

The behavior of new varieties of alfalfa under the conditions of 2024

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1 - NARDI Fundulea; 2 - AAFS BUCURESTI, 3 - SCDA SECUIENI, 4 - SCDA CARACAL and INCDBNA BALOTESTI

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• Alfalfa is the most important forage crop in Romania. The main objectives in alfalfa breeding are: improving quality, dry matter yield, as well as biotic and abiotic stress tolerance.

• Abiotic stress conditions cause extensive losses to agricultural production worldwide especial in perennial crops, like is alfalfa.

• Climatic changes will conducted at sever drought conditions and to aridity of some important regions in Romania, especially in the south part of the country, as happened in 2024. Under these conditions, 9 new varieties of alfalfa were studied in terms of production, quality and tolerance to low temperatures and drought.

• In order to shorten the breeding process, this year also started works that include the selection assisted by molecular markers.

• The experiments were in the first year of vegetation, they were installed in the spring of 2024 and will be studied and in the next 2 years.

MATERIALS AND METHODS

The new Romanian alfalfa cultivars are synthetic ones obtained by polycross method and derived from hybrids between Romanian germplasm and different foreign sources. They are constituted from different number of progenies, from 5 components (F 31005-1-23) to 22 components (F 31005-1-23). One of the most important aims of Romanian breeding programme in alfalfa was to utilized different sources of germoplasm in order to avoid genetic vulnerability, but in the same time we had in the attention that new cultivars must to have a good phenotypic uniformity in concordance with UPOV requirements. The trials were carried out in 2024, in 3 locations: NARDI Fundulea and ARDS Secuieni in dry land and ARDS Caracal under irrigated conditions.

The experimental design was a randomized complete blocks with 4 replications, with 15 m²/plots in Fundulea and with 10 m²/plots in Secuieni and Caracal.

RESULTS

The rainfalls and temperatures recorded at NARDI Fundulea, ARDS Secuieni and ARDS Caracal in agricultural year 2023-2024

Location	Year	Rainfall (mm)				Temperature (0C)			
		Oct- feb.	March-sept.	Total year	Difference	Oct- feb.	March-sept.	Total year	Difference
NARDI Fundulea	2023-2024	158	276.2	434.2	-150.1	7.5	20.0	14.8	+3.9
	Multiyear average	195.3	390	584.3		2.78	16.6	10.9	
ARDS Secuieni	2023-2024	91.8	360	451.8	-80.1	4.88	17.7	12.4	+3.4
	Multiyear average	128.8	403.1	531.9		1.14	14.6	9.0	
ARDS Caracal	2023-2024	153.4	283.9	437.3	-100.1	7.4	19.6	14.3	+3.7
	Multiyear average	205.4	332	537.4		2.42	16.5	10.8	



April 2024



August 2024

Fodder yield achieved by new alfalfa cultivars developed in NARDI Fundulea, in 2024

Genotype	NARDI Fundulea	ARDS Secuieni	ARDS Caracal	Average	
	(t ha ⁻¹)	(t ha ⁻¹)	(t ha ⁻¹)	(t ha ⁻¹)	% from control
F 31012-1-2023	7.5	12.5	18.6	12.9	107.8
F 31005-1-2023	7	13.8	17.5	12.8	107.0
F 31009-1-2023	7.6	13.6	16.9	12.7	106.4
F 31013-1-2023	7.4	12.4	17.5	12.4	104.2
F 31016-1-2023	7.3	13.3	16.5	12.4	103.6
F 31010-1-2023	7.3	12.4	17	12.2	102.5
MIHAELA (Mt.)	6.9	12	16.9	11.9	100.0
F 31008-1-2023	7.3	12.7	14.7	11.6	96.9
F 31022-1-2023	7.3	10.4	16.8	11.5	96.4
F 31006-1-2023	7	11.8	14.5	11.1	93.0
Average	7.3	12.5	16.7	12.2	101.9
% from CARACAL (irrigated land)	43.5	74.9	100	72.8	

Dry matter and crude protein yield achieved by new alfalfa cultivars in the field test, in 2024

