuieni.

Following the selection process, a genotype was identified that met the characteristics of productivity and quality specific to a new cultivar, but also suitability to the successive system culture.

For the characterization of the Succesiv cultivar we used the experimental results obtained in the centres of the State Institute for Varieties Testing and Registration (SIVTR) in the period 2015-2016, but also those obtained at ARDS Secuieni, 2016-2017, and the analysis of the yield results was made compared to the Zenit control variety.

RESULTS

Morphophysiological characters

The length of the plant in the crop for stems was between 1.3 and 1.5 m, and in the seed culture between 1.3-2.2 m. The stem is green - yellowish and has a number of 7-9 grooves.



Figure 1. The „Succesiv” monoecious hemp cultivar

The Succesiv cultivar is the earliest cultivar created at ARDS Secuieni. The vegetation period in the fiber culture is 80-90 days and in the seed culture 90-110 days. When sowing takes place in classical conditions, in April, when the soil is 8-10°C, the fruit is matured between 25th July and 5th August.

When sowing takes place after a precursor (barley, peas, mash) which leaves the land until 20th June, with the possibility of postponing until 1st July, so that the sowing is carried out until 10th July, under irrigation conditions or rainfall to ensure soil moisture (so germination and plant growth are optimal), crop development is normal until harvest.

The flowering period is of 10-15 days.

Cannabinoid content was 0.0139%, according to analysis bulletins issued by the Regional Laboratory for Quality Control and Wine Hygiene Blaj.

Production capacity

In yield trials carried out between 2015 and 2016 in the SIVTR network and between 2016 and 2017 at ARDS Secuieni, in a number of experiments with a high variability in environmental conditions, the Succesiv cultivar achieved higher yields than the Zenit control.



Figure 2. Appearance of the crop at the time of harvest

The hemp cultivar Succesiv showed higher yields than the Zenit control variety in all SIVTR testing centres, except the Sibiu and Negrești centres in the year 2016, where it achieved 66% and 93% of the yield of the control variety (Table 1).

The yield of the Succesiv cultivar varied between 539 kg/ha at Sibiu in 2016 and 2536 kg/ha in Luduș in 2016. On average, over the two years of testing, the monoecious hemp cultivar Succesiv recorded yields which ranged between 853 kg/ha (Sibiu) and 2188 kg/ha (Luduș). It should be noted that only in 2016 the yield of the Succesiv cultivar was lower than that of the control, and only in two locations of the SIVTR network.

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Table 1. Seed yield of the monoecious hemp cultivars from ARDS Secuieni tested in SIVTR network during 2015-2016

Test centre	Cultivar	Seed yield				Average (2015-2016)	
		2015		2016		kg/ha	%
		kg/ha	%	kg/ha	%		
Şimleu Silvaniei	Zenit (control)	1994	100	1215	100	1605	100
	Succesiv	2274	114	1395	115	1835	114
Average of all monoecious cultivars		2134		1305		1720	
Sibiu	Zenit (control)	1031	100	814	100	923	100
	Succesiv	1167	113	539	66	853	92
Average of all monoecious cultivars		1099		677		888	
Satu Mare	Zenit (control)	855	100	1363	100	1109	100
	Succesiv	962	113	1684	124	1323	119
Average of all monoecious cultivars		909		1524		1216	
Negreşti	Zenit (control)	1131	100	968	100	1050	100
	Succesiv	1266	112	901	93	1084	103
Average of all monoecious cultivars		1199		935		1067	
Luduş	Zenit (control)	1835	100	2272	100	2054	100
	Succesiv	1839	100	2536	112	2188	107
Average of all monoecious cultivars		1837		2404		2121	
Average	Zenit (control)	1369	100	1326	100	1348	100
	Succesiv	1501	110	1411	106	1456	108
Average of all monoecious cultivars		1435		1369		1402	

The quality elements of the fiber are shown in Tables 2 and 3. On average over the two years of testing, the Succesiv cultivar presented a total length of the stem lower than that of the control variety of 167 cm and 205 cm, the only place where it exceeded the height of the control was in Satu Mare, of 283 cm, about 4% more.

The value of the total fiber length was influenced by the climatic conditions and soil type specific to each test centre in the SIVTR network. This is the case of the Satu Mare test centre, where the Succesiv cultivar, showed a total stem length superior to that of the control variety, both in 2015 and 2016, by 5% and 3% respectively (Table 2).

