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RESEARCH ON THE SEED PRODUCTION OF SOME VARIETIES AND LINES OF ALFALFA (*MEDICAGO SATIVA*) IN THE PEDO–CLIMATIC CONDITIONS OF CENTRAL MOLDOVA

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Abstract: Among the perennial legumes, alfalfa is also important as a soil–improving plant, because it enriches it in nitrogen thanks to the symbiosis with the bacterium Rhizobium meliloti, saving significant amounts for nitrogen fertilizers during the entire vegetation period. The objective of this study is to evaluate the behavior of 17 varieties and lines of alfalfa of Romanian origin (N.A.R.D.I. Fundulea), under the conditions of A.R.D.S. Secuieni, in the period 2020–2022. The experimental results obtained showed a significant difference in the productions of the studied genotypes. Thus, several synthetic varieties were noted, and the average productions varied between 401 kg/ha (F 2809 –19) and 624 kg/ha (F 2907 – 20), obtaining significant and very significant production increases at the Catinca variety and the lines F 2905 – 20, F 2906 – 20, F 2910 – 20.
Keywords: Medicago sativa L., cultivar, production, seed

1. INTRODUCTION

The main fodder plant in Romania used in animal husbandry is alfalfa (*Medicago sativa* L.). Used as a fodder plant, it is necessary to produce relatively large quantities of seed, to replace old crops and expand cultivated areas. Cultivating alfalfa has many advantages, namely: it is a perennial legume and plays a very important role in crop rotation as a soil improver leaving significant amounts of nitrogen in the soil, it is exploited for 3–5 years, it achieves high productions of fodder with a high crude protein content (*Zhang et al., 2019*).

Ensuring the feed requirement for animal husbandry is achieved by increasing the fodder base area, by increasing the proportion of perennial legumes in pure culture, or in a mixture with perennial grasses, as well as by cultivating varieties with high production and quality performance (*Moga and Schitea, 2005; Schitea 2010*). Alfalfa seed production is a complicated process due to the interaction of plants with agro–climatic and soil conditions (*Dincă et al., 2018*). The selection of genotypes with a high degree of water utilization is an important objective, in the current conditions with reduced areas for irrigation and in climatic conditions with uneven distribution of precipitation, in conditions of increasing temperature (*Noland et al., 2018; Petcu et al., 2019*). The different varieties of alfalfa also depend to a large extent on the values of the productive components such as the height of the plant, the number of racemes per shoot, the number of seeds per raceme and which are found in a series of studies (*Kertikova and Yancheva, 2000; Yancheva et al., 2001; Petkova et al., 2007; Popovic et al., 2007; Dunea et al., 2019*). All these arguments have the effect of expanding the areas cultivated with perennial legumes, including alfalfa, contributing to the reduction of nitrogen inputs to the succeeding plants, in order to reduce pollution and, respectively, help to obtain healthier agricultural products (*Schneider and Huyghe, 2015; Schitea, 2023*).

Improving alfalfa seed production is possible through the creation of high–yielding varieties and improved cultural practices. Genetics and breeding have shown that progress in obtaining a larger amount of seed in alfalfa is the limit, but by using pollinators, applying mineral fertilizers and growth regulators, as well as by respecting the distance between rows and the amount of seed used, they can have a significant impact on yield components, and it seems that it could be a better way to obtain higher and more stable seed yields (*Bolanos–Aguilar et al., 2002; Gossen et al., 2004; Zhang et al., 2008; Andjelković et al., 2010; Stanisavljević et al., 2012*).

The paper presents the results obtained recently at A.R.D.S. Secuieni, regarding the production of alfalfa seed, under non–irrigated conditions, in the period 2020–2022.

2. MATERIALS AND METHODS

The research was carried out in the experimental field of the laboratory of Forage Plant Culture, within the Agricultural Research and Development Station, Secuieni–Neamț. The culture was placed on a

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cambic phaeosium type soil, with a medium texture, characterized as being well supplied with phosphorus (74.8 ppm, PAL), calcium and magnesium (1.6 meq/100 g soil), medium supplied with nitrogen (20.7 ppm N – NO_3) and poorly supplied with potassium (142.6 ppm K_2O). The active humus supply is medium (2.44%), and the soil reaction is slightly acidic (pH – 5.55).