Genotype	NARDI Fundulea	ARDS Secuieni	ARDS Caracal	Average		C.P. from D.M.		Crude protein	
	(t ha ⁻¹)	(t ha ⁻¹)	(t ha ⁻¹)	(t ha ⁻¹)	% from ct.	%	(kg ha ⁻¹)	% from ct.	
F 31016-1-23	2.81	3.97	3.4	3.4	106.0	20.56	697	108	
F 31009-1-23	2.86	4.06	3.4	3.4	107.7	20.17	695	108	
F 31005-1-23	2.62	4.14	3.5	3.4	107.3	20.17	692	107	
F 31012-1-23	2.87	3.78	3.7	3.5	107.9	19.88	686	106	
F 31008-1-23	2.66	3.81	3.1	3.2	99.3	20.73	658	102	
F 31010-1-23	2.8	3.68	3.4	3.3	102.5	19.73	646	100	
MIHAELA (Control)	2.57	3.62	3.4	3.2	100.0	20.16	644	100	
F 31013-1-23	2.8	3.72	3.4	3.3	103.2	19.34	638	99	
F 31022-1-23	2.76	3.06	3.4	3.1	95.9	20.11	617	96	
F 31006-1-23	2.64	3.54	2.9	3.0	94.5	20.16	609	94	
Average	2.7	3.7	3.4	3.3	102.4	20.1	658	102	

Fodder quality of new synthetic alfalfa cultivars in 2024, developed in NARDI Fundulea

Variety	Crude protein, (% from D.M.)	Crude cellulose (% from D.M.)	Neutral detergent fiber (NDF) %	Acid detergent fiber (ADF) %	Relativ feed value (RFV)
F 31008-1-23	20.73	18.87	31.08	17.57	225.11
F 31016-1-23	20.56	20.09	29.16	19.09	236.16
F 31009-1-23	20.17	18.34	31.65	19.52	216.6
F 31005-1-23	20.17	18.56	29.27	17.69	238.74
MIHAELA (Control)	20.16	19.17	30.41	19.12	226.38
F 31022-1-23	20.11	20.37	31.19	20.16	218.3
F 31006-1-23	19.88	18.65	29.59	18.89	233.22
F 31012-1-23	19.88	19.2	29.33	18.21	236.96
F 31010-1-23	19.73	18.99	31.14	19.65	219.84
F 31013-1-23	19.34	19.79	31.24	20.33	217.56
Average	20.1	19.2	30.4	19.0	226.9

Marker assisted selection was employed to detect favorable DNA marker alleles affiliated with two crown-root (CR) biomass during drought stress QTL (*QTL-qcr6A.33* and *QTL-qcr8A.18* by Singh et al., (2022)) into 19 inbred lines (S₁) backgrounds, using SSR markers.

SSR marker AFca11, associated with *QTL-qcr6A* (Singh et al., 2022), has shown the presence of the favorable allele (149bp) in two inbred lines genetic backgrounds (Luc 23 and Luc 30) and SSR marker MITIC103, associated with *QTL-qcr8A*, has shown the favorable allele (176bp) in 8 genotypes (Luc 23, Luc 24, Luc 25, Luc 26, Luc 27, Luc 29, Luc 31 and Luc 32).

The results highlighted the Luc 23 genotype, that carry the both favorable DNA alleles, suggesting that this genotype could be more adapted under water-limited conditions.

Another system marker used in this study was Start Codon Targeted Polymorphism (SCoT). The results obtained showed polymorphism that mean genetic diversity. These results, obtained with SCoT markers, could be a source of the new favorable alleles involved in drought tolerance.



