Series: ✓*Biology*
✓*Horticulture*
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✓*Environmental engineering*

ANNALS OF THE UNIVERSITY OF CRAIOVA

Vol. XXVIII (LXIV) - 2024

TWO NEW RED CLOVER VARIETIES SOMEȘAN AND LIVEZEANU CREATED AT A.R.D.S. LIVADA

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Keywords*: red clover; synthetic variety; polycross*

ABSTRACT

The north western part of the country through A.R.D.S. Livada is a reference point in the improvement of the red clover.As a result of research conducted on this species, by using a diverse germ plasm from different crop areas of red clover, in A.R.D.S. Livada during 1989-2024 were created and recorded 12 synthetic varieties of red clover, two tetraploids and 11 diploids, from which three varieties were patented. The genetic progress made in the improvement of red clover, presented in this paper demonstrates that the new varieties bring an increase in production of 10% to dry mater, 7% to crude protein and 10% to seed compared to the control.

INTRODUCTION

The A.R.D.S. Livada's red clover breeding program has made continuous progress in production potential, forage quality, and adaptation to stress conditions caused by climate change, by creating 12 varieties two tetraploids and ten diploids between 1990 and 2024.

The advantages of growing red clover are well known:

Red clover has high nutritive value, high digestibility coefficients, is rich in vitamins and carotene, and is also an important honey plant.

It is a source of soil enrichment with nitrogen, improving the physico-chemical properties of the soil and contributing to the development of agricultural systems with favorable economic, social, and ecological effects.

It ensures good agricultural soil balance and serves as an excellent precursor for agricultural crops.

It has a positive environmental impact by reducing the need for chemical nitrogen fertilizers.

It can be successfully grown both as a pure crop and in mixtures with forage grasses.

The development and introduction of high-performance red clover varieties is an important step in increasing the quantity, quality, and stability of fodder and seed production.

The aim of this paper is to present new red clover varieties developed at A.R.D.S. Livada, registered in recent years, with improved productivity, quality, and adaptability to the climatic conditions in Romania.

The new red clover varieties 'SOMEȘAN' and 'LIVEZEANU', approved and patented in 2024, are the result of several years of breeding work carried out at S.C.D.A. Livada. This work aimed to accumulate favorable genes responsible for improving production and ensuring its stability under different pedoclimatic conditions. Initially designated as Syn1-09 and Syn3-018, these lines were tested in control fields and in comparative orientation and competition crops at A.R.D.S. Livada, where they exhibited superior agronomic traits. Based on the positive results obtained during testing, they were promoted for verification in the ISTIS network in 2021, and in 2024, they were validated as varieties.

MATERIAL AND METHODS

The synthetic varieties "SOMEȘAN" and "LIVEZEANU," presented in this paper, were obtained using the polycross method, specifically the Half-sib (half-seed) variant. Selection was based on the assessment of general combinatorial capacity, followed by progeny verification and the selection of the most valuable individuals incorporated into their constitution (Varga et al. 1998; Savatti et al. 2004; Schitea et al. 2010; Moisa et al. 2018, 2021).

In the composition of these synthetics, the autochthonous germplasm represents 67%, while the foreign germplasm accounts for 33%. The plants exhibit excellent uniformity in the field. The stems are thin, fistulose, and show good resistance to falling. Under normal environmental conditions, plant height reaches 85–95 cm, with 20–25 shoots per plant and 5–7 internodes per shoot. The inflorescence is elongated, oval-ovate, and pinkish-red in color, containing 90–110 flowers per flower head, with 18–24% double flower heads. The varieties show good resistance to overwintering, drought, and disease (see Table 1).

Table 1.

Some morphophysiological traits of the syntypes Someșan and Livezeanu compared to the control variety David Liv

Variety	Regeneration capacity after reaping (grades 1-9)	Frost resistance (note 1-9)	Drought resistance (note 1-9)	Disease resistance (note 1-9)	Perenniality % plants in third year of vegetation
Someșan 2n	1,5	1,2	2,1	1,5	89,2
Livezeanu 2n	1,4	1,1	2,0	1,4	86,8
David (mt)-2n	1,6	1,7	2,2	1,5	77,3

The red clover improvement field was located under non-irrigated conditions, on typical argiloiluvial-preluvisol soil (brown luvic soil), which had a tendency toward acidification and low humus content.

The last four years (2021–2024) were characterized by significant fluctuations in precipitation and temperature. A common feature during these years of experimentation was that, from sowing in autumn until the onset of the cold season, there was optimal soil moisture for emergence. However, climatic conditions varied greatly during the formation periods of the three green mass harvests, particularly during seed formation.