Table 2. The fibers total length (cm) of the monoecious hemp varieties from ARDS Secuieni tested in SIVTR network during 2015-2016

Test centre	Cultivar	Total length				Average (2015-2016)	
		2015		2016		cm	%
		cm	%	cm	%		
Şimleu Silvaniei	Zenit (control)	173	100	169	100	171	100
	Succesiv	170	98	163	96	167	98
Average of all monoecious cultivars		172		166		169	
Sibiu	Zenit (control)	182	100	210	100	196	100
	Succesiv	185	102	205	98	195	99
Average of all monoecious cultivars		184		208		196	
Satu Mare	Zenit (control)	267	100	276	100	272	100
	Succesiv	280	105	285	103	283	104
Average of all monoecious cultivars		274		281		278	
Negreşti	Zenit (control)	182	100	204	100	193	100
	Succesiv	185	102	189	93	187	97
Average of all monoecious cultivars		184		197		190	
Luduş	Zenit (control)	190	100	216	100	203	100
	Succesiv	180	95	209	97	195	96
Average of all monoecious cultivars		185		213		199	
Average	Zenit (control)	199	100	215	100	207	100
	Succesiv	200	101	210	98	205	99
Average of all monoecious cultivars		200		213		206	

On average over the two years of experimentation in the ISTIS network, the technical length in the „Succesiv” variety recorded values between 98 cm (Șimleu

Silvaniei) and 266 cm (Satu Mare), the values differing from one test centre to another, depending on the climatic conditions of the year (Table 3).

Table 3. The fibers technical length (cm) of the monoecious hemp varieties from ARDS Secuieni tested in SIVTR network during 2015-2016

Test centre	Cultivar	Technical length				Average (2015-2016)	
		2015		2016		cm	%
		cm	%	cm	%		
Șimleu	Zenit (control)	87	100	127	100	107	100
Silvaniei	Succesiv	74	85	121	95	98	92
Average of all monoecious cultivars		81		124		103	
Sibiu	Zenit (control)	165	100	175	100	170	100
	Succesiv	168	102	175	100	172	101
Average of all monoecious cultivars		167		175		171	
Satu Mare	Zenit (control)	250	100	258	100	254	100
	Succesiv	263	105	269	104	266	105
Average of all monoecious cultivars		257		264		260	
Negrești	Zenit (control)	165	100	170	100	168	100
	Succesiv	168	102	170	100	169	101
Average of all monoecious cultivars		167		170		169	
Luduș	Zenit (control)	150	100	120	100	135	100
	Succesiv	140	93	114	95	127	94
Average of all monoecious cultivars		145		117		131	
Average	Zenit (control)	163	100	170	100	167	100
	Succesiv	163	100	170	100	167	100
Average of all monoecious cultivars		163		170		167	

The vegetation period of the hemp varieties tested in the SIVTR network varied according to the test centre and the year climatic conditions. Thus, in 2015, the vegetation period of the Succesiv

monoecious cultivar varied between 131 days in Șimleu Silvaniei and 147 days in Negrești, and in 2016 between 126 in Negrești and 171 days in Luduș (Table 4).

Table 4. The vegetation period of the monoecious hemp varieties from ARDS Secuieni tested in SIVTR network during 2015-2016

Test centre	Cultivar	Vegetation period (days)		Average (2015-2016)
		2015	2016	Days
Șimleu	Zenit (control)	132	150	141
Silvaniei	Succesiv	131	149	140
Average of all monoecious cultivars		132	150	141
Sibiu	Zenit (control)	142	143	143
	Succesiv	145	141	143
Average of all monoecious cultivars		144	142	143
Satu Mare	Zenit (control)	132	139	136
	Succesiv	132	141	137
Average of all monoecious cultivars		132	140	136
Negrești	Zenit (control)	146	128	137
	Succesiv	147	126	137
Average of all monoecious cultivars		147	127	137
Luduș	Zenit (control)	135	171	153
	Succesiv	137	171	154
Average of all monoecious cultivars		136	171	154
Average	Zenit (control)	137	146	142
	Succesiv	138	146	142
Average of all monoecious cultivars		138	146	142

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On average over the two years of testing, the vegetation period of the Succesiv cultivar varied between 137 days (Satu Mare, Negreşti) and 154 days in Luduş.

During 2016-2017, the Succesiv cultivar was also tested in the experimental field of ARDS Secuieni, regarding the seed and stem production, the total length and the technical length of the fiber, compared to the same variety - Zenit, used as a control and in the SIVTR network, too.