Seventeen alfalfa varieties and lines of local origin, created at National Agricultural Research and Development Institute Fundulea, were studied. The arrangement of the experiments was according to the method of randomized blocks, in four repetitions, with the harvestable surface of the plot of 10 m^2. The seed rate was 500 germinating seeds/m^2, and sowing was done at a distance of 25 cm between rows.

The climatic conditions recorded during the analyzed period (agricultural years 2019–2022) had great variability from one year to another. In terms of temperatures, the agricultural years studied were characterized as atypical, warm years, registering deviations between 1.0°C and 1.5°C, compared to the multi–year average, which is 8.9°C (figure 1).

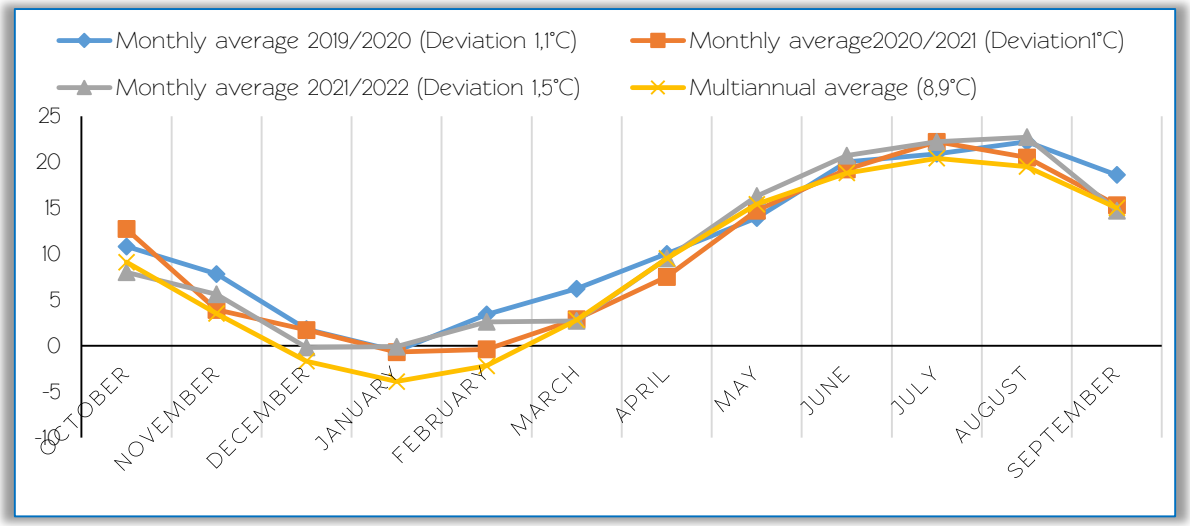

Figure 1 – Variation of average monthly temperatures, in the agricultural years 2019 – 2022

In terms of precipitation, the analyzed period was characterized as dry, compared to the multi–annual amount of 544.3 mm, the deviations recorded were 168.3 mm in the 2019/2020 agricultural year, 144.5 mm in the 2020/2020 agricultural year 2021 and of 283.5 mm in the 2021/2022 agricultural year (figure 2).

