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Comparative Study of Trifoliolate and Multifoliolate Alfalfa (*Medicago sativa* L.) Synthetic Populations

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Abstract

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Forage productivity and quality of alfalfa (*Medicago sativa* L.) are the most important traits. The objective of that study was the productivity and crude protein content of some trifoliolate and multifoliolate alfalfa synthetic populations to be compared. Evaluation trail was grown during 2002-2005 period at the Institute of Agriculture and Seed Science "Obraztsov Chiflik"-Rousse. The experimental design was a randomised complete block in four replications. 15 synthetic populations, 4-multifoliolate and 11-trifoliolate were tested for forage productivity, regrowth height, regrowth rate, leaf/stem ratio and crude protein content in dry matter. The highest forage productivity was found in trifoliolate synthetic population Syn1 N 98 2 (110.4 %) and multifoliolate Syn1 4782 (106.7 %). The first one had higher regrowth rate than the others. Syn1 Ax-95 population with yield being lower than the standard had the best leaf/stem ratio and the highest crude protein content.

Key words: productivity, crude protein, trifoliolate, multifoliolate, populations, *Medicago sativa* L.

Introduction

The alfalfa genotypes selected had to combine the basic traits high forage productivity and quality. Both genetic and environmental factors had influenced on forage productivity and quality in alfalfa. Alfalfa forage quality might be improved by increase the proportion of leave to stems (Volenec and Cherney, 1990 and Djukic et al., 2004). According those authors the higher leaf/stem ratio in multifoliolate plants was not consistently associated with improved forage quality. Herbage yield of multifoliolate populations had been equal to or slightly less than thîse of trifoliolate cultivars under space-planted conditions (Ferguson and Murphy, 1973). Those authors indicated that the slight yield reduction of multifoliolate plants might have been due to inbreeding depression associated with population development. Accord-

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ing data received by Vassileva and Ilieva, (1998) American multifoliolate varieties 4J-10, 3B-50, and 4B-59 had lower matter yield than the three Bulgarian trifoliolate varieties but the multifoliolate had better leafiness and were superior to the trifoliolate in crude protein content by 3.5 % to 5.5 %.

In Bulgaria the first multifoliolate alfalfa variety was created in 1999 (Petkova, 2003) and the breeding work with native multifoliolate forms and populations was conducted at the Institute of Agriculture and Seed Science "Obraztsov Chiflik" - Rousse.

The objective of that study was to compare the productivity and crude protein content of some trifoliolate and multifoliolate alfalfa synthetic populations.

Material and Methods

The study was carried out at the Institute of Agriculture and Seed Science "Obraztsov Chiflik" - Rousse in 2001-2005 without irrigation. Evaluation trail was grown during 2002-2005 period in the experimental field of IASS "Obraztsov Chiflik" - Rousse. The experimental design was a randomised complete block in four replications. 15 synthetic populations, 4-multifoliolate and 11-trifoliolate were tested for forage productivity (dry matter yield - kg ha^{-1}), regrowth height (cm), regrowth rate i.e. stem height 10 days after harvesting (grade 1-10, where 10 > 25 cm, and 1 > 5 cm) and leaf/stem ratio. Crude protein content (after Kjeldahl) was determined. The harvesting was performed at early flowering stage. Statistical processing of data was performed after Shanin (1977).

Results and Discussion

Meteorological conditions during the period of study were relatively favourable for alfalfa growth and development. The precipitation from March to September (period of vegetation) in 2003 (229 mm m^{-2}) and 2004 (336.7 mm m^{-2}) were lower than the average. Precipitation in 2002 (229 mm m^{-2}) and 2004 (336.7 mm m^{-2}) during the vegetation period March - September, although lower was about the average (385.8 mm m^{-2}), while in 2002, and 2005 was extremely favourable for vegetation mass development with higher than the average precipitation (till May) - 503.7 mm m^{-2} and 655.6 mm m-2 respectively. During the first year, purposely-good plant rooting, the first cut was left for seeds, but because of the heavy precipitation in July (106.1 mm m^{-2}), the racemes degenerated, and the regrowth was cut, and weighed. Later another cut was harvested but the total dry matter yield remained low. Next two years cuts were 4, and 5, respectively. Last year 3 cuts were reported till July.