In 2022, the drought that set in during May and June (+0.5°C and +3.1°C above normal), was amplified by extremely high temperatures, which did not drop below 30°C in the shade. This, combined with a significant precipitation deficit of -138.1 mm compared to the area's normal levels, impacted green mass production, particularly in the second and third harvests, and even more so in seed production (Fig. 1). In contrast, precipitation in May and June 2024, totaling 177.4 mm, helped preserve green mass and seed production, despite July and August 2024 recording the highest temperatures in recent years. Over the period from September 2021 to August 2024, total precipitation amounted to 752.1 mm. In previous years, precipitation levels were: 1010.7 mm in 2020–2021, 570.9 mm in 2021–2022, 849.5 mm in 2022–2023, and 780.5 mm in 2023–2024, with a deficit of -181.2 mm in 2022 compared to the multi-year average (Fig. 1).

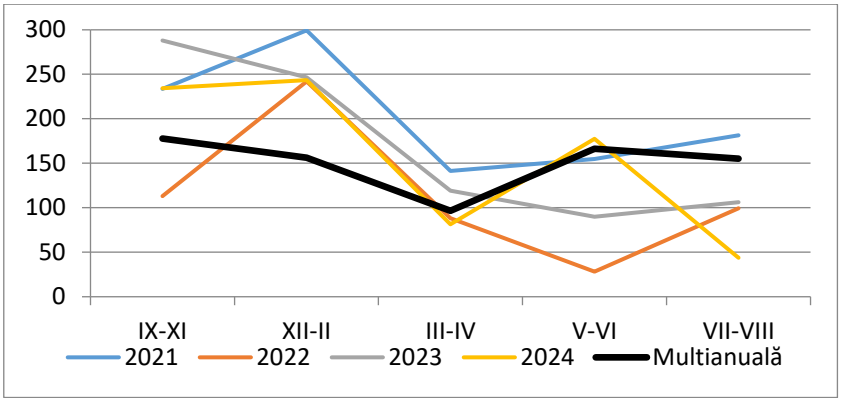

Figure1. Distribution of precipitation (mm) by vegetation phases for red clover.

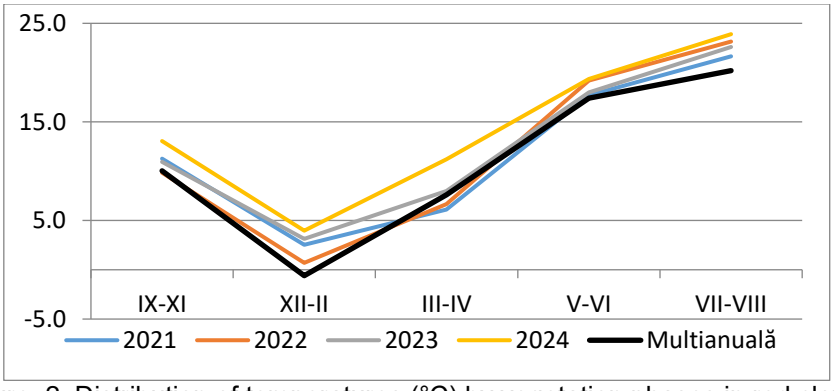

Figure. 2. Distribution of temperatures (°C) by vegetation phases in red clover.

The years 2021 and 2024 were favorable for red clover cultivation. Precipitation in May and June, measuring 154.8 mm and 177.4 mm respectively, promoted the formation of harvests for both green mass and seed.

The 2023–2024 crop year ended with an average temperature of 13.3°C, which was 3.4°C higher than the multi-year average.

The significant fluctuations in climatic conditions, ranging from extremely rainy to extremely dry years, highlight the need to study how the varieties respond to these factors.

The experimental data were processed using appropriate statistical methods (CEAPOIU, 1968).

The tests conducted at A.R.D.S. Livada between 2021 and 2024 highlighted consistently strong performance in terms of production for these newly approved varieties throughout the entire experimentation cycle (Table 2).

The production results from 2021 to 2024 were significantly influenced by the varying weather conditions during each growing season, which differed greatly from year to year.

From the experimental research conducted between 2021 and 2024, it was found that the best results in terms of green mass were achieved in 2021 and 2024, both of which were favorable years for red clover cultivation. In contrast, production was lower in 2022 due to the severe drought experienced in May and June, which is critical for plant growth, development, flowering, and grain formation (Tab. 2).

Table 2.