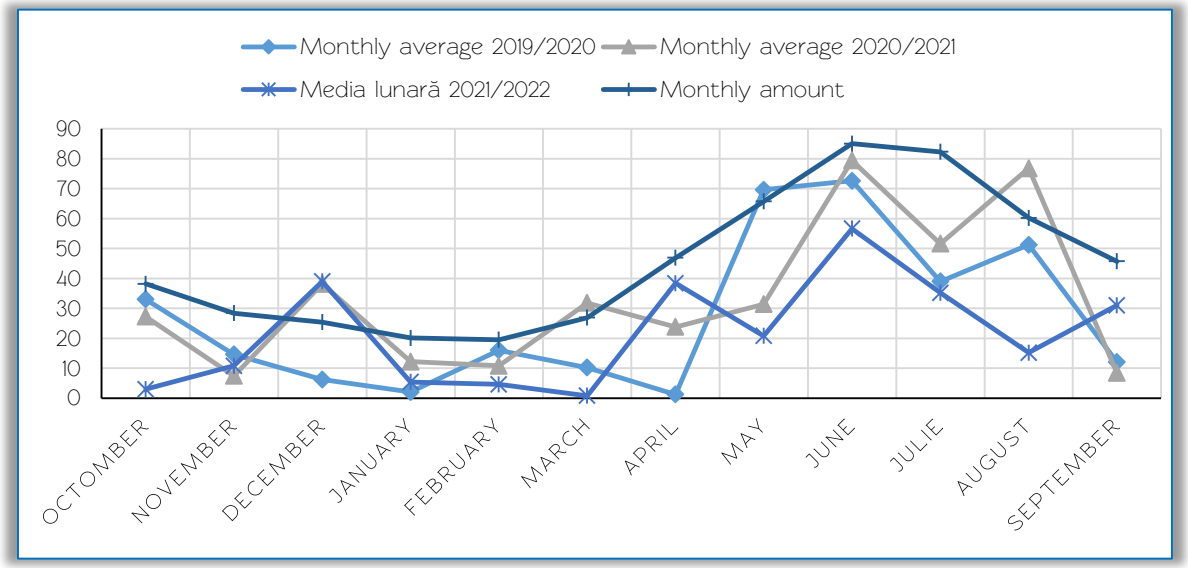

Figure 2 – Variation of average monthly precipitation, in the agricultural years 2019 – 2022

In the experiments, all technological links were respected, and the data obtained were processed and statistically interpreted according to the variance analysis method (ANOVA, 2013).

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3. RESULTS

In order to characterize the varieties studied, a series of morphophysiological determinations were made during the vegetation period, such as plant height, number of racemes/shoot, number of seeds/raceme, disease resistance and regeneration after mowing.

On average over the three years studied, the plant height was between 48.4 cm at line F 2811–19 and 62.6 cm at line F 2812–19, the average number of racemes/shoots varied between 4.21 at line F 2905–20 and 6.88 at line F 2906–20, and the number of seeds in the raceme was between 9.94 at line F 2909 – 1 – 20 and 25.66 at line F 2906 – 20 (table 1).

During the growing season, the diseases alfalfa rust (*Uromyces striatus*) and brown leaf spot (*Pseudopeziza medicaginis*) were identified. They were graded on a scale of 1–9, with values ranging from 1.5 to 3. After the seed production scythe, plant regeneration was graded, and grades ranged from 1.78 for Ileana to 3.82 for line F 2910 – 20 (table 1).

Table 1. Phenological and biometric data in the alfalfa species (*Medicago sativa* L.), in the period 2020–2022

No.	Variety	Average plant height (cm)	Mean number of racemes/ sprout	Average number of seeds /racem	Resistance to diseases *	Regeneration after mowing*
V1	Catinca	50.2	5.82	14.86	1.5	2.85
V2	Liliana	51.0	4.46	12.26	1.5	2.21
V3	Pompilia	55.8	4.22	15.41	2.0	2.60
V4	Ileana	57.0	5.62	25.56	2.0	1.78
V5	F 2809 –19	60.0	5.42	24.49	1.5	3.21
V6	F 2810 – 19	52.8	5.21	15.65	2.5	3.29
V7	F 2811 – 19	48.4	5.00	16.78	1.5	2.87
V8	F 2812 – 19	62.6	4.86	13.55	1.0	2.54
V9	F 2814 – 19	56.0	4.32	20.00	2.5	3.25
V10	F 2905 – 20	53.8	4.21	12.10	2.5	3.47
V11	F 2906 – 20	61.4	6.88	25.66	1.5	2.19
V12	F 2907 – 20	53.2	5.64	12.14	1.5	3.70
V13	F 2908 – 20	49.4	4.96	14.13	1.0	3.25
V14	F 2909 – 1 – 20	55.2	4.38	9.94	2.5	3.25
V15	F 2909 – 2 – 20	55.2	5.18	13.30	2.5	2.76
V16	F 2910 – 20	53.8	5.02	14.73	3.0	3.82
V17	F 2020 – 20	53.2	4.66	10.04	3.0	380

*) Notes 1–9; 1 = very good, 9 = very poor.

