

NEW ROMANIAN CULTIVARS OF ALFALFA DEVELOPED AT NARDI FUNDULEA

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ABSTRACT

This paper presents 4 new cultivars of alfalfa (Sandra, Cosmina, Adin and Carina) which have been registered during the last 4 years (2003-2006) as result of selection for high fodder and seed yield, quality and adaptability to various environmental conditions. They are synthetic cultivars obtained by recombination of foreign and Romanian germplasm. These cultivars are characterized by rapid growth in the spring, faster regrowth after cutting, good resistance to common diseases spread in Romania and a very good level of winter hardiness. All these cultivars performed very well under irrigation and non-irrigation conditions. Three years data, across six locations, showed that the new cultivars are better than check variety Selena for fodder nutritive value, while Adin and Carina also had significantly higher seed yields.

Key words: alfalfa, synthetic cultivars, forage, seed, yield, fodder quality.

INTRODUCTION

The main objective in forage crops breeding is to improve the useful dry matter yield by improving fodder quality, while maintaining a high fodder yield potential and a good adaptability to biotic and abiotic stress (Rotili et al., 2002).

Alfalfa is the most important forage crop in Romania. During the last 5 years, from a total of 1.2 million ha cultivated with forage crops, the area covered by alfalfa was about 350,000 ha, 3.8% of arable land of Romania (Moga and Schitea, 2005). Currently in the breeding programs in forage crops, the highest selection pressure is on improving fodder yield and quality (Varga, 1994, 1995). The latter can be improved by increasing the leaf/stem ratio, which could be achieved by selecting genotypes with short internodes. On the other hand, to facilitate multiplication of the new cultivars, it is necessary to combine high fodder and high seed yields (Bolanos-Aguilar et al., 2002; Julier et al., 2000).

MATERIAL AND METHODS

The new synthetic cultivars Sandra, Cosmina, Adin and Carina, were developed by crossing Romanian cultivars with foreign germplasm, and were selected for fodder yield, seed yield, disease resistance and regrowth after cutting. The cultivar Sandra was registered in the Romanian Official Catalogue of Cultivars in 2003, Cosmina in 2004 and Adin and Carina in 2006. The trials were carried out during 2000-2005, in six locations of NARDI Fundulea network (NARDI Fundulea and ARDS Caracal, under irrigated conditions and in dry land and ARDS Teleorman, ARDS Lovrin, ARDS Simnic and ARDS Podu-Iloaiei, in dry land conditions).

The experimental design was randomized complete blocks in 4 replications, with 15 m² harvested plots. On each replication the traits evaluated were: dry matter yield (DMY, t ha⁻¹), regrowth at 14th day (RGW, cm), plant height at cut (PLH, cm), plant density (%) in the 3rd year of persistence, and leaf-stem ration (LSR %). The cultivars were harvested at early flowering growth stage (10% flowers).

Chemical analysis was performed only on the first cut, every year. A random sample of forage for quality analysis was taken from each plot, dried in a forced air oven at 60 °C for 48 hours and then ground in a Cyclotec mill to pass a 1-mm screen. Crude protein (CP %) was obtained multiplying the N content obtained by micro-Kjeldahl analysis by 6.25. Neutral detergent fiber (NDF, %) and acid detergent fiber (ADF, %) were determined by methods of Goering and Van Soest (1970), digestible organic matter (DOM, g/kg) and net energy (NE, kcal.) were determined by methods of Terry and Tilley (1964), meat fodder units (MFU) were determined by methods of Georgescu (1995).

RESULTS AND DISCUSSION

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During experimentation, the water deficit was high, affecting the yield level especially at locations without irrigation. The water deficit was registered during October-March, but especially during April-September (vegetation period). The driest year was the agricultural year 1999-2000, with rainfall values between 319 mm/year at ARDS Teleorman, and 340 mm/year at ARDS Caracal, and this influenced the fodder and seed yield level.

The maximum yield, achieved by cultivar Sandra was 21,600 kg ha⁻¹ dry matter under irrigation at NARDI Fundulea and the average over three years was 19,600 kg ha⁻¹ (5.9% higher than the check) The cultivar Sandra ranked first for yield under dry land conditions at ARDS Podu-Iloaiei, with third year yield of 17,800 kg ha⁻¹ dry matter and three years average of 13,200 kg ha⁻¹ dry matter.

Under less favorable conditions, without irrigation at ARDS Teleorman, the yields were modest. In the first year of vegetation, in the severe drought conditions, the average yield did not exceed 3,000 kg ha⁻¹ dry matter. In the second and third year of vegetation, the yields were relatively high, although the three years average was of only 7,600 kg ha⁻¹ dry matter in cultivar Sandra and 6,500 kg ha⁻¹ dry matter in the check Selena.

On average over three years, the cultivar Cosmina, achieved a yield of 18,500 kg ha⁻¹ dry matter at NARDI Fundulea and 16,600 kg ha⁻¹ averaged over all locations, with a distinctly significant gain of 7.1% (Table 1).

The cultivars Adin and Carina recently registered (2006), were superior to the check Selena, as well as to cultivars Sandra and Cosmina. Under NARDI Fundulea conditions, as well as across six locations, they outyielded the check by 10.3%.

