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"GHEORGHE IONESCU - SISESTI"

ACTA AGRICOLA ROMANICA

FIELD CROPS, NATURAL RESOURCES AND MECHANIZATION

Tom 5, An 5, Nr.5.1.

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CONTENT

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THE FORAGE QUALITY FROM THE IMPROVED SUBALPINE GRASSLANDS, GRAZED WITH DAIRY COWS AND THE MILK'S CHEMICAL COMPOSITION

CALITATEA FURAJELOR OBŢINUTE PE PAJIŞTILE SUBALPINE AMELIORATE, PĂŞUNATE CU VACI DE LAPTE ŞI COMPOZIŢIA CHIMICĂ A LAPTELUI

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Abstract

Knowing the quality of fodder obtained on mountain meadows is important for ensuring a rational feeding of animals, as well as for choosing those improvement technologies, which allow satisfying the nutritional requirements in order to achieve the highest possible animal productions. The purpose of this work was to show the quality of the fodder obtained on 5 experimental plots, with different improvement measures applied, grazed with dairy cows, as well as the milk's chemical composition. The study was carried out in the Bucegi Mountains at 1800 m altitude over a period of three years (2017-2019). Forage quality assessment was performed by determining the main quality parameters: crude protein (CP), ash (ASH), crude fiber (CF), dry matter digestibility (DDM). The chemical composition of the fodder registered changes during the studied period, being influenced by the botanical composition, climatic conditions, as well as the improvement measures applied. A positive influence of the improvement methods on the quality of the fodder on the improved plots was found, especially for the second year of research, compared to the fodder obtained on the control plot. The chemical composition of cow's milk recorded different values between the pastured plots, but not statistically assured ($p > 0.05$), except for the content in SNF and protein, which registered significant differences, statistically assured ($p \leq 0.05$), between the three years studied.

***Keywords*: subalpine grasslands, floristic composition, forage quality, milk composition**

Rezumat

Cunoașterea calității furajelor obținute pe pajiștile montane este importantă pentru asigurarea unei alimentații raționale a animalelor, precum și pentru alegerea acelor tehnologii de îmbunătățire, care să permită satisfacerea cerințelor nutriționale în vederea realizării unor producții animaliere cât mai ridicate. Scopul acestei lucrări a fost acela de a prezenta calitatea furajelor obținute pe 5 parcele experimentale, tratate diferit, pășunate cu vaci de lapte, precum și compoziția chimică a laptelui obținut. Studiul a fost realizat în Munții Bucegi la 1800 m altitudine și s-a desfășurat pe o perioadă de trei ani (2017-2019). Evaluarea calității furajelor a fost efectuată prin determinarea principalilor parametri de calitate: proteină brută (PB), cenușă (ASH), fibre brute (FB), digestibilitatea substanței uscate (DSU). Compoziția chimică a furajului a înregistrat schimbări în perioada studiată, fiind influențată de compoziția botanică, condițiile climatice, precum și de măsurile de îmbunătățire aplicate. S-a constatat o influență pozitivă a metodelor de îmbunătățire asupra calității furajului de pe parcelele ameliorate, cu precădere în anul doi de cercetare, față de furajul obținut pe parcela martor. Compoziția chimică a laptelui de vacă a înregistrat valori diferite între parcelele pășunate, nefiind asigurate statistic ($p > 0,05$), excepție făcând conținuturile în SNF și proteină, care au înregistrat diferențe semnificative, asigurate statistic ($p \leq 0,05$), între cei trei ani studiați

***Cuvinte cheie*: *pajiști subalpine, compoziția floristică, calitatea furajului, compoziția laptelu*i**

INTRODUCTION

The mountain grasslands provide the animals with a very heterogeneous vegetation, providing food for the main cattle species that people raised for milk production. The subalpine grasslands of Bucegi Mountains represent an important source of fodder for ruminants.

Grazing plays the most important role in the nutrition of dairy cows in many regions of the world (MARKOVI´C et al., 2017), this is one of the best uses of grassland as it contributes greatly to food and feed production, to botanical diversity and to the preservation of the entire agroecosystem (METERA et al., 2010).

The use of grazing in feeding of dairy cows has several advantages, such as increasing the opportunities to encourage the natural behaviour of cows and contributing to the image of the dairy sector, but it also has deficiencies, such as greater nitrate excretion and less balanced nutrition (HENNESSY et al., 2020; ELGERSMA et al., 2016). The monitoring of pasture quality through the evaluation of protein and fiber content over time is critical to define the nutritional value of pastures and design balanced diets for grazing animals (DEMANET et al., 2015).

Forage quality is affected by species composition and abundance (KHALSA et al., 2012) and soil resource availability (NIU et al., 2016), which are both in turn affected by climatic conditions. The milk composition and yield are affected by many factors (O'CALLAGHAN et al., 2018).

Milk yield and milk chemical composition can be a good indicator of animal response to the amount of pasture biomass, as well as composition and quality.

The purpose of this work was to show the quality of the fodder obtained on 5 experimental plots improved differently, grazed with dairy cows, as well as the chemical composition of the obtained dairy product.

MATERIAL AND METHOD

The researches were conducted for three years, in 2017-2019, in Blana Bucegi Mountains (coordinates: 45°21'24.3"N 25°27'33.6"E) on slightly sloping ground with western exposure, at 1800 m altitude. The climatic characteristics in this area is specific to the alpine floor, where the annual air temperature is 4.9^0C. The amount of precipitation recorded, in the months of June-September, during the vegetation period is approximately 400-600 l/m2, and the annual amount of precipitation is around 1200-1300 l/m2. The annual average wind speed is over 5-6 m/s.

The study used cows from the *Brown of Maramureş* (*Schwyz*) breed adapted to the harshest mountain conditions, with average production milk (12-14 l/head). For each plot taken in the study were distributed 3 cows, which grazed under the open sky, without shelter, these feeding only with grass from the plot, salt and water.

The 5 experimental plots A, B, C, D, and T were treated differently, as follows:

1. Plot (Group) A: Natural grassland (*Nardus stricta dominant species*) fertilized with chemical fertilizers, as follows: 200 kg/ha N + 100 kg/ha P_2O_5 +100 kg/ha K_2O in the year 2000; 150 kg/ha N + 75 kg/ha P_2O_5 +75 kg/ha K_2O in the year 2001; 100 kg/ha N + 50 kg/ha P_2O_5 + 50 kg/ha K_2O in the year 2002; 150 kg/ha N + 100 kg/ha P_2O_5 + 100 kg/ha K_2O in the year 2010; 100 kg/ha N in the year 2011; 50 kg/ha N in the year 2012; 150 kg/ha N + 100 kg/ha P_2O_5 + 100 kg/ha K_2O in the year 2014; 100 kg/ha N in the year 2015; 50 kg/ha N in the year 2016.

2. Plot (Group) B: Natural grassland (*Nardus stricta dominant species*) chemical fertilized in the period: 1996-1998 with a rate of 150 kg/ha N + 75 kg/ha P_2O_5 +75 kg/ha K_2O, then paddocked with dairy cows in the years 2004, 2010 and 2016. Before or immediately after paddocking, chemically fertilized by superphosphate at a dose of 100 kg/ha P_2O_5.

3. Plot (Group) C: Natural grassland (*Nardus stricta dominant species*), limed on 2/3 of Ah in 1995, chemically fertilized in the period 1996-1998 with a dose of 150 kg/ha N + 75 kg/ha P_2O_5 +75 kg/ha K2O, then paddocked with dairy cows in the years 2003, 2009 and 2015.

4. Plot (Group) D: Seeded and limed pasture in 1995 year, chemically fertilized with NPK between 1996-1998 years, identical to plots B and C, and paddocked with dairy cows in the years 2002, 2008 and 2014. For sowing it has been used a mixture of perennial grasses and forage legumes consisting

of: *Phleum pratense* Favorit variety (40%), *Festuca pratensis* Transilvan (25%), *Lolium perenne* Marta (5%), *Trifolium hybridum* - local population of Brasov (15 %), *Lotus corniculatus* Livada variety (15%).

5. Plot (Group) T: Natural grassland (*Nardus stricta dominant species*), 30 years rationally used, located within the experimental field of the Mountain Grassland Research Base from Bucegi.

The forage samples were grounded with a Grindomix GM 200 mill and prepared for chemical analysis. Crude protein content based on total N content was determined with Kjeldahl method (multiplying N content by the factor 6.25), with the Gerhardt system. The cude fiber (CF) content was analysed according to the manufacturer's procedure of the Gerhart Fibertherm fiber extraction device and in accordance to the Van Soest method (VAN SOEST and WINE, 1967; VAN SOEST, 1963). The total ash was determined by the gravimetric method after calcining the grass samples at 550^0C in the Nabertherm B150 furnace. The determination of the digestibility of the dry matter (DDM) of the fodder was carried out by the technique of Near Infrared Spectroscopy (NIRS).

The composition of cow's milk (fat, solids non-fat (SNF), density, pH, protein, lactose) was determined using the equipment Ekomilk Total, BULTEH 2000 model.

All analyses were performed using the MSTATC and STATISTICA software. Statistical differences in quality parameters were evaluated, and the significant differences were evaluated based on the Student's T test, by a one-way and bifactorial analysis of variance using the ANOVA procedure.

RESULTS AND DISCUSSION

In the floristic composition of the studied grasslands, a number of 14 grasses, 1 legume, 11 species from other botanical families and other species without fodder value were identified (Table 1). The participation of plant groups in the composition of the grassy carpet varied significantly over the three-year period (2017-2019). Figures 1, 2, 3 show the percentages regarding the participation of plant quality groups in the botanical composition of the experimental plots.

Table 1. Plant species present in the experimental field's grassy carpet // Speciile de plante prezente în covorul vegetal al câmpului experimental

Species	Forage quality index	Species	Forage quality index
Gramineae		**Leguminosae**	
Agrostis capillaris	7	*Trifolium repens*	8
Agrostis rupestris	5	**Other families**	
Anthoxantum odoratum	5	*Achillea stricta*	6
Dactylis glomerata	9	*Alchemilla vulgaris*	6
Deschampsia caespitosa	0	*Campanula abietina*	0
Deschampsia flexuosa	0	*Campanula napuligera*	0
Festuca nigrescens	7	*Geum montanum*	0
Festuca pratensis	9	*Hieracium aurantiacum*	0
Nardus stricta	0	*Ligusticum mutellina*	6
Phleum alpinum	6	*Polygonum bistorta*	5
Phleum pretense	9	*Potentilla aurea*	0
Poa annua	7	*Ranunculus montanus*	0
Poa media	5	*Taraxacum officinale*	7
Poa pratensis	8	Other species	0

The value of the fodder quality index can be between 0 and 9 for plant species, depending on the quality class (MARUȘCA, 2016). From the graphic representation (Figure 1), it is highlighted that in 2017, only in the floristic composition of plot D, species of excellent forage plants were identified, in a percentage of 3%. The highest share of very good fodder plant species was recorded in plot C (49%).

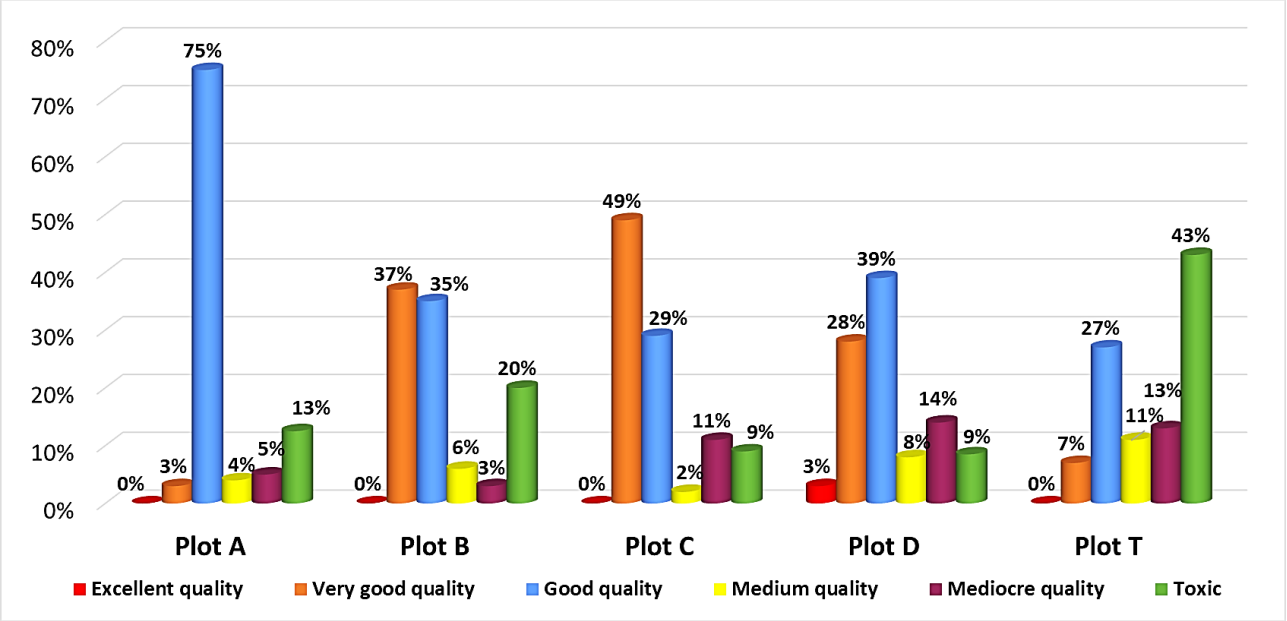

Figure 1. Participation of plant quality groups in the botanical composition of the 5 experimental plots (2017) // Participarea grupelor de calitate a plantelor în compoziția botanică a celor 5 parcele experimentale (2019)

In 2018, the participation of excellent and very good forage plant species was more increased on plots C and D, with percentages of 2% and 6%, respectively 50% and 46%. The highest percentage of participation of good fodder plant species (66%) was recorded in plot A, followed by plot B, with a percentage of 45% (Figure 2).