The trifoliate synthetic population Syn1 N 98 2 formed the highest dry matter yield, totally 45.35 t ha^{-1} during 2002-2005 periods, and the exceeding of standard yield in 2004, and 2005 was statistically significant, LSD being 0.1 and 0.01 (Table 1). Plants of that synthetic population were 60.9 cm in height and had the highest evaluation concerning regrowth rate. Next in productive abilities was Syn1 4782 multifoliolate population, which formed 106.7 % dry matter yield, being 59.2 cm in height, and regrowth rate - 7.

Syn_1 Ax - 95 multifoliolate population had the highest leaf mass percentage (45.43%), respectively the best leaf/stem

Table 1

Dry matter yield, t ha^{-1}

Entries	Year					Relative yield, %	Regrowth height, cm	Regrowth rate
	2002	2003	2004	2005	2002-2005			
Prista 2 - St	0.83	9.54	18.69	12.02	41.08	100	56.8	6
Syn_1 KS - 207	1.19	9.41	19.05	13.2	42.85	104.3	56	6
Syn_1 NS	0.97	8.44	18.84	12.56	40.81	99.3	55.1	5
Syn_1 KS - 206	0.9	7.87	17.93	11.92	38.62	94	55.9	5
Syn_1 Ax - 93	0.93	8.29	18.36	12.23	39.81	96.9	54.6	5
Syn_1 4782	1.22	9.77	20.03	12.71	43.83	106.7	59.2	7
Syn_1 Dunavka 22	0.94	7.98	18.72	10.31	37.95	92.4	60	6
Syn_1 Dunavka 2	1.07	8.28	19.44	11.84	40.63	98.9	57.1	6
Syn_1 Lot 4910	1.34	9.07	19.8	13.43	43.63	106.2	55.5	7
Syn_1 Dunavka 3	0.65	8.55	18.69	10.19	38.08	92.7	55.7	6
Syn_1 NS Banat	0.77	9.04	18.75	11.19	39.75	96.8	61.6	6
Syn_1 Ax - 95	1.1	8.68	20.53	10.68	40.99	99.8	57.6	6
Syn_1 Ka Kai	0.95	7.69	16.87	9.14	34.65	84.3	55.7	5
Syn_1 97-24	0.68	7.63	16.9	9.47	34.68	84.4	51.5	5
Syn_1 Prista 2	0.76	8.7	19.76	11.85	41.07	100	59	6
Syn_1 N_{98} 2	1.05	10.11	20.92	13.27	45.35	110.4	60.9	8
LSD 5		0.61	1.48	0.89				
LSD 0.1		0.81	1.97	1.22				
LSD 0.01		0.105	2.57	1.58				

ratio (0.82) (Table 2). The crude protein content 207 g kg^{-1} was the highest among the investigated ones. The positive differences concerning the three of the qualitative components were statistically significant. The same was with lower productivity (96.9 %) than the standard.

Conclusions

We can make the conclusion that Syn1 N98 2 trifoliate synthetic population is the most productive, while the other investigated in the experiment multifoliolate populations Syn1 Ax - 95, Syn1 4782, Syn1 Lot

Table 2

Morphological traits and crude protein content

Entries	Leaves, %	Steams, %	Leaf stem^{-1}	Crude protein, g kg^{-1}
Prista 2 - St	42.11	57.89	0.73	196
Syn_1 KS - 207	39.13	60.87	0.64	195
Syn_1 NS	38.26	61.74	0.62	194
Syn_1 KS - 206	39.5	60.5	0.65	192
Syn_1 Ax - 93	45.43	54.57	0.82	207
Syn_1 4782	43.67	56.33	0.78	201
Syn_1 Dunavka 22	38.46	61.54	0.62	188
Syn_1 Dunavka 2	38.18	61.82	0.62	187
Syn_1 Lot 4910	43.48	56.52	0.8	198
Syn_1 Dunavka 3	43.33	56.67	0.76	190
Syn_1 NS Banat	44	56	0.78	188
Syn_1 Ax - 95	40	60	0.67	192
Syn_1 Ka Kai	42.86	59.14	0.72	200
Syn_1 97-24	44.12	55.88	0.79	191
Syn_1 Prista 2	38.39	61.61	0.62	189
Syn_1 N_{98} 2	43.48	56.52	0.77	184
LSD (0.05)	2.42	2.73	0.11	6

4910, and Syn1 Ax - 96 exceed it regarding protein content.

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