Production of green mass t/ha, achieved by red clover varieties in the period 2021-2024, at A.R.D.S. Livada

	Variety	2021	2022	2023	2024	Media	±	%
1	Someșan	63,0	49,4	58,8	63,1	58,6	4,7	109
2	Syn 2-017	61,2	46,7	55,1	59,9	55,7	1,8	103
3	Syn 4-017	61,8	47,5	57,7	61,5	57,1	3,2	106
4	Livezeanu	62,9	49,2	58,4	61,6	58,0	4,1	108
5	Tinu Liv	58,2	45,4	51,0	59,8	53,6	-0,3	99
6	Livada 10	61,5	47,5	57,5	60,4	56,7	2,8	105
7	David Liv	58,1	45,7	51,6	60,0	53,9	0,0	100
8	Media	61,0	47,3	55,7	60,9	56,2	2,3	104
	DL5%	1,9	1,1	2,4	2,3		1,9	

In the comparative crops analyzed over the four years, the new varieties Someșan and Livezeanu demonstrated the best performance in green mass production, achieving average yields of 58.6 and 58.0 t/ha, respectively, surpassing the control variety by 8–9% (Tab. 2).

In the analyzed period, the high variability of environmental conditions was reflected in the variation of dry matter production from one year to another, with an average of 10.4 t/ha in 2022 and 13.2 t/ha in 2024.

Compared to the witness David Liv, the average increase of the two synthetic varieties, Someșan and Livezeanu can be distinguished with statistically assured values of 10%, achieving on average 12.7t/ha and 12.8t/ha respectively (Table 4). The other synthetics, Syn 4-017, Livada 10, and Syn 2-017, also achieved higher production than the control variety David Liv, with increases of 4–7% in dry matter (Tab. 3).

Table 3.

Dry matter production t/ha, achieved by red clover varieties in the period 2021-2024, at A.R.D.S. Livada

	Variety	2021	2022	2023	2024	Media	±	%
1	Someșan	13,9	10,6	12,9	13,6	12,7	1,1	110
2	Syn 2-017	12,9	10,3	12,1	13,2	12,1	0,5	104
3	Syn 4-017	13,0	10,5	12,7	13,5	12,4	0,8	107
4	Livezeanu	13,8	10,8	12,8	13,6	12,8	1,2	110
5	Tinu Liv	12,8	10,0	11,0	12,6	11,6	0,0	100
6	Livada 10	12,9	10,5	12,7	13,3	12,3	0,7	106
7	David Liv	12,5	10,1	11,4	12,6	11,6	0,0	100
8	Media	13,1	10,4	12,2	13,2	12,2	0,6	105
	DL5%	0,4	0,6	0,6	0,7		0,6	

The value of diploid synthetics lies in their high capacity for flowering and fruiting, producing an average of over 500 kg/ha of seed over three years of production when grown using intensive technology with autumn sowing.

The production capacity of these diploid synthetics—Livezeanu, Someșan, Syn4-017, Syn2-017, and Livada 10 has shown superior seed yields compared to the David Liv control variety, achieving increases of 6 to 10% with statistical significance (Table 4). The strong performance of these synthetics is primarily due to their enhanced resistance to drought, characterized by fistulous stems and good resistance to diseases.

The highest seed production over the four-year period was achieved by the synthetic variety Someșan in 2021, reaching 641 kg/ha. This year was considered favorable for seed formation and harvesting.

In 2022, both pedological and especially the atmospheric drought conditions hindered the formation of red clover seeds. The absence of precipitation, coupled with temperatures exceeding 30°C in June and July, was detrimental to red clover pollination. As a result, the seeds remained dry, and the overall seed yield was substantially reduced.

Table 4.

Seed production of red clover diploid varieties created at A.R.D.S. Livada in the period 2021-2024

	Soiul	2021	2022	2023	2024	Media	±	%
1	Someșan	641,0	111,0	581,0	613	487	40	109
2	Syn 2-017	577,0	109,0	620,0	594	475	28	106
3	Syn 4-017	609,0	109,0	614,0	612	486	39	109
4	Livezeanu	621,0	112,0	623,0	615	493	46	110
5	Tinu Liv	541,0	96,0	581,0	617	459	12	103
6	Livada 10	623,0	90,0	557,0	618	472	25	106
7	David Liv	531,0	105,0	546,0	605	447	0	100
8	Media	592	105	589	611	474	27	106
9	DL 5%	29	4	27	31		23	

An important objective of the red clover breeding program at A.R.D.S. Livada is to improve forage quality. The new varieties Someșan and Livezeanu provide feed

with excellent nutritional value in terms of crude protein content, ranking first with 20.3% and 20.1%, respectively, followed by Syn4-017 at 20.0% and Syn2-017 at 19.6%, on average over four years (Fig. 3).