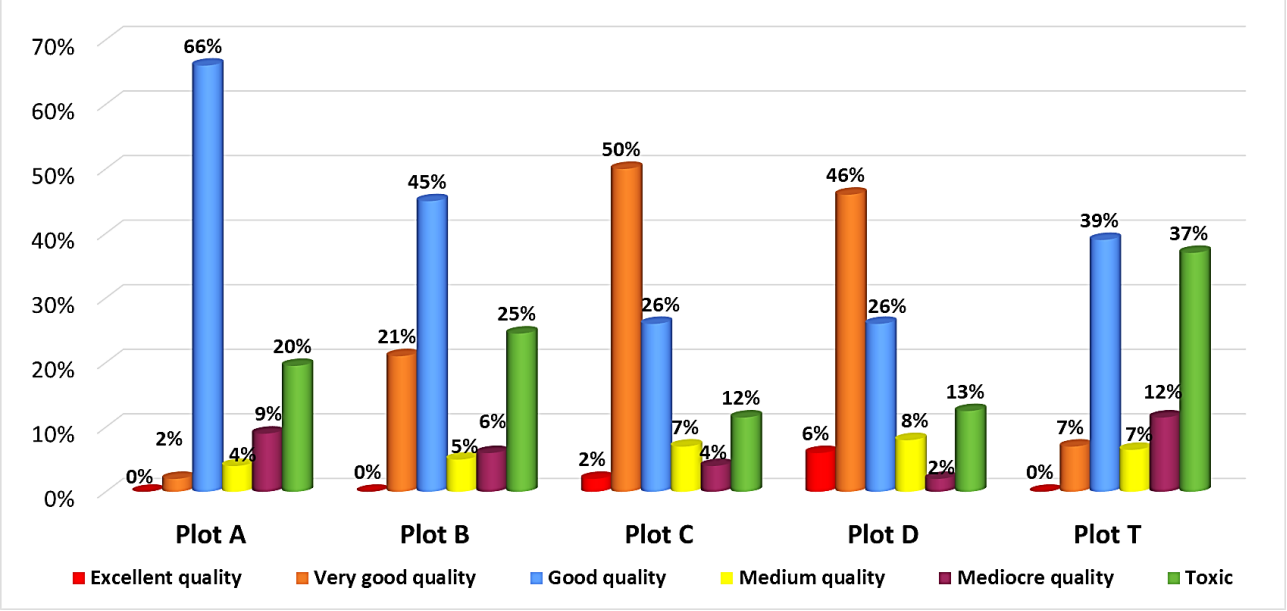

Figure 2. Participation of plant quality groups in the botanical composition of the 5 experimental plots (2018)// Participarea grupelor de calitate a plantelor în compoziția botanică a celor 5 parcele experimentale (2018)

In 2019, the participation of good and very good forage plant species in the grass carpet was increased, being between 57% and 71%, for all improved plots (A, B, C and D) compared to the control plot T, which had a participation of 50% (Figure 3).

Compared to the improved plots (A, B, C and D), in the floristic composition, the participation of toxic plant species was the highest in all three experimental years at the control plot T, with a percentage between 36-43%.

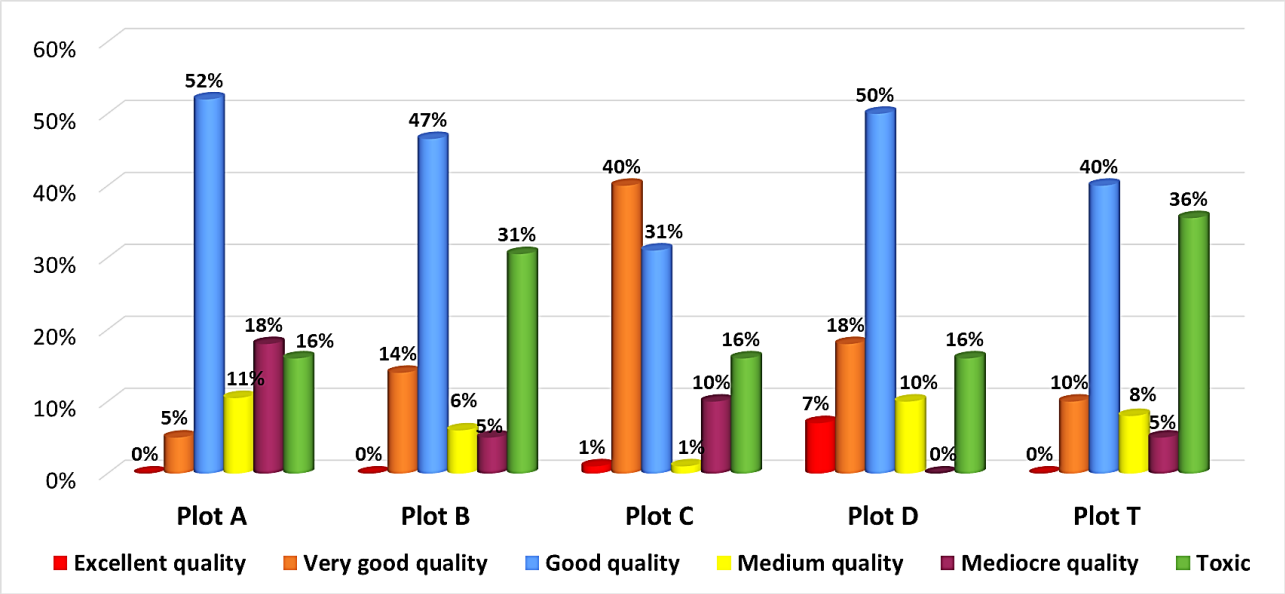

Figure 3. Participation of plant quality groups in the botanical composition of the 5 experimental plots (2019)// Participarea grupelor de calitate a plantelor în compoziția botanică a celor 5 parcele experimentale (2019)

The chemical composition of the fodder registered changes during the studied period, which are showed in the Table 2. Regarding the crude protein content of forages taken from the experimental plots A, B, C and D, compared to the control plot T, the crude protein content of the forages in 2017 was significantly higher ($p \leq 0, 05$) for plots A and D. The favourable temperature conditions and the more abundant rainfall recorded in the months of May-July of 2018 favoured the accumulation of protein, especially on the improved plots.

The absolute values of the crude protein (CP) content of the forage obtained on the improved experimental plots were significantly higher ($p \leq 0.05$) compared to the control plot T, unimproved, as a result of the residual effect of paddocking and the application of chemical fertilizers.

In 2019, overall protein contents decreased compared to the previous year, for all five plots studied. The protein content, from the fodder taken from all the improved plots, did not show significant differences ($p > 0.05$) compared to the control plot.

According to the Student's test, in terms of crude fiber (CF) content in the first experimental year, no statistically significant differences ($p > 0.05$) were revealed, compared to the control plot, for any of the plots improved by different methods. The content in fiber, together with that in protein compounds, contributes significantly to the qualitative value of the fodder intended for animals (LINSKENS and JACKSON, 1989), being that component that helps to regulate intestinal transit, to stimulate the feeling of satiety (GEORGESCU et al. 2007).

In 2018, a decrease in fiber content is observed in the feed from the improved plots, with highly significant ($p \leq 0.001$) and distinctly significant ($p \leq 0.01$) lower differences compared to the control plot T. A content of crude fiber, between 20-30%, characterizes a good quality forage, optimal for the forage ration of ruminants (NICHITA, 1984).

Forage samples, taken in the third year of the study, 2019, had a slightly higher crude fiber content for all improved plots, with the exception of control plot T.

Regarding the total content in mineral elements (crude ash), in the first experimental year, the fodder harvested from the improved plots did not show significant differences ($p > 0.05$) compared to the control plot. In the second year of the study, the total ash content was higher, compared to the year 2017, for all the experimental plots, these registering significantly greater differences, statistically assured ($p \leq 0.05$) compared to the control. In 2019, regarding the total ash content in the feed, it did not register significant differences ($p > 0.05$), for the improved experimental plots, compared to the control plot T, these not being statistically ensured.

The digestibility coefficient of the dry matter (DDM), in the first year of the study, 2017, in the fodder harvested from the improved experimental plots A, B, C and D, did not register significant differences ($p \leq 0.05$), compared to the fodder on the plot control T, unenhanced.

In the second year of the study, the values of the digestibility coefficients of dry matter (DDM), recorded on the improved experimental plots, showed very significantly ($p \leq 0.001$) higher differences compared to the unimproved plot. The values were between 60.50% - 68.13%.

In the last year of the study, the only experimental plot, which registered a distinctly significant difference ($p \leq 0.01$), was plot D, 13.60% higher than the control plot T. The other experimental plots did not register significant differences ($p \leq 0.05$), in terms of dry matter digestibility (DDM), compared to the control plot T.

Table 2. The chemical composition of the fodder in the three years (2017-2019)// Compoziția chimică a furajelor în cei trei ani (2017-2019)

Parameter	Year	PLOT					DL		
		A	B	C	D	T	5%	1%	0.1%
CP (%)	2017	13,20*	11,90^{ns}	12,33^{ns}	13,07*	9,87^{wt}	3,19	4,64	6,97
	2018	16,40***	15,30**	15,20**	16,20***	11,57^{wt}	1,82	2,65	3,98
	2019	13,47^{ns}	11,23^{ns}	11,13^{ns}	13,97^{ns}	10,67 ^{wt}	4,1	5,96	8,96
CF (%)	2017	32,83^{ns}	36,17^{ns}	31,90^{ns}	28,70^{ns}	31,50^{wt}	7,06	10,27	15,43
	2018	28,37^{00}	26,10^{000}	28,03^{00}	24,53^{000}	32,60^{wt}	2,48	3,61	5,43
	2019	29,00^{ns}	28,47^{ns}	28,87^{ns}	25,13^{0}	31,10^{wt}	4,81	6,99	10,51
ASH (%)	2017	7,53^{ns}	6,97^{ns}	7,77^{ns}	8,23^{ns}	7,57^{wt}	1,62	2,36	3,54
	2018	10,10**	9,37*	10,23***	10,17**	8,17^{wt}	0,95	1,38	2,07
	2019	8,73^{ns}	7,77^{ns}	7,73^{ns}	8,30^{ns}	7,43^{wt}	2,09	3,04	4,56
DDM (%)	2017	56,50^{ns}	52,80^{ns}	55,80^{ns}	63,23^{ns}	57,47^{wt}	13,27	19,31	29,01
	2018	62,37***	66,50***	60,50***	68,13***	48,90^{wt}	3,34	4,86	7,31
	2019	61,87^{ns}	62,90^{ns}	63,53^{ns}	69,70**	56,10^{wt}	8,71	12,68	19,04

Significance level: ns $p > 0,05$; * $p \leq 0,05$; ** $p \leq 0,01$; *** $p \leq 0,001$

In Table 3 are presents a summary of the average of the main physico-chemical parameters of the milk collected from the cows that grazed on the five experimental plots A, B, C, D and T, which were analysed during the study period 2017-2019. During the three experimental years, the average percentage

of crude fat in the milk samples was in the range of 3.651% - 3.706%, the effect of the grazed plot being statistically uncertain ($p > 0.05$).

Regarding the average value of the concentration of SNF (solids non-fat), from the milk samples, the plot effect was not statistically assured ($p > 0.05$), and statistically assured values for SNF were obtained within the study years ($p \leq 0.05$).

The highest average value of crude milk protein (3.429%) was obtained in the last year of the study (2019), statistically assured ($p \leq 0.001$). Changes in milk fat and protein content are affected by changes in the floristic and chemical composition of biomass (DUBLJEVI´C et al., 2020).

The average of the three years studied (2017-2019), regarding the lactose content of the milk taken from the five batches of cows A, B, C, D and T, varied between 4.863% and 4.954%.

For the pH value in the milk samples, significant values ($p \leq 0.05$) were recorded, statistically ensured for the groups of cows, from the five plots.