Before testing

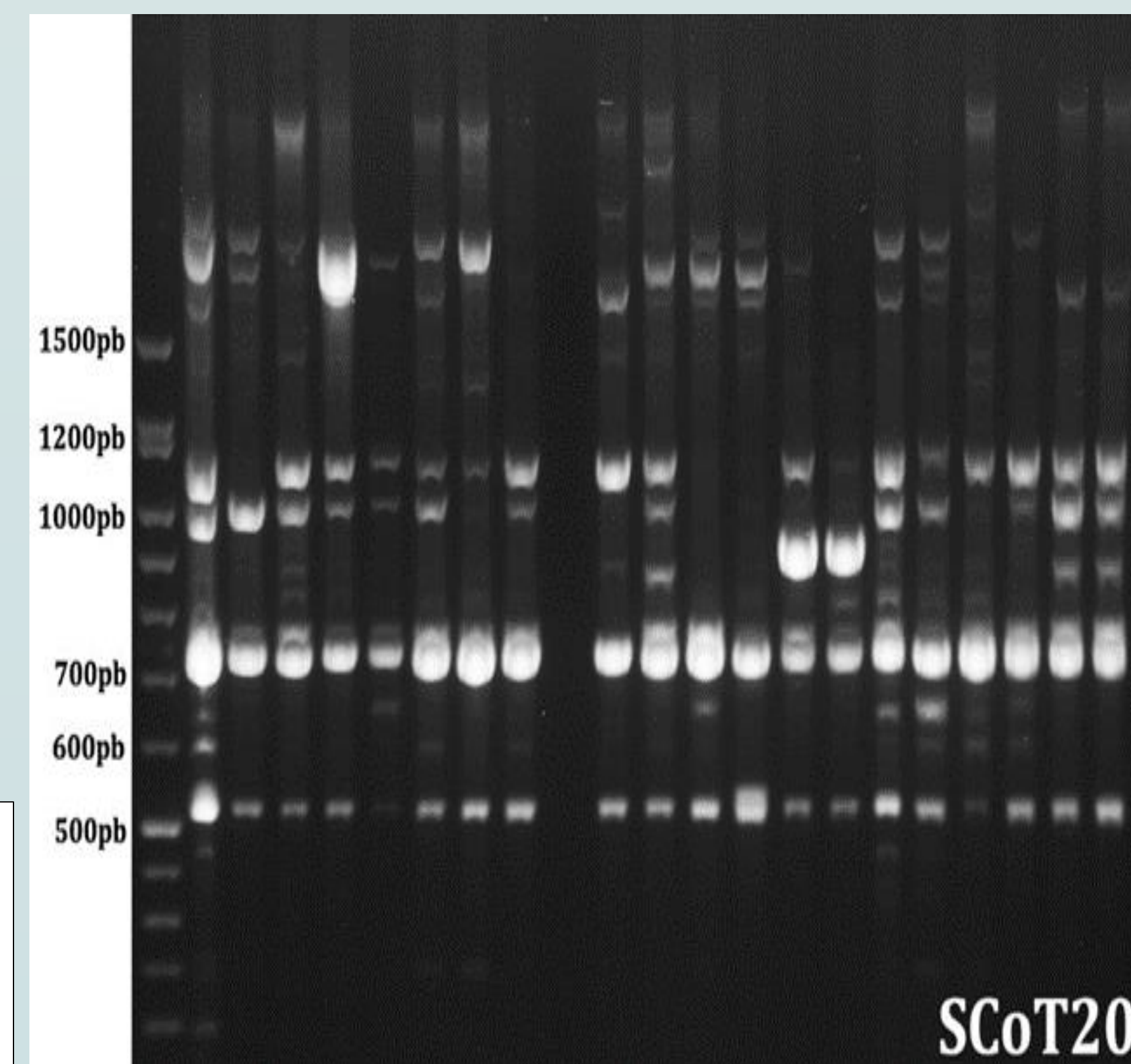
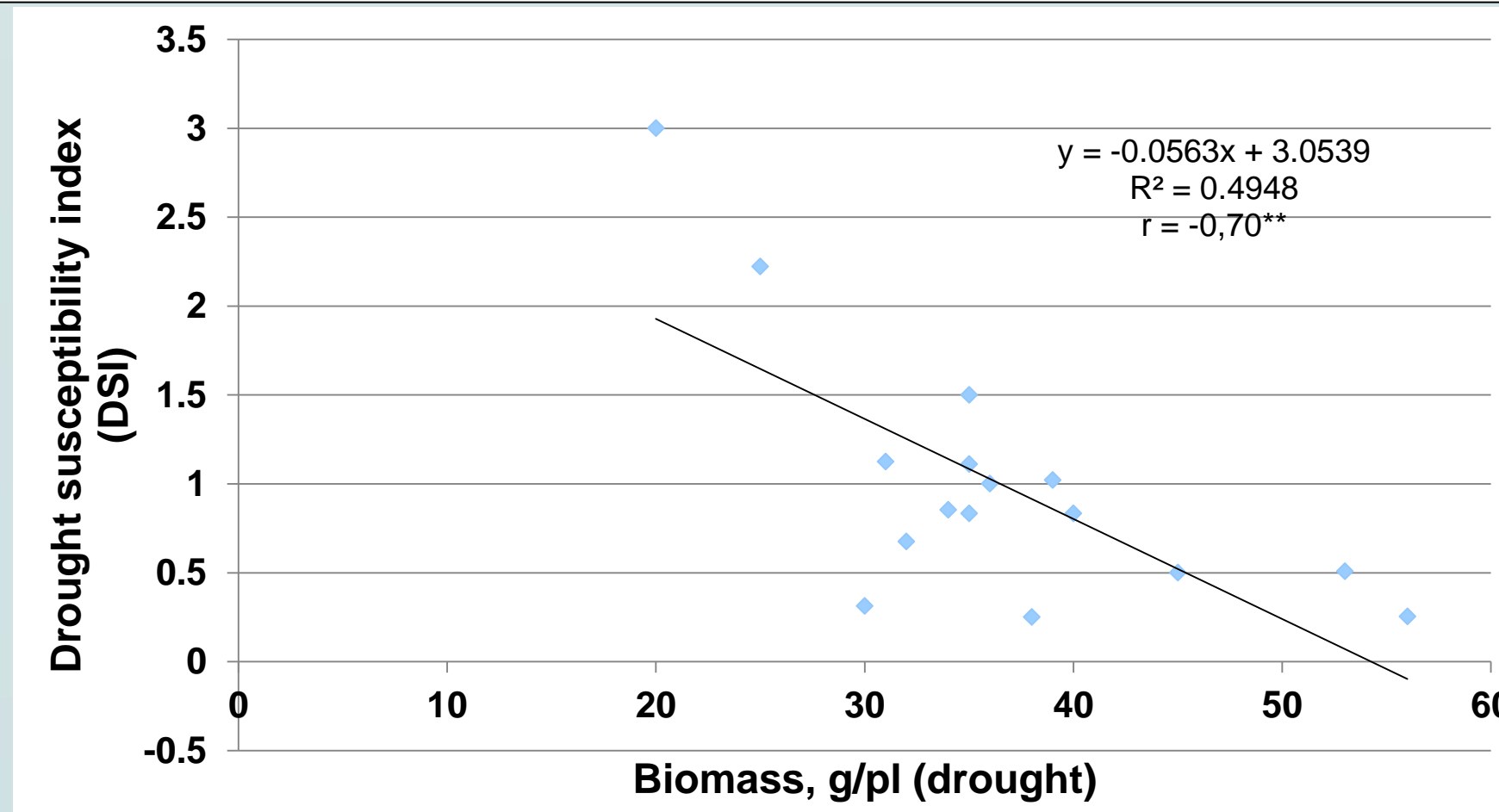