Regarding the correlation between the number of racemes per plant and the number of seeds in the raceme, in the three years of experimentation, it was observed that it was direct, and the correlation coefficient (r) was statistically ensured and interpreted as highly significant (figure 3).

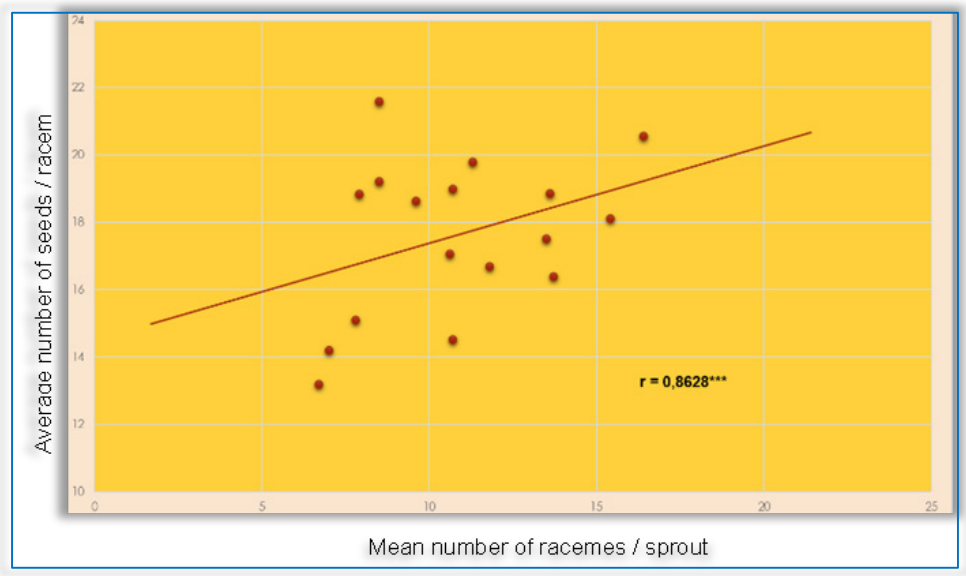

Figure 3 – Correlation between the number of racemes per plant and the number of seeds in the raceme, average 2020 – 2022

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The experimental results obtained, during the analyzed period, indicate a significant difference in the production of the alfalfa varieties and lines studied. On average, during the three years of experimentation, the production obtained in the varieties and lines studied varied within very large limits, between 401 kg/ha (F 2809 –19) and 624 kg/ha (F 2907 – 20), being directly influenced by the high temperatures during the vegetation period (table 2).

Compared to the production recorded by the control variant (the average of the experience), from the 17 varieties and lines studied, very significant increases in production were recorded in the lines F 2910 – 20 and F 2907 – 20, and distinctly significant at the Catinca variety and lines F 2905 – 20 and F 2906 – 20 respectively. The lines F 2809 –19, F 2810 – 19, F 2811 – 19, F 2812 – 19, F 2909 – 1 – 20 and F 2020 – 20 that achieved highly significant, distinctly negative and significantly negative production differences (table 2).

Table 2. Average seed yields of new varieties and lines of alfalfa (*Medicago sativa* L.), in the period 2020–2022

No.	Variety	Production (kg/ha)				(%)	Difference	Significance
		2020 (year I)	2021 (year II)	2022 (year III)	Average			
1	Catinca	820	615	317	584	111	60	**
2	Liliana	610	430	358	466	89	–58	o
3	Pompilia	730	501	408	546	104	22	
4	Ileana	780	518	353	550	105	26	
5	F 2809 –19	520	312	370	401	76	–124	ooo
6	F 2810 – 19	680	439	267	462	88	–62	oo
7	F 2811 – 19	670	395	329	465	89	–60	o
8	F 2812 – 19	650	487	308	482	92	–43	o
9	F 2814 – 19	830	532	304	555	106	31	
10	F 2905 – 20	840	646	282	589	112	65	**
11	F 2906 – 20	810	639	311	587	112	62	**
12	F 2907 – 20	820	686	366	624	119	100	***
13	F 2908 – 20	780	531	347	553	105	29	
14	F 2909 – 1 – 20	630	418	358	469	89	–55	o
15	F 2909 – 2 – 20	720	509	274	501	96	–23	
16	F 2910 – 20	800	677	327	601	115	77	***
17	F 2020 – 20	600	429	406	478	91	–46	o
Average					524	100	Ct.	
LSD 5% (kg/ha)							35	
LSD 1% (kg/ha)							63	
LSD 0,1% (kg/ha)							71	