Table 3. The average values of the physico-chemical parameters of milk (2017-2019)// Valorile medii ale parametrilor fizico-chimici ai laptelui (2017-2019)

Parameter	**Lot/Plot** (P)					**Year** (Y)			Effect and signification		
	A	**B**	**C**	**D**	**T**	**2017**	**2018**	**2019**	P[2]	Y[3]	PxY[4]
Fat (%)	3,655	3,622	3,681	3,706	3,651	3,609	3,652	3,727	ns	ns	ns
SNF[1] (%)	8,976	9,026	8,915	8,891	8,866	8,902	8,866	9,037	ns	*	ns
Density g/cm^3	1,030	1,030	1,030	1,0302	1,029	1,030	1,031	1,032	ns	ns	ns
Protein (%)	3,399	3,400	3,393	3,409	3,345	3,393	3,346	3,429	ns	***	ns
Lactose (%)	4,895	4,903	4,954	4,915	4,863	4,938	4,867	4,913	ns	ns	ns
pH	6,44	6,46	6,50	6,49	6,44	6,47	6,49	6,44	*	ns	*

[1] SNF = Solids Non Fat
[2] P = Plot
[3] Y =Year
[4] PxY = Plot x Year interaction

Level of significance: ns $p > 0,05$;* $p \leq 0,05$; ** $p \leq 0,01$; *** $p \leq 0,001$

CONCLUSIONS

1. The changes in the composition of the grassy carpet regarding the participation percentage of plant species were due to the improvement methods applied and the climatic conditions of the respective years.
2. The values of the crude protein content of the feed obtained on the improved plots were in 2018 significantly higher ($p \leq 0.05$), compared to the protein content of the feed obtained from the control plot.
3. The crude fiber content of the feed from the improved plots decreased in 2018 with highly significant ($p \leq 0.001$) and distinctly significant ($p \leq 0.01$) lower differences compared to the control plot.
4. In the second study, the values of the digestibility coefficients of the dry matter (DSU), recorded on the improved experimental plots, recorded very significantly ($p \leq 0.001$) higher differences compared to the unimproved plot.
5. The chemical composition of the fodder registered changes during the studied period, being influenced by the botanical composition, climatic conditions, as well as the improvement measures applied.

6. A positive influence of the improvement methods on the quality of the fodder from the improved plots was found, especially for the second year of research, compared to the fodder obtained from the control plot.

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INNOVATIVE TEHNOLOGIE OF GRAIN SORGHUM PROCESSING

TEHNOLOGIE INOVATOARE DE PRELUCRAREA SORGULUI DE BOABE

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Abstract

As sorghum is a plant originating from southern regions, its temperature requirements are high. The amount of heat expressed by the thermal constant for sorghum is between 2,000 and 5,000 °C, depending on the precocity of the hybrids. It is known that there is a negative correlation between production and precocity. Through the spread of hybrids with a longer vegetation period and high yield potential, there is a risk that it will not reach a humidity that does not require pre-drying. Now that energy is very expensive it forces us to find economical cover solutions. For several years we have tested almost the entire range of sorghum hybrids from several continents in our unit and we came to the conclusion that since we are located in an area with a limited heat regime (multiannual average of the sums of active temperatures of 1270 ° C based on 10 ° C between the last spring frost and the first autumn frost) we can only spread in the area extra-early hybrids, which reach the storage humidity of 12-14%.The introduction of hybrids from the semi-early and semi-late groups with yields of 9-10 t / ha, which in the warmest year reach a humidity of 27-30% until the first frost, requires the identification of conservation technologies not in the form of grain - which is also very expensive, but instead as paste. During 2021 we tested this process as our own solution and developed a technology for preservation at higher humidity and we also want to test it on groups of cattle in our own unit.

Keywords: Grain Sorghum, grain croshing/crimping, silobags, preservation

Rezumat

Sorgul fiind o plantă origninară din regiunile sudice, pretențiile față de temperatură sunt mari.

Cantitatea de căldură exprimată prin constanta termică pentru sorg este cuprinsă între 2000 și 5000 °C în funcție de precocitatea hibrizilor. Se știe că între producție și precocitate este o corelație negativă. Prin extinderea hibrizilor cu perioadă mai lungă de vegetație și cu potențial mare de producție, există riscul ca acesta să nu ajungă la o umiditate încât să nu necesite o uscare prealabilă, ori acum energia fiind foarte scumpă ne obligă la găsirea unor soluții acoperitoare economic. Pe parcursul mai multor ani am testat în unitate aproape toată gama de hibrizi de sorg de pe mai multe continente și am ajuns la concluzia că fiind situați într-o zonă cu regim termic limitat (media multianuală a ∑ temperaturilor active de 1270 °C cu baza de10 °C între ultima brumă de primăvară și prima brumă de toamnă) nu putem extinde în zonă decât hibrizi extratimpurii, care ajung la umiditatea de păstrare (12-14%). Introducerea de hibrizi din grupele semi-timpurii și semi-tardivi cu producții de 9-10 t/ha, care în cel mai cald an ajung la umiditatea de 27-30% până la prima brumă, impune găsirea de tehnologii de conservare nu sub formă de boabe care este și foarte costisitoare, ci sub formă de pastă. În anul 2021 am testat acest procedeu ca fiind o soluție proprie și am elaborat o tehnologie de conservare la umiditate mai ridicată urmând o testare pe grupe de bovine în unitate.

Cuvinte cheie: Sorg de boabe, zdrobirea/ sertizarea boabelor , silobag, conservare

INTRODUCTION

The climatic conditions of the last years were very unsuitable for most fodder crops, due to a drastic water and thermal stress that occurred during the critical periods of vegetation. In recent years, the drought established during the summer in many European countries was also felt in all regions of Romania, causing the scorching of pastures and compromising a high proportion of cereal, oilseed and fodder agricultural crops located in areas characterized by a high degree of aridity such as they are in Dobrogea, eastern Bărăgan, southern Moldavia, the southern extremity of the Romanian Plain, but also local areas of the Transylvanian Plain.

Of all the branches of the economy, agriculture suffered the most from the phenomenon of aridification, a fact that determined the explosive increase in the prices of agri-food products and the decrease in the purchasing power and the standard of living of the population. Taking into account the increasing aridification phenomenon, the vulnerability of current crops manifested by the sharp reduction

of yields due to the absence of water at key moments of development, it is necessary to diversify the structure of field crops and fodder crops, promote drought-tolerant species and adopt technologies and soil processing systems that have the effect of preserving the water reserve (www.icpa.ro).

In this context, the crop that went well over the climate shock, without showing significant yield drops, was sorghum, a species that shows a special resistance to the stress caused by dryness, not demanding on the type of soil. The high ecological plasticity, the high photosynthetic yield places sorghum, along with corn, among the most productive cultivated cereals (www.caussade.ro).

Sorghum is an ecological, energetic, economic crop. Ecological: 1 Ha of sorghum absorbs 50 t of CO2, 3 times more than 1 Ha of forest, 5 times more than 1 Ha of field crop. Energy: 1 Ha of sorghum = 4-5 t biodiesel, 12 t briquettes. Economic: For 1 kg of SU consumes 271 l of water, 3 times less than 1 ha of alfalfa, 1.5 less than 1 ha of corn (Bilteanu, 1979).

Sorghum is a short-day plant, needing short days and long nights to go through the vegetative phase. Any shortening or lengthening of the photoperiod causes a change in the duration of the vegetation period. During the entire vegetation period, the sum of the temperature degrees required for sorghum is 2500-3500°C (average positive temperatures) (Bilteanu, 1989). The required thermal constant is closely related to the variety and there is a wide range of hybrids, some flowering in about 45 days after sowing and the very late ones that bloom only after 120 days and do not reach maturity in the pedo-climatic conditions of our country (Muresan et al., 1965). The variation in temperature also has a great influence on the rate of development of sorghum. Thermal stress, especially in the reproductive phenophase, significantly affects plant height and productivity elements, such as the number of seeds in the panicle and the size of the grain (Bekele E.,1998).

Sorghum is a thermophilic species, with very high temperature requirements. The minimum temperature for seed germination is 10-12°C, and the favorable temperature during plant growth is 25-27°C. At temperatures lower than 5-10°C, sorghum stops growing. Among the annual fodder plants cultivated in our country, sorghum has the highest resistance to drought, due to the highly developed root system and the reduction of growth in case of insufficient water. This also explains the low transpiration coefficient of sorghum (140-170) (Sin Gheorghe, 2005).

Due to the adaptation to arid climatic conditions, the average production in drought conditions can even exceed the average corn yield by 30%, and in optimal rainfall conditions it can be compared with similar yields, a fact by which sorghum contributes to the safety of production (www.euralis.ro).

Although very promising, the expansion of sorghum production was not spectacular, despite the fact that the breeders set as their objectives the increase of grain production in sorghum, based on the increase in the number of grains in the panicle, the increase in the number of panicles per plant and MTG, the creation of hybrids of sorghum resistant to drought, to aphid attack, to tolerance of soil alkalinity and salinity as well as to varieties with a low tannin content (Besancon T., 2003).

We grow sorghum because it utilizes soil water very well due to its deep root system and has low evapotranspiration level, and in case of heat, it pollinates and does not suffer as much as corn, being able to produce profitable yields. It capitalizes on poor lands and minimal fertilization conditions (Berenji J., Dahlberg J., 2004). Sorghum is not sensitive to the preceding plant, it also produces under monoculture conditions. Crops that leave the land clean of weeds are recommended as a precursor plant, because in the first 2-3 weeks after emergence, due to the slow growth rate in this phase, there is a danger of strong weeding. In this sense, the best are fallow crops (maize, sunflower) and fodder plants (Starodub Victor, 2008).

Table 1. The chemical composition and nutritional value of sorghum in various forms// Compoziţia chimică şi valoarea nutritivă a sorgului sub diferite forme

The type of feed	Water	% Dry Substance					
		Proteins	Fats	Non nitrogenous extracts	Cellulose	Ashes	N.U. /100 kg of fodder
Silage sorghum	72.1	10.1	2.5	50.2	29.8	7.5	23.4
Last harvest of silage sorghum	77.0	14.4	2.6	44.4	27.4	11.3	19.4

The type of feed	Water	% Dry Substance					
		Proteins	Fats	Non nitrogenous extracts	Cellulose	Ashes	N.U. /100 kg of fodder
Silage fodder	71.5	8.8	3.8	48.2	29.8	9.8	22.0
Hay of the lost harvest	15.0	12.6	3.7	52.0	22.2	9.5	57.4
Hay	15.0	11.3	2.4	45.1	31.7	9.7	49.2
Grains	16.0	12.9	3.2	77.9	3.5	2.6	118.8

Sursa/Source: Starodub, 2008

Used in animal feed in its green state, hay or silage, sorghum is imposed by yields comparable in quantity to corn, with close fodder value (90-100% of the value of corn) - see table 1.

The ARVALIS institute, in collaboration with the state agency FranceAgrimer, carries out analysis on grain sorghum every year. The results indicate that in terms of chemical composition, grain sorghum is similar to other grains such as wheat or maize. The starch content of sorghum (source of energy) represents 74% of the dry matter; exceeding wheat and equaling corn. The protein content of sorghum (which is, on average, 11%) can vary between 10 and 12%, in the best cases. Due to its chemical composition, energy value and high protein content, as well as its low sensitivity to mycotoxins, sorghum presents important advantages in animal feeding, integrating perfectly into the rations of both monogastrics and cattle (www.sorghum-id.com).

MATERIAL AND METHODS

The Research and Development Station for Cattle Breeding is located on the territory of Sangeorgiu de Mures, which is located 3 km north of the city of Targu Mures, having the geographical coordinates: the meridian 24°33’ east longitude and the parallel 46°33’ north latitude. It has tested different varieties of sorghum for grain and silage for several years.

The culture was placed on a brown forest soil, weakly podzolic (representative of over 80% of the surface of Targu Mures), with a humus content of 2.2, pH of 5,8, P_2O_5 suply is 17.4 mg/100 g soil, K_2O 21,7 mg/100 g soil and an N index of 1.4, water table above 12 m.

The culture technology consisted of the following stages: the land was plowed in the fall to 25 cm, and in the spring when it was possible to enter the field, there was a discussion of uniformity and to favor the development of perennial weeds (Agropyron repens, Convolvulus arvensis, Cirsium arvense, Symphytum officinale). Since sorghum is sown after May 10, we waited for good perennial weed development, and applied a non-selective herbicide Glyphogan. 4-5 days before sowing we carried out work with the combiner for the formation of the germinative bed and the incorporation of fertilizers. The culture being located on an acid soil, we applied 200 kg of Nitrolime. When the soil reached 12-13 °C with a growth tendency, sowing was carried out (starting from May 10-15). Sowing was done with the SPC6 seeder using a density of 250,000 pl/ha.

Immediately after sowing, a pre-emergence herbicide was carried out with Dual Gold 1.5 l/ha, to control annual monocotyledons, and to combat perennial dicotyledons on vegetation at 5-6 leaves, a combination of 0.7 l/ha Tomigan and 0.8 l was used /ha Amino.

During the vegetation period no other interventions were needed. Since the last years these have been quite atypical from a climatic point of view, the hybrids tested in our area did not lose moisture enough to be stored as such, requiring prior drying, which is very expensive.

We chose to preserve the grains in the form of a paste at a humidity of over 25%. The transformation of the grains into paste was achieved with a special mill with rollers driven from the power take-off of the tractor at 540 rpm.

The resulting paste was blown by pressure into a special silobag equipped with double foil walls. During grinding, the paste was treated with a special inoculant for better preservation. It was stored for 3 months, after which it was introduced into the feed, replacing corn in the feed ration of young cattle.

RESULTS AND DISCUSSIONS

A limiting factor in the expansion of sorghum in our area is the amount of active temperatures accumulated to reach maturity. In order to identify hybrids with thermal requirements that can be realized in the area, we undertook a series of experiments with sorghum hybrids with different periods of maturity. In table no. 2, 3 and 4 shows yields and moisture at harvest.