The Succesiv hemp cultivar achieved higher yields than the control in all the tested variants and in all the years (Table 5). The yield varied in the Succesiv cultivar between 1130 kg/ha in 2016 and 1440 kg/ha in 2017. On average over the two years of testing, the Succesiv monoecious hemp cultivar recorded yields ranging from 1170 kg/ha and 1300 kg/ha, with yield increase of 24% respectively 35% compared to the control.

Table 5. Seed yield of the Succesiv cultivar tested at ARDS Secuieni during 2016-2017

Distance between rows (cm)	Cultivar	Seed yield				Average (2016-2017)	
		2016		2017		kg/ha	%
		kg/ha	%	kg/ha	%		
50	Zenit (control)	830	100	1100	100	965	100
	Succesiv	1160	140	1440	131	1300	135
Average of all monoecious cultivars		995		1270		1133	
70	Zenit (control)	840	100	1040	100	940	100
	Succesiv	1130	135	1210	116	1170	124
Average of all monoecious cultivars		985		1125		1055	

On average over the two years of testing, the Succesiv cultivar presented a total length of fiber inferior to that of the control variety, of 155 cm respectively 165 cm, with about

28% respectively 21% less than the control variety. The total length of the fiber had values between 150 cm (2017) and 165 cm (2016, 2017) (Table 6).

Table 6. The fibers total length (cm) of the „Succesiv” cultivar tested in ARDS Secuieni during 2016-2017

Distance between rows (cm)	Cultivar	Total length				Average (2016-2017)	
		2016		2017		cm	%
		cm	%	cm	%		
50	Zenit (control)	220	100	210	100	215	100
	Succesiv	160	73	150	71	155	72
Average of all monoecious cultivars		190		180		185	
70	Zenit (control)	200	100	220	100	210	100
	Succesiv	165	83	165	75	165	79
Average of all monoecious cultivars		183		193		188	

The technical length of the Succesiv cultivar varied between 80 cm (2017) and 100 cm (2016). On average over the two years of experimentation, the Succesiv cultivar recorded values between 90 cm and 93 cm (Table 7).

The tetrahydrocannabinol (THC) content is a limiting factor for hemp cultivation; the maximum allowed level in some European Union countries is less than 0.2%, the

subsidy being given only for varieties that meet this criterion.

Regarding the THC content, the testing of the Succesiv cultivar and other monoecious hemp varieties created at ARDS Secuieni, was carried out within the Regional Laboratory for Quality Control and Wine Hygiene Valea Călugărească - Blaj subsidiary. The results of the analyses are presented in Table 8.

Table 7. The fibers technical length (cm) of the Succesiv cultivar tested at ARDS Secuieni during 2016-2017

Distance between rows (cm)	Cultivar	Technical length				Average (2016-2017)	
		2016		2017		cm	%
		cm	%	cm	%		
50	Zenit (control)	160	100	150	100	155	100
	Succesiv	100	63	80	53	90	58
Average of all monoecious cultivars		130		115		123	
70	Zenit (control)	140	100	160	100	150	100
	Succesiv	90	64	95	59	93	62
Average of all monoecious cultivars		115		128		122	

Table 8. The THC content of the monoecious hemp varieties created at ARDS Secuieni during 2015-2016

No.	Cultivar	Quality test	THC content (%)		
			2015	2016	Average (2015-2016)
1.	Zenit	Leaves + inflorescence peaks	0.021	0.029	0.025
2.	Dacia – Secuieni	Leaves + inflorescence peaks	0.037	0.038	0.038
3.	Secuieni – Jubileu	Leaves + inflorescence peaks	0.021	0.018	0.020
4.	Succesiv	Leaves + inflorescence peaks	0.051	0.018	0.035

The results show that no sample contained more than 0.2% THC, the maximum allowed by Romania. In fact, in all samples the THC values are below 0.06%, which makes the varieties created at ARDS Secuieni to be particularly valuable and recommends them for cultivation in other European countries as well.

CONCLUSIONS

The monoecious hemp cultivar „Succesiv” is the earliest cultivar (90-110 days in the seed culture) and the newest cultivar (approved in 2017) created at ARDS Secuieni.

It is suitable for classical cultivation, registering an average production of 1456 kg/ha (for the five test centres) in the SIVTR network, during 2015-2016, while at ARDS Secuieni, between 2016-2017, yielded an average yield of 1235 kg/ha.

The genotype can also be cultivated in successive crop, after precursors that release the land early, with the related output being between 800-1100 kg/ha.

The THC content is within the limits of European legislation, of maximum 0.2-0.3%, and can be cultivated both internally and externally.

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