After testing -18°C

Resistance of alfalfa genotypes to low negative temperatures (TEST TEMPERATURE: -18°C)

Genotype	Nota	Resistance class
La Bella		
Campagnola	7	Sensitive
Mihaela	6	Mediu resistant
F 31005-23	4	Resistant
F 31006-23	4	Resistant
F 31008-23	3	Very resistant
F 31009-23	3	Very resistant
F 31010-23	4	Very resistant
F 31012-23	5,5	Very resistant
F 31013-23	6	Mediu resistant
F 31016-23	3	Very resistant
F 31022-23	3	Very resistant

The relationship between the drought sensitivity index and biomass accumulation



Electrophoresis pattern of SCoT20

Left to right: DNA Ladder -M 50bp (GeneDirex); (1) Luc 16, (2) Luc 17, (3) Luc 18, (4) Luc 19, (5) Luc 20, (6) Luc 21, (7) Luc 22, (8) Luc 23, (9) Luc 24, (10) Luc 25, (11) Luc 26, (12) Luc 27, (13) Luc 28, (14) Luc 29, (15) Luc 30, (16) Luc 31, (17) Luc 32, (18) Luc 33, (19) Luc 34, (20) Luc 25-1 și (21) Luc 25-2

CONCLUSIONS

- The new Romanian alfalfa cultivars represent a genetic progress achieved in the alfalfa breeding program of NARDI Fundulea; all new cultivars demonstrated a resistance to low temperature (-18°C);
- In conditions of very high water deficit, accompanied by high temperatures, only one harvest was obtained for alfalfa in the first year of vegetation;
- Compared to SCDA Caracal where 3 irrigations were applied and where obtained 16.7 t/ha of green matter, the yield in Fundulea represented only 43.5%, and in Secuieni 74.5% from production in Caracal.
- On average in the three test centers, the best behavior was the varieties: F 31016-1-24, F31009-1-24 and F 31005-1-24 with a production of 3.4 t ha⁻¹ dry matter and around 700 kg ha⁻¹ crude protein (7-8% more than Mihaela, the control variety);
- New genotypes are characterized by a very good quality (more than 20% C.P., and 210 - 236 Relative feed value);
- The research aimed at the assisted selection of molecular markers for resistance/tolerance to diseases and drought, highlighted a great variability and creates the premises for their use in the alfalfa breeding program in Fundulea.

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