Hybrids from 3 maturity groups were tested: early, mid-early and mid-late.

Table 2. Results regarding the yield of some grain sorghum hybrids experimented at SCDCB Tg. Mures in 2018// Rezultate privind producția a unor hibrizi de sorg boabe experimentat la S.C.D.C.B. Tg. Mureș în anul 2018

Nr.	Hybrid	Maturity group	Humidity	Yield kg/ha	Avg. yield kg/ha
1	Quebec	Early	16.0	4700	4790
2	Arfiro	Early	16.9	4900	
3	Queyras	Early	16.7	4400	
4	Arlys	Early	16.9	5880	
5	Armida	Mid-early	17.7	7400	7550
6	Es Alize	Mid-early	17.5	7300	
7	Arkanciel	Mid-early	17.0	7940	
8	Solaris	Mid-late	19.6	7700	7725
9	Mistral	Mid-late	19.8	7750	

The obtained yields were 4970 kg/ha at the early hybrids, 7750 kg/ha at the mid-early hybrids and 7725 kg/ha at the mid-late hybrids.

It should be noted that the humidity at harvest was between 16%, 17.5% and 19.8% depending on the precocity of the hybrids, but no hybrid reached 14% even though the thermal input of 2018 was over 1200 °C active.

In 2019, we sowed and monitored 10 hybrids, also from Lidea of the three maturity group.

Table 3.Rezults regarding the yield and chemical composition of some grain sorghum hybrids experimented at S.C.D.C.B. Tg. Mureș in 2019// Rezultate privind producția și compoziția chimică a unor hibrizi de sorg boabe experimentat la S.C.D.C.B. Tg. Mureș în anul 2019

Nr.	Hibryd	Maturity group	Humidity	Yield kg/ha	Avg. yield kg/ha	Protein	Fats	Starch
1	Aquilon	Early	17.8	5400	6500	9.6	2.2	64.5
2	Arfiro	Early	17.5	5900		10.0	2.8	64.6
3	Arlys	Early	17.5	6700		8.8	2.3	64.9
4	Alize	Early	18.0	8000		9.3	2.6	64.1
5	Arakan	Mid-early	17.0	8100	8675	9.2	2.8	65.3
6	Arak	Mid-early	17.5	8500		10.5	2.0	63.7
7	Armida	Mid-early	17.8	8300		9.6	1.8	64.4
8	Arkansiel	Mid-early	17.9	9800		10.3	2.6	63.0
9	Solaris	Mid-late	18.4	9700	9600	9.1	2.1	65.3
10	Mistral	Mid-late	19.6	9500		9.4	1.9	64.1
Maize			21.0	8943		8.9	3.4	65.3

The obtained yields were between 5400 kg/ha and 9800 kg/ha depending on the precocity of the hybrids. The protein content was between 8.8% and 10.5%, and the starch content was between 63.7% and 65.3%. Moisture at harvest was between 17% and 19.6%.

In 2020 we studied 7 hybrids, this year achieving the highest yields, reaching 13200 kg/ha at the hybrids with late maturity group. Protein % was between 8% and 10.5% and starch % between 62.2% and 64.1%.

Table 4. Rezults regarding the yield and chemical composition of some grain sorghum hybrids experimented at S.C.D.C.B. Tg. Mureș in 2020// Rezultate privind producția și compoziția chimică a unor hibrizi de sorg boabe experimentat la S.C.D.C.B. Tg. Mureș în anul 2020

Nr.	Hybrid	Maturity group	Humidity	Yield kg/ha	Avg. Yield. Kg/ha	Protein	Fats	Starch
1	Arfiro	Early	18.0	7300	9566	10.5	3.0	63.7
2	Es Typhon	Early	18.9	10600		10.5	2.0	63.6
3	Es Alize	Early	18.6	10800		9.6	2.6	63.1
4	Arakan	Mid-early	21.5	10600	10350	8.7	2.8	64.1
5	Arkansiel	Mid-early	20.7	10100		9.2	3.2	62.5
6	Aquilon	Mid-late	23.0	13200	12450	8.0	2.4	63.9
7	Es Foehn	Mid-late	23.7	11700		8.4	2.9	62.2
Maize			19.4	12500		7.7	3.3	65.0

Grain humidity at the harvest was between 18% and 23.7% at the hybrids with the mid-late maturity group.

The examined grain sorghum hybrids have never reached storage moisture (14%) in the past few years, raising the question of whether grain sorghum can be promoted in the central area of Romania. In this situation, we conducted analyses over the last 13 years regarding the amount of active temperatures with a base of 12°C, presented at table 5.

Table 5. Analysis over the last 13 years of the ∑ activ temperatures with a base of 12°C// Analiza pe ultimii 13 ani a ∑.t.a. cu baza de 12°C

	April	May	June	July	August	September	October	Total
2010	11.3	126.1	209.4	268.5	282.0	81.5	0	978.8
2011	15.5	118.9	201.6	254.9	249.5	156.3	5.9	1002.6
2012	39.2	130.5	258.8	379.0	292.7	178.3	52.3	1330.8
2013	53.0	154.5	223.8	278.,1	315.9	66.9	16.4	1108.6
2014	26.0	106.4	180.0	276.0	255.4	168.3	35.1	10472
2015	21.7	121.0	202.0	302.2	294.3	164.3	11.3	1116.8
2016	57.7	94.4	264.7	294.3	260.6	157.4	8.3	1137.4
2017	25.3	135.1	250.3	282.9	325.2	135.7	6.7	1161.2
2018	116.6	210.4	241.9	270.8	338.1	146.1	29.4	1353.3
2019	37.1	117.8	302.0	272.,7	327.2	160.1	21.2	1238.1
2020	10.4	78.1	230.2	279.7	309.1	189.3	50.,0	1146.8
2021	8.5	95.,0	238.4	320.3	262.8	162.6	2.2	1089.8
2022	9.8	114.6	289.2	337.6	325.1	94.8	11.2	1212.3
Avg.	33.23	125.6	237.8	293.6	295.2	143.2	19.2	1147.9

The active temperatures of the months of April and October and those of the first decade (1-10) of the month are still unused by sorghum in most years. Sorghum does not germinate normally unless the april temperature is consistently above 12°C, and October temperatures when atmospheric humidity is high do not help sorghum ripen.

Therefore the useful temperatures for sorghum in our area only add up to 1060°C.
1147-33.23+19.2+34 (first decade of May and October) = 1060, or at this amount of heat even the earliest hybrids do not reach maturity The climatic conditions in our area are not favorable for the realization of high grain yields with adequate storage moisture (14-15%). In this situation we are forced to resort to other solutions to preserve the grains without spending significant energy. In this sense, we have implemented the grain preservation technology with a moisture content of 25% by turning the grains into a flour and storing them in a silobag.

Silobag, more precisely, silage bagging is an innovative technical solution for farmers, which favors the efficiency of harvest storage processes. This new system significantly reduces both quantitative and qualitative losses.

During the winter time, the sorghum flour was preserved very well, with no undesirable phenomena. After 3 months of preservation, the silobag was opened and an analysis of the chemical composition was made by an authorized company in comparison to corn flour. We reproduce the comparative results in table 6.

Table 6. Comparative results of chemical analyzes of sorghum flour //Rezultatele comparative a analizelor chimice al făinii de sorg

	Shorgum flour (paste)	**Maize flour**
Dry matter	77,21	83,18
Humidity	22,79	16,82
Starch	75.94	64.43
Total protein	10,30	8,9
Digestible protein	8.44	7.36
Crude fat	1,81	1,70
Crude fibre	5,34	4,89
Ash	1,75	1,54
ADF *= non-digestible cellulose	12,01	8,25
NDF *= dry substance intake of the rumen	31,85	28,54

The amount of dry matter was lower in sorghum flour because preservation was done at 25% moisture and in corn at 17%.

An economic analysis of preserving grains in the form of paste highlights that the cost price is lower than the option of drying with a thermal agent. Drying costs 23 lei + VAT/%/t (24% y 14% = 273 lei +VAT), and preservation in the form of paste costs 70.4 lei + VAT/t (Together with mill rental, silo bag's price, the price of the inoculants and workmanship).

The paste was administered to young cattle. From the quality analysis we can conclude that sorghum paste can be an alternative to maize, but further experiments need to be carried out both with young cattle and milk cows.

CONCLUSIONS

1. The high costs of feed, its production in the needed quantities and ensuring the economic efficiency of a cattle farm in the context of global warming generate worldwide problems for which scientific research is required to find innovative solutions for optimizing feed rations and increasing the digestibility of basic feed without affecting the production, quality and health of the animals.
2. As a crop, sorghum makes very good use of soil water making use of poorer lands. In addition, pollination is not as strongly affected by heat as in the case of corn.
3. It is not attacked by crows or wild boars and is not an attractive culture for evasion. Thus, it contributes to the safety of fodder production.
4. Based on the results achieved so far, we believe that sorghum paste will constitute a good fodder for the animal husbandry sector in the context of unfavorable climate changes in recent years. Sorghum paste will be tested on the farm on groups of animals and the results will be published in a future session.

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RESEARCH ON WEED CONTROL OF GRAIN SORGHUM CROP

CERCETĂRI PRIVIND CONTROLUL BURUIENILOR DIN CULTURA SORGULUI PENTRU BOABE

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Abstract.
*The research was carried out in the period 2019-2020, in the conditions of the sandy soils of southern Oltenia and aimed at the control of weeds in the grain sorghum culture, by applying chemical products, alone or associated with other herbicides and with mechanical control measures. The obtained results revealed an average degree of weeding during the sorghum vegetation period, noted on the EWRS scale with values between 1.3-8.1, the maximum being recorded in the control variant (unherbicided and not hoeing mechanics). The best results were obtained in the variants in which the weeds were controlled by chemical methods with pre-emergent and post-emergent herbicides + 2 mechanical hoeing in the vegetation, the weeds being destroyed in a proportion of 79-84%, compared to the control variant. Plant height and leaf area index were distinctly significantly negatively correlated with increasing weediness (r=-0.823**; r=-0.980**). Treating the sorghum crop with the product Dual Gold 960, applied pre-emergent at a dose of 1.5 l/ha, in combination with a post-emergence herbicide with one of the products Buctril Universal, applied at a dose of 1 l/ha, Trek P334 SE, in dose of 3.5 l/ha or Dicopur Top 464 SL, in a dose of 1 l/ha and associated with two mechanical weedings production increases of 143-168% were achieved as, compared to the non-herbicated control and without hoeing mechanics in the vegetation.*
Keywords: *sorghum, herbicides, selectivity, efficacy, weeds, production*

Rezumat
*Cercetările s-au efectuat în perioada 2019-2020, în condițiile solurilor nisipoase din sudul Oltenia și au vizat controlul buruienilor din cultura sorgului pentru boabe prin aplicarea unor produse chimice, singure sau asociate cu alte erbicide și cu măsuri de combatere mecanică. Rezultatele obținute au relevat un grad mediu de îmburuienare pe perioada de vegetație a sorgului, notat pe scara EWRS cu valori cuprinse între 1,3-8,1, maximul fiind înregistrat in varianta martor (neerbicidat și neprășit). Cele mai bune rezultate au fost obținute în variantele în care buruienile au fost controlate prin metode chimice cu erbicidare preemergentă și postemergentă + 2 prășile mecanice in vegetație, buruienile fiind distruse în proporție de 79-84%, comparativ cu varianta martor. Talia plantei și suprafața foliară s-au corelat distinct semnificativ negativ cu creșterea gradului de îmburuienare (r=-0,823**; r=-0,980**). Erbicidarea culturii de sorg cu produsul Dual Gold 960, aplicat preemergent în doză de 1,5 l/ha, în combinație cu o erbicidare postemergentă cu unul dintre produsele Buctril Universal, aplicat în doză de 1 l/ha, Trek P334 SE, în doză de 3,5 l/ha sau Dicopur Top 464 SL, în doză de 1 l/ha și cu efectuarea a 2 prașile mecanice, a realizat sporuri de producție de 143-168%, față de martorul neerbicidat și nelucrat mecanic în vegetație.*

Cuvinte cheie: *sorg, erbicide, selectivitate, eficacitate, buruieni, producție*

INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] is a cereal adapted to hot and dry climates, native to Equatorial Africa, being the main bread grain in Africa, Southern Europe, Central America and Southern Asia. Although 80% of the world's sorghum production is under drought conditions, water stress at the vegetative stage can reduce yield by over 36%, and water stress at the reproductive stage can reduce yield by over 55% (Assefa et al., 2010). A recent study showed that sorghum has the yield and economic advantage over maize in dry regions due to better drought and high temperature tolerance (Starggenborg et al., 2008, Prasad et al., 2021). Sorghum grains have a high nutritional value with 70-80% carbohydrates, 11-13% protein, 2-5% fat, 1-3% fiber and 1-2% ash. Sorghum grain proteins do not contain gluten, making it a special food for people suffering from celiac disease (gluten intolerance),

including diabetic patients (Prasad and Staggenborg, 2010). Reducing the degree of weeding of crops is a major objective in obtaining good results in agriculture and can be achieved primarily by improving the management of plant cultivation, i.e. by reintroducing "good practices in agriculture" (soil quality works, quality seeds with rapid emergence, crop rotation, weed-free maintenance of the land between crops, elimination of sources of infestation etc.).