The values of the mass of one thousand grains varied within very wide limits depending on the genotype, from 1.61 g for the Catinca variety and 1.96 g for the F 2907–20 line. With the mass of one thousand grains values above 1.90, the lines F 2809 –19, F 2907 – 20 and F 2909 – 2 – 20 stand out (figure 4).

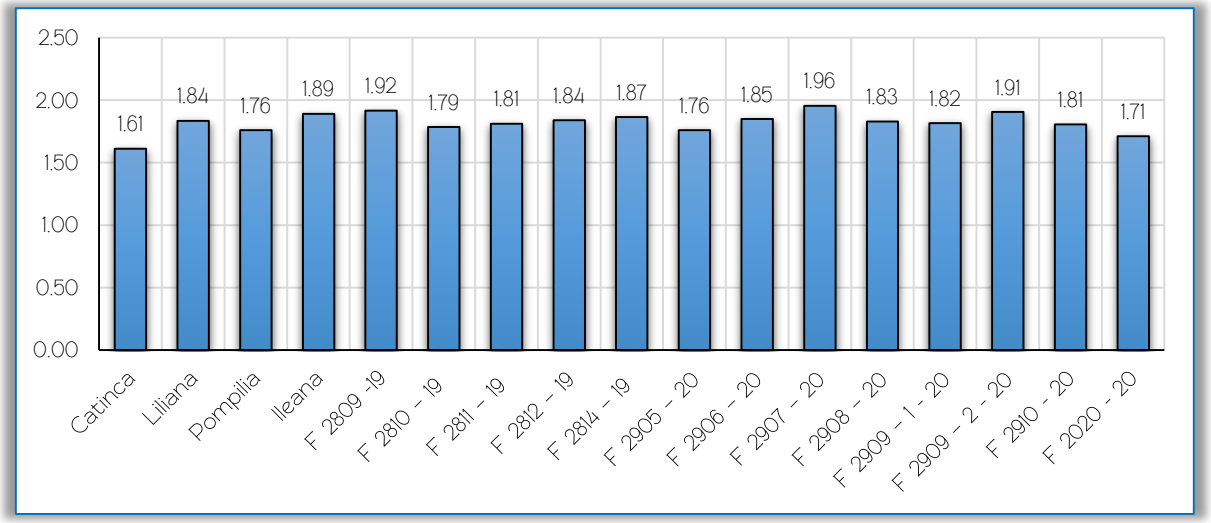

Figure 4 – Mass of one thousand grains of the alfalfa genotypes studied, average 2020–2022

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4. CONCLUSIONS

During the three years of experimentation, the productions obtained from the 17 varieties and lines of lucerne, tested at ARDS Secuieni, varied within very wide limits, from 401 kg/ha (F 2809 –19) to 624 kg/ha (F 2907 – 20). In order to identify the most adapted varieties and lines, genetic variability was noted for: plant height at F 2812–19 (62.6 cm), the number of racemes per plant at F2906–20 (6.88) and the number of seeds in the raceme at F2906–20 (25.66).

Compared to the control (the average of the experience), very significant increases in production were recorded for the Catinca variety and the lines F 2905 – 20, F 2906 – 20 and F 2907 – 20.

With the lowest adaptability to the conditions at ARDS Secuieni, from the seventeen varieties and lines tested, a number of seven genotypes were identified that achieved lower productions, namely F 2809 – 19, F 2810 – 19, F 2811 – 19, F 2812 – 19, F 2909 – 1 – 20 and F 2020 – 20.

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