Table 1. Fodder yield of the new alfalfa cultivars Sandra, Cosmina, Adin and Carina, average of 3 years in the period 2000-2005

Cultivars	NARDI Fundulea		Average network (6 experimental stations)	
	Dry matter*	Meat Fodder Units*	Dry matter*	Meat Fodder Units*
Sandra (2000-2002)	106.0	109.2	105.1	108.3
Cosmina (2002-2004)	106.3	108.5	107.1	109.3
Adin (2003-2005)	106.6	105.5	110.3	109.1
Carina (2003-2005)	109.9	113.7	110.3	113.7
Selena - the check (kg ha ⁻¹)	18,033	17,312	14,067	13,504
LDS 5%	5.2	5.2	4.5	4.5
LDS 1%	7.3	7.3	6.3	6.3
LDS 0.1%	10.3	10.3	8.9	8.9

* % of the check

The main purpose of alfalfa is to provide inexpensive food for ruminants. Since long time alfalfa breeders have been aware of the importance of forage quality for improving animal performance. The term forage quality is a broad term, referring to a number of factors that affect nutritive value of the forage. Among these factors, dry matter digestibility is considered to be the most important one (Posselt, 1994). During the last years, improving the forage nutritive value became the main objective in alfalfa breeding program in Romania.

Data presented in tables 1 and 2, show an average progress of 10% over the check variety in the cultivars Sandra, Adin and Carina, regard-

ing the quantity of meat fodder units ha⁻¹, both at Fundulea and on average over all locations.

Averaged over three years and six locations, the cultivar Sandra yielded 14,625 MFU ha⁻¹, (gain of 8.3 % vs. check), Cosmina 14,760 MFU ha⁻¹ and Adin and Carina 14,733 respectively 15,273 MFU/ha.

The digestibility coefficient, on the average of three years, was 74.6%, 74%, 73%, and 72% for Sandra, Carina, Adin, Cosmina and the check cultivar Selena respectively, with an increase of 1-2.6%. Superior values were also found in the new cultivars Adin, Carina and Sandra for other quality indicators, such as net energy value of 1515-1528

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kcal, vs. 1479 at cultivar Selena. Regarding the meat fodder units, this varied between 0.95 in the cultivar Cosmina and 0.99 in Sandra, as compared with the check, 0.96 (Table 2).

The differences registered in NDF, ADF and CP between the new cultivars and the check,

contributed to their high fodder value. Some morphological traits, such as leaves/ stem ratio and number of internodes also contribute to the fodder quality (Table 3).

Table 2. Feed quality of new alfalfa cultivar as compared to the official check

Cultivar	<i>In vitro</i> organic matter digestibility (%)	Net energetic value (Kcal)	Meat Fodder Units	Neutral detergent fiber (NDF, %)	Acid detergent fiber (ADF, %)	Crude protein (CP %)
Carina	74.0	1524	0.99	39.26	25.65	21.32
Adin	74.0	1515	0.98	39.58	27.24	20.05
Cosmina	73.0	1467	0.95	39.41	26.62	20.57
Sandra	74.6	1528	0.99	38.40	25.25	20.92
Selena	72.0	1479	0.96	40.07	25.90	20.58

Table 3. Some morphological characteristics of new cultivars in the first year of vegetation. Average over locations, 2004

Cultivar	Leaves stem ratio (%)	% of Selena	Number of internodes	% of Selena	Plant height (cm)	% of Selena	Leaf area index
Sandra	38	108.6	11.0	115.7	64.0	102.2	5.5
Cosmina	36	102.9	10.0	105.3	63.0	100.6	5.4
Adin	39	111.4	10.5	110.5	62.3	99.5	5.4
Carina	38	108.6	10.3	108.4	60.0	96.8	5.3
Selena	35	100.0	9.5	100.0	62.6	100.0	5.6

Leaves stem ratio was 36% in Cosmina, 38% in Sandra and Carina, the highest value being registered by Adin (39%), 14% more than the standard Selena. Similar differences were noticed regarding the number of internodes, but not for plant height and leaf area index.

The new cultivars proved to be superior to the check Selena also for vigor, regrowth after cutting, and disease resistance, especially for *Fusarium* wilt (Table 4).

Table 4. Some characteristics of new alfalfa cultivars as compared to the official check (Selena)

Cultivar	Vigor	Regrowth after cutting	Winter hardiness	Resistance to <i>Fusarium oxysporum, medicaginis</i>
Carina	1.7	1.7	1.8	2.4

Adin	1.8	1.8	1.9	2.2
Cosmina	2.0	1.9	2.0	2.0
Sandra	2.0	2.0	2.0	2.5
Selena	3.0	3.0	2.0	3.0

Notes: 1 (very high) to 9 (very low)

CONCLUSIONS

The cultivars Sandra, Cosmina, Adin and Carina achieved higher fodder yield and nutritive value compared to the check Selena. The cultivars Adin and Carina also gave high seed yields. All new cultivars have demonstrated good yield stability, due to their high level of resistance to diseases and winter hardiness.

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