Tillage technology can influence weed population dynamics and consequently the choice of appropriate weed management practices. In this sense, the research carried out by Govindasamy et al., (2020) at Texas A&M University, College Station, showed that on the land worked by the conventional method for 36 years, the degree of weeding in the sorghum crop was lower , compared to the use of the no-till method, where a high percentage of perennial weeds (*Sorghum halepense* (L.) Pers.) was found. In grain sorghum, weed management is a key challenge to achieve economic production, but available herbicides are very limited, especially those applied post-emergence to control monocot weeds (Fromme et al., 2012, Werle et al., 2017, Bagavathiannan et al., 2018).

Worldwide research has shown that the use of herbicides increases the coefficient of utilization by cultivated plants of improved vegetation factors: solar energy, nutrition space, fertilizing elements, irrigation, drying etc. (Pannacci et al., 2018). To exploit the genetic potential of sorghum, in addition to other technological factors, an integrated sustainable weed management approach is emphasized, which includes a strategic application of preemergence and postemergence herbicides used in combination with non-chemical practices. Research in Arkansas showed that sorghum yield was 50% lower on land where no chemical weed control treatments were applied (Bararpour et al., 2019).

Development of an integrated management plan for weed control in sorghum may become necessary if herbicide-intolerant sorghum hybrids are sown, which limit chemical control options and therefore increase the rate of germination and emergence of sorghum weeds. Studies conducted by Grichar et al. (2005) highlight the optimal timing of application of atrazine, pendimethalin, and trifluralin herbicides, applied alone or in a mixture, by testing at different developmental stages of weeds and sorghum. The best results were obtained by applying the herbicides based on *atrazine* and *trifluralin* in the early development phase of the 7 cm plants, the weeds being controlled in a percentage of 76-100%, depending on the climatic conditions of the year. The same results were obtained in the state of Gujarat on the west coast of India (Verma et. al., 2018).

The quality of sorghum production can be significantly reduced when the degree of weeding is not controlled (Protein=9.94%), compared to the application of various weed control methods where the protein in the grain is 10.31-10.63%, function of treatment (Verma et. al., 2017). The chemical control of weeds creates favorable premises for the complete mechanization of agricultural crops, at the same time facilitating the increase of the efficiency of some agrophytotechnical measures and their culture parameters (Matei, 2011, Drăghici et al., 2019). The high degree of weeding on sandy soils is determined by the fact that weed seeds retain their generative capacity very easily and for a long time, as a result of increased aeration and lower soil moisture. On these lands, the high porosity and the use of irrigation water provide favorable conditions for the growth and development of cultivated plants, but also for weeds (Pintilie et al., 1972, Matei et al., 2021).

MATERIAL AND METHOD

The research was carried out during 2019-2020 at the Research-Development Station for Plant Culture on the also Dăbuleni Sands and aimed at preventing and combating weeds in grain sorghum culture and aimed at the prevention and control of weeds in the grain sorghum crop, by applying some chemical products, alone or associated with other herbicides and mechanical control measures, compared with a control variant (not herbicided and not hoeing mechanics). The experiment included 9 experimental variants (Table 1), located in the field according to the method of randomized blocks in 3 repetitions.

The sorghum culture was placed in an irrigated system, on a sandy soil poorly supplied with nitrogen (0.04% and 0.12%), well supplied with phosphorus (54-10 ppm), with a state of low to medium exchangeable potassium supply (26-64 ppm), and in organic matter (organic carbon =0.20-0.63%) and a pH in water with values between 4.64 and 5.63, which shows a moderately to weakly acidic reaction acid. The sorghum culture was established between April 24 (2019) - April 29 (2020), by sowing the ES ALIZE hybrid, treated with CONCEP III, ensuring a seeding of 25 germinable grains/m^2 and a plant nutrition regime of $N_{150}P_{80}K_{80}$. The pre-emergent herbicides were applied immediately after sowing the sorghum crop, without exceeding the 5-day period from the preparation of the seed bed so that the weeds do not germinate. The application of post-emergent herbicides was carried out in the period between weed seed germination and the 4-6 leaf phase of the weeds, in the last decade of May.

During the vegetation period of the sorghum plants, determinations were made regarding the degree of weeding, the selectivity and effectiveness of the herbicides, the height of the plant, the diameter of the stem and leaf area index. At harvest, the quantity and physical quality of grain production were determined. The obtained research results were analyzed by the method of analysis of variance (ANOVA) and with the help of mathematical functions.

Table 1. Experimental variants for weed control in grain sorghum // Variante experimentale pentru combaterea buruienilor la sorgul pentru boabe

No.var.	The experimental variant	Active substance	Application time	Dose (l/ha)
1.	Control	-	-	-
2.	Trek P34 SE	*pendimetalin 64 g/l + terbutilazin 270 g/l*	Postemergence	3.5
3.	Gardoprim Plus Gold 500 SC	*S-metolaclor 312,5 g/l + terbutilazin 197,5 g/l*	Preemergence	3.5
4.	Buctril universal	*bromoxilin 280 g/l + acid 2,4 D (ester) 280 g/l*	Postemergence	1
5.	Dicopur Top 464 SL	*sare de dimetilamină 40 g/l + dicamba 120 g/l*	Postemergence	1
6.	Dual Gold 960 EC	*S-metolaclor 960 g/l*	Preemergence	1.5
7	Dual Gold 960 EC + Trek P34 SE + Hoeing mechanic	*S-metolaclor 960 g/l* *pendimetalin 64 g/l + terbutilazin 270 g/l*	Preemergence Postemergence	1.5 3.5
8	Dual Gold 960 EC + Buctril universal+ Hoeing mechanic	*S-metolaclor 960 g/l* *bromoxilin 280 g/l + acid 2,4 D (ester) 280 g/l*	Preemergence Postemergence	1.5 1
9	Dual Gold 960 EC + Dicopur Top 464 SL+ Hoeing mechanic	*S-metolaclor 960 g/l* *sare de dimetilamină 40 g/l + dicamba 120 g/l*	Preemergence Postemergence	1.5 1

RESULTS AND DISCUSSION

Analyzing the climatic conditions recorded at the weather station of the Research-Development Station for Plant Culture on Sands Dabuleni (R&DSPCS Dabuleni), the emphasis of the thermal-hydric stress in the area is highlighted, through the increase of 1.46 ^{0}C in the average air temperature during the period April - September 2019-2020, compared to the multi-year average (Table 2). The drought intensified in the months of July and August, when the average air temperature recorded values of 24.15-25.15 ^{0}C, with an increase of 0.91-2.55 ^{0}C, compared to the multi-year average. The amount of rainfall of 224.4 mm, recorded during the plant's consumption period (May-August), was unevenly distributed and insufficient for the growth and development of sorghum plants, necessitating the application of 4 waterings with a rate of 250 m^3 water/ ha.

Regarding the tolerance of the sorghum plant to the chemical products tested, tolerance assessed by grades in the range 1-9, according to the scale established by the European Weed Research Society (*EWRS*), the results obtained showed a good selectivity for the sorghum plants of the herbicides

Gardoprim Plus Gold 500 SC, *Buctril universal* and *Dual Gold 960 EC* (Table 3). A slight phytotoxic effect, presented in the form of burns on the leaves, was manifested with the post-emergence application of the products *Trek P334 SE* and *Dicopur Top 464 SL*, an effect that faded with the development of the leaf apparatus.

Table 2. Climatic conditions recorded at the weather station* of R&DSPCS Dabuleni during the sorghum vegetation period // Condiții climatice înregistrate la stația meteo* a SCDCPN Dăbuleni în perioada de vegetație a sorgului

Climatic conditions		**Calendar month**						**Period**	
		April	**May**	**Junie**	**July**	**August**	**September**	**April - September**	**May -August**
Average 2019-2020	Average monthly air temperature (^{0}C)	12.8	17.55	22.7	24.15	25.15	20.6	20.49	22.39
	Maximum monthly air temperature (^{0}C)	29	33	35	37.6	38.4	37.3	38.4	38.4
	Minimum monthly air temperature (^{0}C)	-2	4.7	6.7	11	12.9	3.5	-2	4.7
	Rainfall (mm)	32.5	57.3	71.5	63.9	31.5	25.1	281.8	224.2
	Relative air humidity (%)	73	75	78	65	60.5	59	68.42	69.63
Multiannual average 1956-2020	Average monthly air temperature (^{0}C)	11.93	16.93	21.53	23.24	22.6	17.94	19.03	21.08
	Sum of monthly rainfall (mm)	46.82	62.88	70.43	55.19	36.88	45.3	317.5	225.38
Deviation from the multi-year average	Average monthly air temperature (^{0}C)	0.87	0.62	1.17	0.91	2.55	2.66	1.46	1.31
	Rainfall (mm)	-14.32	-5.58	1.07	8.71	-5.38	-20.2	-35.7	-1.18

**AgroExpert from Adcon Telemetry SRL Romania*

Table 3. Selectivity of herbicides against sorghum plants// Selectivitatea erbicidelor față de plantele de sorg

The experimental variant	**Dose (l/ha)**	**Application time**	**Herbicide selectivity at:**			
			15 days from application	**30 days from application**	**45 days from application**	**60 days from application**
Martor (neerbicidat, nelucrat)	-	-	-	-	-	-
Trek P334 SE	3.5	Postemergence	2	1	1	1
Gardoprim Plus Gold 500 SC	3.5	Preemergence	1	1	1	1
Buctril universal	1	Postemergence	1	1	1	1
Dicopur Top 464 SL	1	Postemergence	2	1	1	1
Dual Gold 960 EC	1.5	Preemergence	1	1	1	1

The determinations regarding the efficacy of the products tested in the control of weeds in the sorghum culture, which were carried out dynamically starting with the price of post-emergence herbicide, then at 15, 30, 45 and 60 days after application, they showed that the unilateral use of herbicides did not ensure a good effectiveness in weed control, the degree of weediness at 60 days after application being noted on the EWRS scale with grades in the range 4.6-6 (Table 4). It should be noted that the degree of weeding in the control variant remained high throughout the vegetation period, being noted 6 before the post-emergence application of herbicides, reaching a maximum (note 9) after a period of 45 days. The use of the *Buctril universal* product, applied post-emergence at a dose of 1 l/ha, in combination with pre-emergence weedicide with *Dual Gold 960 EC*, applied at a dose of 1.5 l/ha + mechanical works has shown the best results in combating weeds in grain sorghum crop (average grades being 1.3). Also, good results were recorded by the post-emergence application of *Trek P334 SE* and *Dicopur Top 464 SL* products, in the same combination of pre-emergence herbicide + mechanical works (EWRS Notes 1.6-1.7).

Research in Texas showed that the combined application of products based on *pyrasulfotole* and *bromoxynil* resulted in more than 94% control of *Amaranthus ssp*, *Cucumis melo* and *Proboscidea louisianica* (Fromme et al., 2012). The degree of weeding, recorded on sandy soils, is generally much higher, compared to other soils, because sands heat up more easily, and early spring creates an optimal environment for the germination of weed seeds (Șarpe, 1987, Drăghici Iul, 1999). In our study, the degree

of weeding in the untreated version was high throughout the growing season, rated on the EWRS scale with grades ranging from 6-9 and an average of 8.1.

Table 4. Efficacy of herbicides in the control of weeds in grain sorghum crop / /Eficacitatea erbicidelor în combaterea buruienilor din cultura de sorg boabe

The experimental variant	*Dose(l /ha)*	*Application time**	*Efficacy depending on the date of application of post-emergence herbicides*					
			one day before	*at 15 days*	*at 30 days*	*at 45 days*	*at 60 days*	*average*
Control	-	-	6	8	8.3	9	9	8.1
Trek P34 SE	3,5	Postem	6	4	5	5.33	6	5.3
Gardoprim Plus Gold 500 SC	3,5	Preem	2	2	2.3	4	4.6	3.0
Buctril universal	1	Postem	5.3	3	4.6	5	5.6	4.7
Dicopur Top 464 SL	1	Postem	5.3	3	4	4.66	6	4.6
Dual Gold 960 EC	1,5	Preem	2	2.66	3.33	4.66	6	3.7
Dual Gold 960 EC, Trek P34 SE, Hoeing mechanic	1,5 3,5	Preem Postem	2	1	1.3	1.66	2	1.6
Dual Gold 960 EC, Buctril universal, Hoeing mechanic	1,5 1	Preem Postem	2	1	1	1.33	1.3	1.3
Dual Gold 960 EC, Dicopur Top 464 SL, Hoeing mechanic	1,5 1	Preem Postem	2	1	1.6	1.66	2	1.7

**pre=preemergence; post=postemergence*

The spectrum of weeds recorded in the sorghum crop, in the control variant (Figure 1) was highlighted by the abundant presence of the species *Digitaria sanguinalis* (48.11%), followed by *Ambrosia artemisiifolia*, in a percentage of 29.42 %, by *Portulacca oleraceaea* (10.872%), by *Chenopodium album* (7.17%) and by *Amaranthus retroflexus* (4.43%).