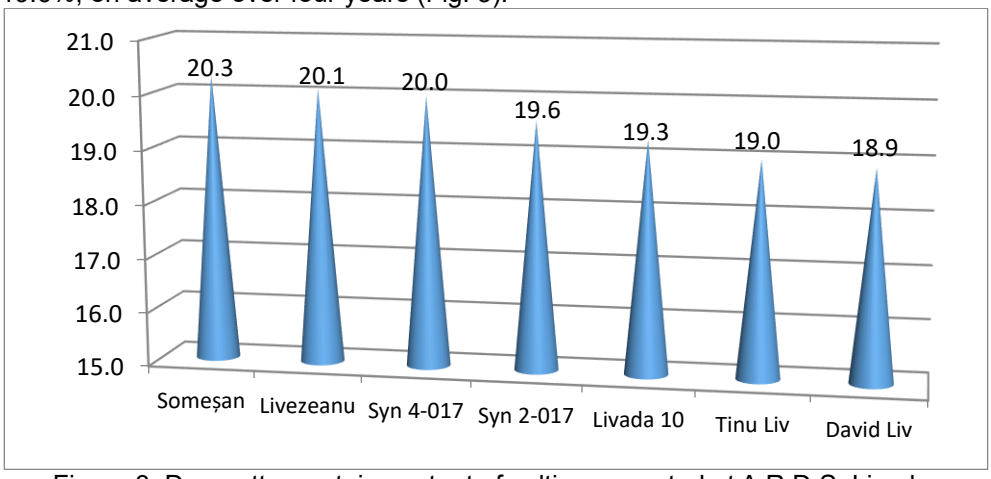

Figure 3. Dry matter protein content of cultivars created at A.R.D.S. Livada

The synthetics Someșan and Livezeanu represent genetic progress aimed at enhancing the production capacity for both fodder and seed, as well as improving forage quality.

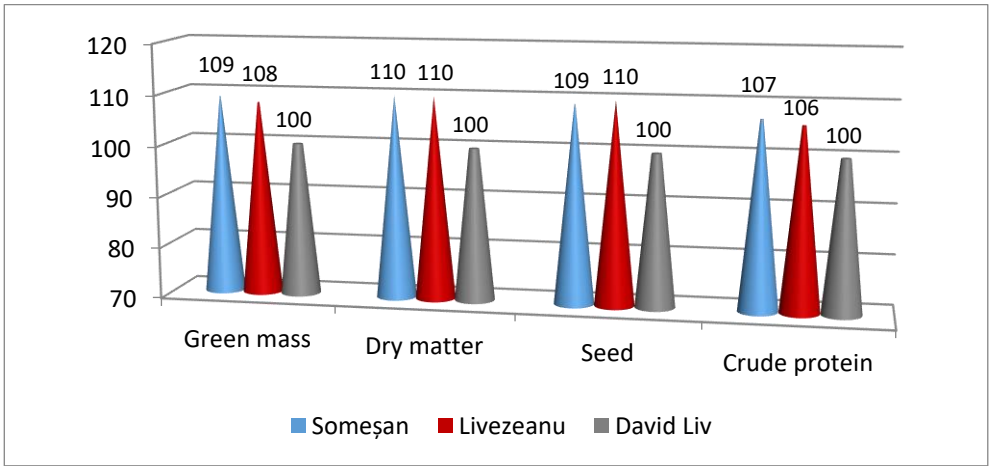

Fig. 4 Genetic progress achieved in red clover breeding at A.R.D.S. Livada

The genetic progress achieved in the improvement of red clover, as shown in Figure 4, demonstrates that the Someșan and Livezeanu synthetics, approved and patented in 2024, result in production increases of 8–9% for green mass, 10% for dry matter, 9–10% for seed, and 7.4% and 6.3% respectively for crude protein compared to the control variety, David Liv (Fig. 4).

CONCLUSIONS

The new red clover varieties 'SOMEȘAN' and 'LIVEZEANU', approved and patented in 2024, are the result of breeding work carried out at S.C.D.A. Livada over a period of several years, which aimed to accumulate favorable genes involved in conditioning production and its stability in different pedoclimatic conditions.

The red clover varieties SOMEȘAN and LIVEZEANU has a very good resistance to drought, fall and diseases. SOMEȘAN and LIVEZEANU cultivas reveled than the check variety David Liv with 8-9% green forage, 10% dry matter and 9-10% seed (statistically assured), compared to the David Liv control variety.

It provides a feed with a good nutritional value in terms of crude protein content, the new varieties Someșan and Livezeanu are in first place with 20.3% and 20.1%.

Cultivation of this variety is recommended in all areas of red clover cultivation, both in intensive and classic technology.

Image from the red clover amelioration field at A.R.D.S. Livada.

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