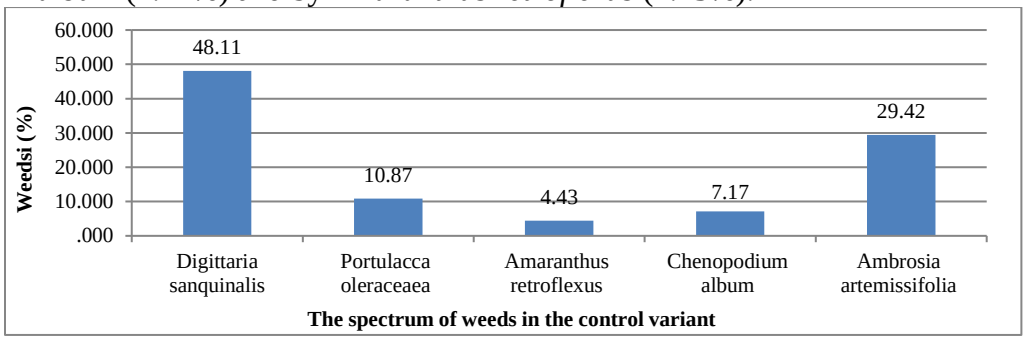

Figure 1. The percentage of weeds recorded in the grain sorghum crop in the control variant / Procentul de buruieni înregistrat în cultura de sorg pentru boabe în varianta martor

The best results regarding efficacy the application of methods to prevent and control the weeding of the grain sorghum crop were obtained by using herbicides with pre-emergent and post-emergent application associated with mechanical methods of maintaining the crop in vegetation through two mechanical works, in which weeds were destroyed in a proportion of 79-84%, compared to the control that presented an average degree of weeding noted on the EWRS scale with a grade of 8.1 (Figure 2).

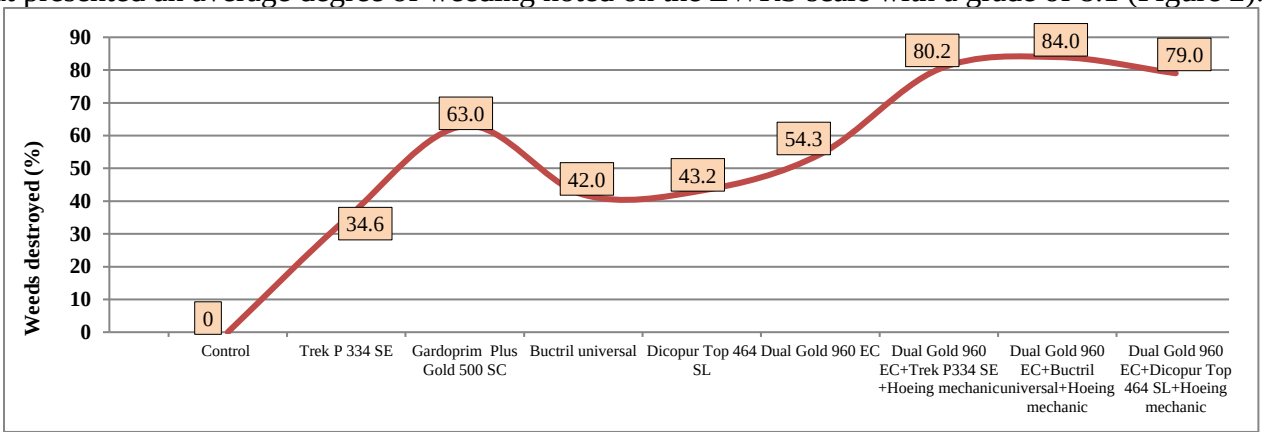

Figure 2. Efficacy methods of prevention and control of weeds during the vegetation period of grain sorghum / Eficacitatea metodelor de prevenire și combatere a buruienilor din perioada de vegetație a sorgului pentru boabe

The determinations made 60 days after the application of post-emergent herbicides revealed the very good efficacy of the combined methods of weed control, by using chemical methods with pre-emergent + post-emergent herbicides and mechanical methods (Figure 3, Photo 1, Photo 2). Thus, compared to the control variant, where the degree of weeding was noted as 9 and a weed biomass amount of 55.11 t/ha was recorded, the positive effect was highlighted in the integrated weed control variants (chemical methods + mechanical methods), where the degree of weeding in the sorghum crop was noted as 1.3-2, being reported 60 days after the post-emergence herbicide only the species *Digitaria sanguinalis* in the amount of 0.6-0.9 t/ha biomass. From the analysis of the effectiveness of the treatment variants on weed species, it can be seen that the products *Gardoprim Plus Gold 500 SC* and *Dual Gold 960 EC* applied alone pre-emergence better controlled the species *Digitaria sanguinalis* and less the species *Ambrosia artemisiifolia*, and the products applied post-emergence, respectively *Trek P334 SE*, *Buctril universal* and *Dicopur Top 464 SL* provided better control of *Ambrosia artemisiifolia* and poorer control of *Digitaria sanguinalis.*

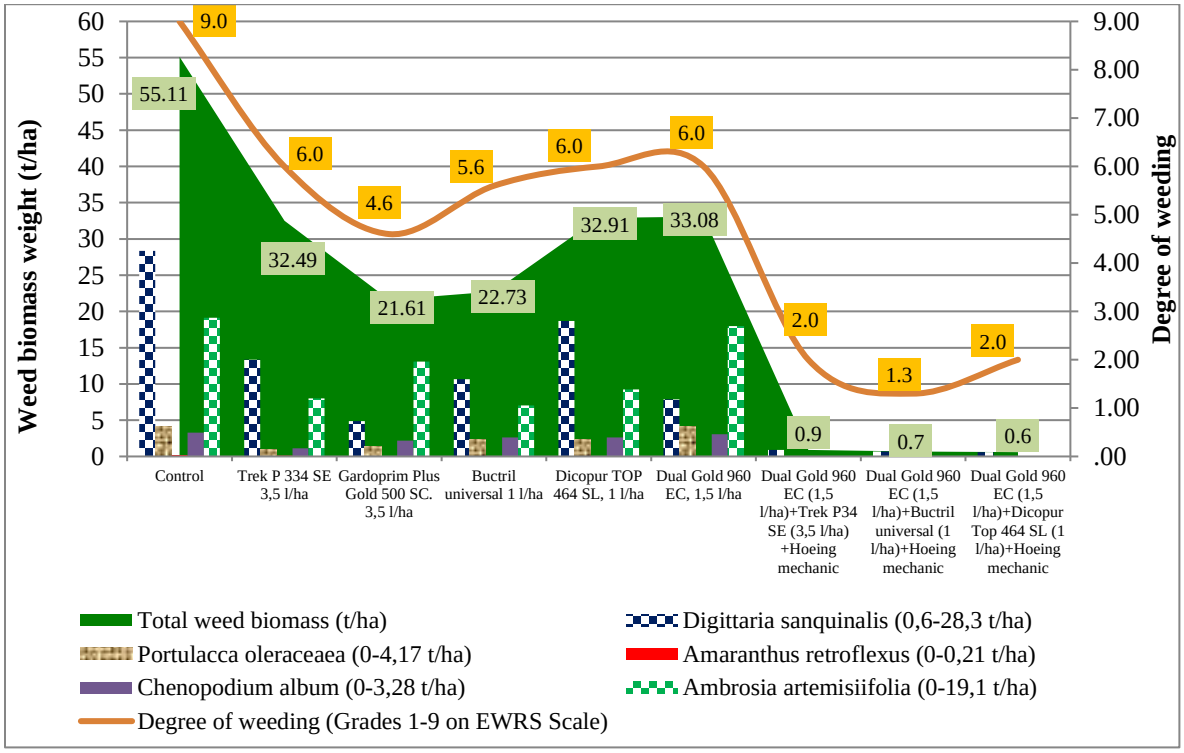

Figure 3. Degree of weediness and weed biomass in sorghum after 60 days from the application of postemergence herbicides / Gradul de îmburuienare și biomasa de buruieni la sorg după 60 zile de la aplicarea erbicidelor postemergente

The analysis of the morphological, physiological and productivity parameters recorded in grain sorghum revealed differentiated values according to the weed prevention and control option (Table 5). The application of measures to prevent and control the weeding of the sorghum crop produced positive effects compared to the non-herbicided and unworked control, where the lowest values were recorded regarding plant height, stem diameter, leaf surface index (LAI), weight of one thousand grains (WTG) and hectoliter weight (HW). Thus, the integrated options for preventing and combating weeds were clearly separated, by using out pre-emergent herbicide with *Dual Gold 960*, applied in a dose of 1.5 l/ha, and in vegetation carrying out post-emergent herbicide with one of the products *Trek P334 SE* (3.5 l/ha), *Buctril universal* (1 l/ha) or *Dicopur Top 464 SL* (1 l/ha), associated with the performance of two mechanical weeding works, which achieved, compared to the control, increases of 29.08-32.66% in the height of the plant, of 41.35-88.77% in the diameter of the stem, of 72.72-78.78% in the leaf surface index, of 67.56-70.81% at the weight of one thousand grains and 17.94-19.08% at the hectoliter weight.

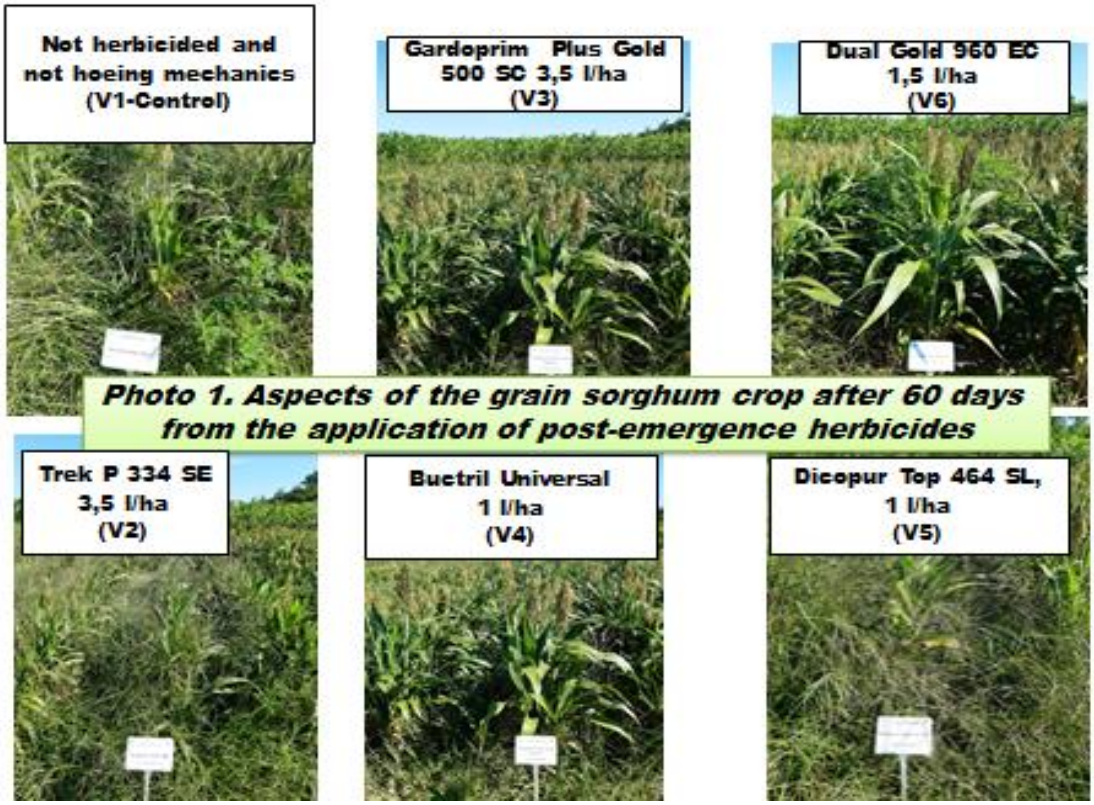

Photo 1. Aspects of the grain sorghum crop after 60 days from the application of post-emergence herbicides

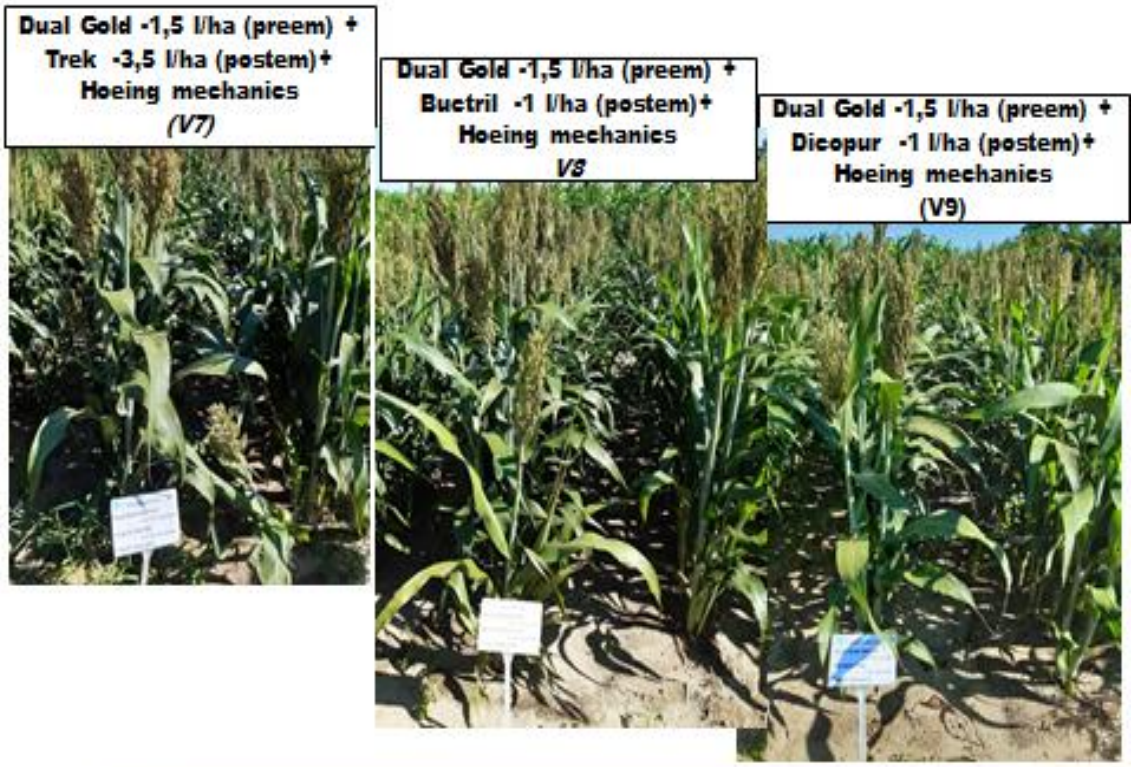

Photo 2. Aspects of the grain sorghum crop after 60 days from the application of post-emergence herbicides

Table 5. Variability of some morphological and productivity parameters in grain sorghum depending on the weed prevention and control option // Variabilitatea unor parametri de morfologie și productivitate la sorgul pentru boabe în funcție de varianta prevenire și combatere a buruienilor

No. var.	The experimental variant	Dose (l/ha) l/ha	The plant height (cm)	The stem diameter (mm)	LAI	WTG (g)	WH (kg/hl)
V1	Control	-	89.4	8	3.3	18.5	61.3
V2	Trek P34 SE	3.5	96.2	8	4.5	29	71
V3	Gardoprim Plus Gold 500 SC	3.5	118.4	10.91	5.1	23	70.3
V4	Buctril universal	1	107.6	8.43	4.6	25	71.6
V5	Dicopur top 464 SL	1	113.8	8.99	4.4	23	70
V6	Dual Gold 960 EC	1.5	124.2	10.43	4.6	23	69.6
V7	Dual Gold 960 EC+ Trek P34 SE + Hoeing mechanic	1.5+ 3.5	115.4	11.31	5.9	31	73
V8	Dual Gold 960 EC + Buctril universal + Hoeing mechanic	1.5 + 1	118.6	11.5	5.9	31.6	73
V9	Dual Gold 960 EC + Dicopur top 464 SL + Hoeing mechanic	1.5 + 1	117.4	14.46	5.7	31	72.3
Difference from control (%) of combined treatments applied in V7, V8, V9			*29.08 - 32.66*	*41.35 - 80.77*	*72.72 - 78.78*	*67.56 - 70.81*	*17.9 - 19.08*

The literature mentions that a weed-free sorghum crop can develop normally, generating a leaf apparatus that has positive implications in the realization of production components (Pannacci et al., 2018, Johnson et al., 2023). From the graphic representation (Figure 4) of the interaction of the degree of weeding of the sorghum crop with the growth of the plant and the development of the leaf apparatus, presented with the help of mathematical functions, negative correlations are highlighted, which show a distinctly significant decrease in plant height and leaf surface with the increase in the degree of weeding (r=-0.823**; r=-0.980**).

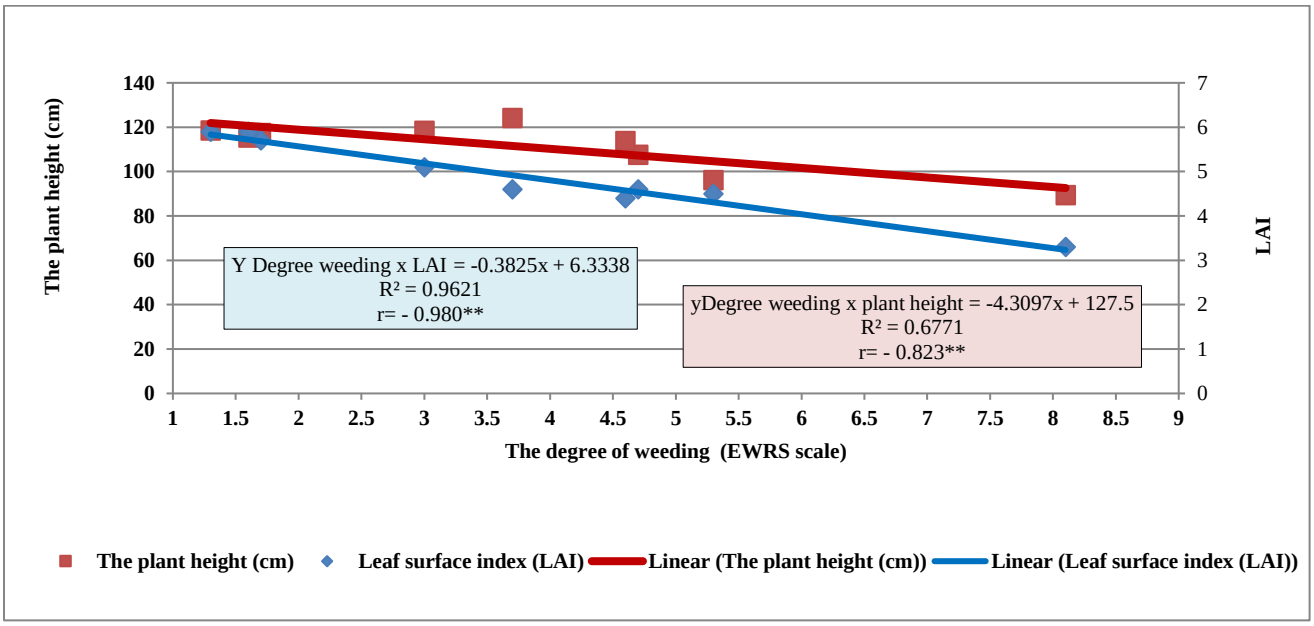

Figure 4. Correlations between the degree of weeding and the development of the sorghum plant // Corelații între gradul de îmburuienare și dezvoltarea plantei de sorg

Having a good ability to efficiently exploit natural resources, sorghum can achieve high yields in ecological conditions less favorable to other cereals (Antohe, 2007, Drăghici, 1999). The production results obtained in grain sorghum, cultivated under sandy soil conditions, were between 2488.3-6678.3

kg/ha, being differentiated by the variant of prevention and control of weeds in the crop (Table 6). Compared to the control variant, which recorded a minimum production of 2488.3 kg/ha, all herbicides brought statistically guaranteed production increases.

Table 6. Influence of herbicide application on grain yield of grain sorghum grown under sandy soil conditions/ / Influența aplicării erbicidelor asupra producției de boabe obținută la sorgul pentru boabe cultivat în condițiile solurilor nisipoase

The experimental variant	*Dose(l/ha)*	*Application time*	**Grain Yield**		**Difference from control**	
			kg/ha	**%**	**kg/ha**	**Significance**
Control	-	-	2488.3	100	Control	Control
Trek P34 SE	3.5	Postemergence	4387.4	176.3	1899.1	**
Gardoprim Plus Gold 500 SC	3.5	Preemergence	4369.0	175.6	1880.7	**
Buctril universal	1	Postemergence	4150.3	166.8	1662.0	*
Dicopur top 464 SL	1	Postemergence	3893.1	156.5	1404.8	*
Dual Gold 960 EC	1.5	Preemergence	3854.4	154.9	1366.1	*
Dual Gold 960 EC+ Trek P34 SE+ Hoeing mechanic	1.5 3.5	Preemergence Postemergence	6238.4	250.7	3750.1	***
Dual Gold 960 EC+ Buctril universal+ Hoeing mechanic	1.5 1	Preemergence Postemergence	6678.3	268.4	4190.0	***
Dual Gold 960 EC+ Dicopur top 464 SL+ Hoeing mechanic	1.5 1	Preemergence Postemergence	6048.7	243.1	3560.4	***

LSD 5%= 1245.5; LSD 1% = 1812.7; LSD 0.1% =2717.4

The best results were obtained by controlling the weeding of the sorghum crop with chemical+mechanical methods. Thus, the herbicide treatement of the sorghum crop with the product *Dual Gold 960*, applied pre-emergent at a dose of 1.5 l/ha, in combination with a post-emergent herbicide with one of the *Buctril Universal* products, applied at a dose of 1 l/ha, *Trek P334 SE*, in a dose of 3.5 l/ha or *Dicopur Top 464 SL*, in a dose of 1 l/ha and with association of 2 mechanical harrowings in the vegetation, led to production increases of 143-168%, compared to the control, the differences being very significant, from a statistical point of view.

The statistical analysis of the influence of the degree of weeding during the sorghum vegetation period on grain production and on the physical quality of the grains (Figure 5), highlighted distinctly significant negative correlations between the degree of weeding and grain production (r= (-)0,913**) and weight hectoliter (r = (-)0,879**) and a significantly negative correlation with weight of one thousand grains (r = (-)0,766**). The obtained results demonstrated that technology elements significantly influence the production potential of grain sorghum (Matei, 2011, Narges et al., 2013). Research in India has shown that weeds are a major problem in increasing productivity in sorghum, with losses ranging from 15-97%, depending on the nature and density of weeds (Verma et al., 2019).

CONCLUSION

1. Pre-emergent application of Dual Gold 960, at a dose of 1.5 l/ha, in combination with a post-emergence herbicide with one of the products Buctril Universal, at a dose of 1 l/ha, Trek P334 SE, at a dose of 3, 5 l/ha or Dicopur Top 464 SL, in a dose of 1 l/ha and in association performance of 2 mechanical weedings during the vegetation of the plant led to production increases of 143-168%, compared to the non-treated control and mechanically unworked in vegetation.

ACKNOWLEDGEMENT

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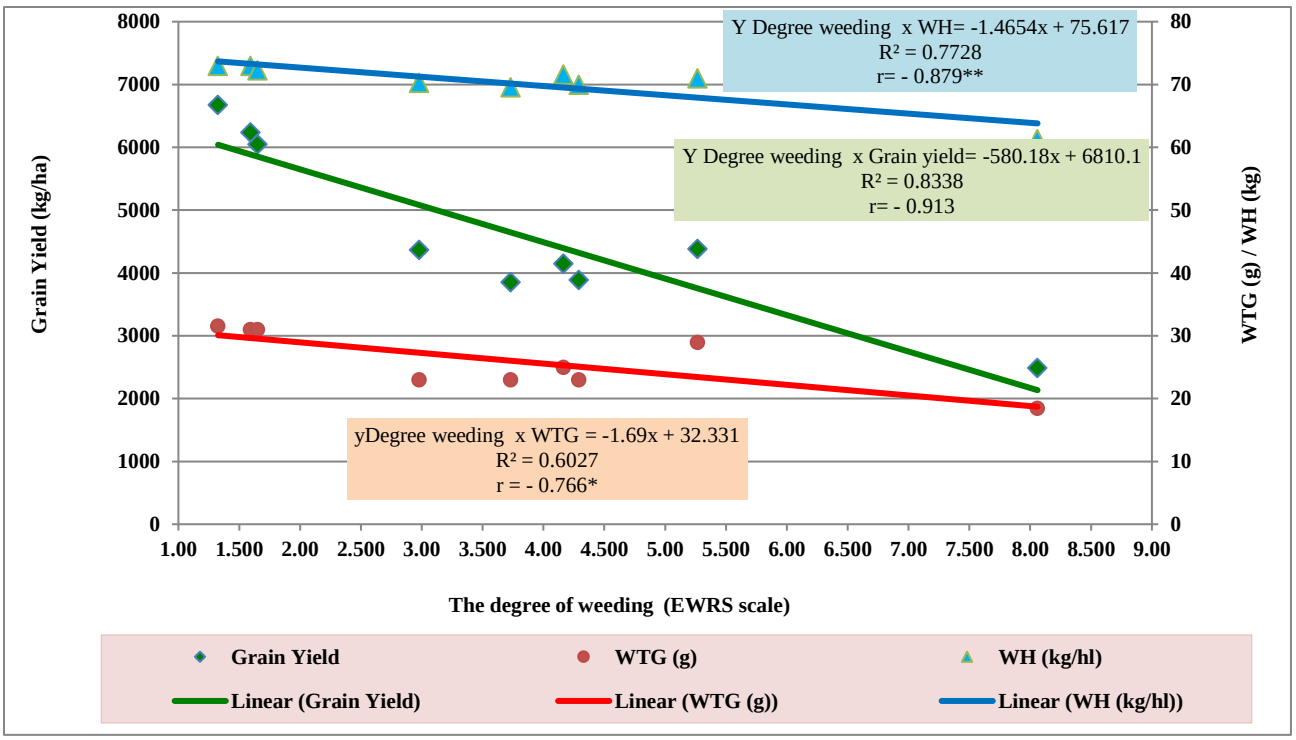

Figure 5. Correlations between the degree of weeding and the productivity of the sorghum plant //Corelații între gradul de îmburuienare și productivitatea plantei de sorg

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THE IMPACT OF XENOTOXIC SUBSTANCES ON SOME ECOPHYSIOLOGICAL INDICES DURING THE FLOWERING PHASE OF BROAD BEAN CROP (*Vicia faba L. var. major Harz*) IN THE ECOLOGICAL CONDITIONS OF THE NORTH OF SUCEAVA COUNTY

IMPACTUL SUBSTANȚELOR XENOTOXICE ASUPRA UNOR INDICI ECOFIZIOLOGICI ÎN FAZA DE ÎNFLORIRE LA CULTURA DE BOB (*Vicia faba L. var. major Harz*) ÎN CONDIȚIILE ECOLOGICE DIN NORDUL JUDEȚULUI SUCEAVA

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Abstract

The research was carried out at SCDA Suceava, in the pedoclimatic conditions of the Pojorâta Center during 2017-2018, on a lithic alluvial soil, located on the first terrace of the Moldova River, at an altitude of 700 m. One of the main factors in this experience, constituted the use of a xenobiotic product, called Tender 960 EC, herbicide from the IV toxicity group and its implications on the microbiological activity of the soil. The following research variants were pursued:V_1- untreated unsown; V_2 - manually sown; V_3- treated 1 l/ha before sowing; V_4- 1.5 l/ha before sowing; V_5- 1 l/ha before the plants sprouting; V_6- 1.5 l/ha before the plants sprouting; V_7- 1 l/ha after sprouting; V_8- 1.5 l/ha after sprouting, sown at 50 cm between rows; V_9- untreated unsown; V_{10}- manually sown; V_{11}- 1,5 l/ha before sprouting, sown at 30 cm between rows. This paper analyzes the action exerted by the herbicide mentioned above in the fight against weeds in broad beans culture on some ecophysiological indices (the content of dry matter, total water and carbohydrates) in the flowering phenophase of the plants. It was found that the accumulation of dry matter, in the flowering phase of the broad bean, in the pedoclimatic conditions of normal years, varies between 20.35 and 32.28%. The highest values of the dry matter content were recorded in the plants of the uncultivated variant not treated with herbicide (31.84-32.28%), and the lowest in the sowed but untreated variants (20.35-21.05%). The rest of the variants show an average accumulation in dry matter between 22.89 and 30.42%. The analysis of the broad bean carbohydrate content, by form and total, was done using the Bertrand-Iljin titrimetric micromethod. The directly reducing carbohydrates (glucose-fructose), the water-soluble carbohydrates (sucrose) and the water-insoluble polysaccharide (starch) were analyzed. Organ analysis of carbohydrates by form and total, indicates an increased content of carbohydrates in reproductive organs and leaves and a lower content in roots and stems. In the varieties treated with herbicide, the lowest content of soluble carbohydrates and the highest content of water-insoluble carbohydrates were achieved.

Keywords: Tender 960 EC, ecophysiological indices, Vicia faba, carbohydrates.

Rezumat

Cercetările au fost efectuate la SCDA Suceava, în condiţiile pedoclimatice de la Centrul Pojorâta în perioada 2017-2018, pe un sol aluvial litic, situat pe prima terasă a râului Moldova, la altitudinea de 700 m. Unul din principalii factori în această experienţă, l-a constituit utilizarea unui produs xenobiotic, numit Tender 960 EC, erbicid din grupa a IV de toxicitate şi implicaţiile lui asupra activităţii microbiologice ale solului. S-au urmărit următoarele variante de cercetare: V_1 - netratat neprăşit; V_2- prăşit manual; V_3- tratat 1 l/ha înainte de semănat; V_4- 1,5 l/ha înainte de semănat; V_5- 1 lg/ha înainte de răsărire; V_6- 1,5 l/ha înainte de răsărire; V_7- 1 l/ha după răsărire; V_8- 1,5 l/ha după răsărire, semănate la 50 cm între rânduri şi V_9- netratat neprăşit; V_{10}- prăşit manual; V_{11}- 1,5 l/ha înainte de răsărire, semănate la 30 cm între rânduri.

În prezenta lucrare se analizează acţiunea exercitată de erbicidul amintit mai sus în combaterea buruienilor la cultura bobului asupra unor indici ecofiziologici (conţinutului în substanţă uscată, apă totală şi a glucidelor) în fenofaza de înflorire a plantelor. S-a constatat că acumularea de substanţă uscată, în faza de înflorire la bob, în condiţiile pedoclimatice ale anilor normali, variază între 20,35 şi 32,28 %. Cele mai mari valori ale conţinutului de substanţă uscată s-au înregistrat

la plantele din varianta nelucrată netratată cu erbicid (31,84-32,28 %), iar cele mai mici la variantele prăşite dar netratate (20,35-21,05 %). Restul variantelor prezintă o acumulare medie în substanţă uscată cuprinsă între 22,89 şi 30,42 %. Analiza conţinutului de glucide la bob, pe forme şi totale, s-a făcut folosind micrometoda titrimetrică Bertrand-Iljin. S-au analizat glucidele direct reducătoare (glucoză- fructoză), glucidele solubile în apă (zaharoză) şi poliglucidul insolubil în apă (amidonul).Analiza pe organe a glucidelor pe forme şi totale, indică un conţinut sporit de glucide în organele de reproducere şi în frunze şi un conţinut mai mic în rădăcini şi tulpini. În variantele tratate cu erbicid, s-a realizat cel mai scăzut conţinut de glucide solubile şi cel mai ridicat conţinut de glucide insolubile în apă.
Cuvinte cheie : Tender 960 EC, indici ecofiziologici, Vicia faba, glucide.

INTRODUCTION

The growth of cultivated plants, respectively of broad bean, is characterized by the summation of favorable climatic factors as well as agrotechnical ones. During growth, the largest amount of organic matter is accumulate due to the photosynthesis process (Sălăgeanu N., Atanasiu L., 1981). This process is well highlighted, practically, by the accumulation of dry matter and total carbohydrates.

The thermal regime greatly influences the accumulation of dry matter, or what is called net photosynthesis. The bean is one of the species that can withstand lower temperatures, which is why it is recommended to be cultivated in the colder and wetter areas of the country.

Carbohydrates have an essential energy role, constituting the source of energy used in the process of breathing and therefore life maintenance. They also represent the main form of organic substances under which reserve substances are deposited in most cultivated and spontaneous plants. If we also take into account the fact that both soluble and insoluble forms of carbohydrates are preferred nutrients in food, we understand why the content in carbohydrates is an index of the quality of cultivated plants.

MATERIAL AND METHOD

The research was carried out in the pedoclimatic conditions of Pojorâta, during 2017-2018, on a lithic alluvial soil, located on the first terrace of the Moldova river, at an altitude of 700 m. It focused on the influence of weed control methods at bean (manual work and herbicide use) on the content of dry matter, total water and carbohydrates in the flowering phenophase of the plants.

Eleven research variants are studied: uncultivated - untreated, manually worked, variants sown at two distances between rows (30 cm and 50 cm) and 7 variants treated with herbicide. Two herbicide doses (1 and 1.5 l/ha) were studied, applied in three periods (before sowing, before sprouting and after the sprouting of beans plants), in variants sown at a distance of 50 cm between rows and 10 cm per row, ensuring 200,000 germinable grains per ha and a variant sown 30 cm between rows and 10 cm per row applied before sunrise, ensuring 300,000 germinable grains per ha.

The analysis of the broad bean carbohydrate content, by form and total, was done using the Bertrand-Iljin titrimetric micromethod. The directly reducing carbohydrates (glucose-fructose), the water-soluble carbohydrates (sucrose) and the water-insoluble polysaccharide (starch) were analyzed.

From a meteorological point of view, the multiannual average temperature in this area was 6.4°C for the entire year and 12.7°C during the vegetation period, and the multiannual average precipitation recorded values of 726.2 for the entire year and 531.0 for vegetation period (tab.1). Temperatures recorded values equal to normal throughout the year and exceeded normal during the vegetation period by 0.8°C. The year 2018 was normal in terms of precipitation both throughout the year and during the vegetation period , but temperatures were significantly above normal, by 2.5°C for the whole year and by 3.4°C during the growing season.

Table 1. Climatic conditions during the experiment period.// Condiţiile climatice din perioada de experimentare.

Specification	Rainfall (mm)		Temperature (° C)	
	annual	IV- IX	annual	IV – IX
2017	699,5	637,9	6,4	13,5
2018	757,7	520,8	8,9	16,1
Multiannual average	726,2	531,0	6,4	12,7

RESULTS AND DISCUSSION

a. **Dry matter**

From table 2, it can be seen that the accumulation of dry matter, in the flowering phase of the broad bean, in the pedoclimatic conditions of normal years, varies between 20.35 and 32.28%. The highest values of the dry matter content were recorded in the plants of the uncultivated variant not treated with herbicide (31.84-32.28%), and the lowest values in the sown but untreated variants (20.35-21.05%). The rest of the variants show an average accumulation in dry matter between 22.89 and 30.42%.

The cause of this behavior can be attributed to the fact that, in their struggle for survival, the plants from the untreated version have a greater osmotic force to extract water and mineral salts from the soil, and their tissues are more strongly sclerified and lignified, precisely to reduce water loss from plants. Under these conditions, the percentage of dry matter is slightly higher compared to the variants where a different agricultural technique was applied.

The plants from the variants to which weeding works and herbicide were applied due to the aeration of the soil, the water retention power in the loosened soil was higher, and the plants had a more optimal water regime, with a higher percentage of water (67.18 - 79.65 %) compared to the uncultivated version, and less dry matter.

b. Carbohydrates

In the analyzed organs of the bean, carbohydrates have a share of over 40-50% of the total dry substance accumulated, thus occupying an important place from a quantitative and qualitative point of view.

Carbohydrates have an essential energy role, constituting the source of energy used in the process of breathing and therefore of life maintenance. They also represent the main form of organic substances under which reserve substances are deposited in most cultivated and spontaneous plants.

If we also take into account the fact that both soluble and insoluble forms of carbohydrates are preferred nutrients in food, we understand why the content in carbohydrates is an index of the quality of cultivated plants.

The variant analysis of the homogenized aerial organs reveals the fact that large amounts of soluble carbohydrates are present in the grain (tab. 3). These have a value preponderance over the forms of insoluble carbohydrates in the unprocessed and processed variants. In the variants in which the herbicide was given in higher doses and administered especially after the emergence of the plants, the value of soluble carbohydrates obviously decreases in the plants, a fact also illustrated by the ratio between the soluble forms and the insoluble forms which in these variants becomes subunit (0.44 - 0.58). Even so the value of total carbohydrates is the highest (50.31-57.03 %).

Comparing various forms of analyzed carbohydrates, we find that the highest values are generally recorded for insoluble forms (starch), followed by directly reducing sugars (glucose, fructose, sorbose) and then sucrose (diglucose soluble in water). The ratio of soluble / insoluble carbohydrates is over unity in the uncultivated and sown variants and below unity in all variants treated with herbicide. This proves that the xenobiotical product used induces to an unforeseen extent both the metabolism of sugary substances in plants, increasing it slightly also through the accumulation of dry matter.

For the qualitative analysis of the broad beans from all the studied variants, a homogenate of the aerial (stem, leaves, inflorescences) and underground (roots) parts of the plant was used, brought to the flour stage by raising.

Table 2. The influence of the method of weed control on the dry matter content of broad beans plants. // Influenţa modului de combatere a buruienilor asupra conţinutului în substanţă uscată a plantelor de bob.

Variant	Distance beetwen rows (cm)	Dry matter (%)	Total water (%)
no hoeing - unteatred	50	31,84	68,16
manual hoeing	50	20,35	79,65
1 l/ha before soweing	50	29,33	70,67
1.5 l/ha before soweing	50	22,89	77,11
1 l/ha before sprouting	50	25,11	74,89
1.5 l/ha before sprouting	50	24,48	75,52
1 l/ha after sprouting	50	30,42	68,58
1.5 l/ha after sprouting	50	28,30	71,70
no hoeing - unteatred	30	32,28	67,72
manual hoeing	30	21,05	78,95
1.5 l/ha before sprouting	30	23,82	67,18

Table 3.The influence of the method of weed control on the carbohydrate content of broad bean // Influenţa modului de combatere a buruienilor asupra conţinutului în glucide a plantelor de bob

Variant	**Distance beetwen rows (cm)**	**Forms of carbohydrates g / 100 g s.u.**				**Total carbohydrates sol. + insol.**	**Total report sol/insol.**
		directly reducing	**soluble in water**	**totally soluble**	**insoluble in water**		
no hoeing - unteatred	50	20,05	4,08	24,13	21,06	45,19	1,14
manual hoeing	50	19,49	4,59	24,08	18,87	42,95	1,28
1 l/ha before soweing	50	18,05	5,49	23,54	24,05	47,59	0,98
1.5 l/ha before soweing	50	12,52	7,56	20,08	21,96	42,04	0,91
1 l/ha before sprouting	50	13,84	5,73	19,57	23,87	43,44	0,82
1.5 l/ha before sprouting	50	11,84	5,95	17,79	28,31	46,10	0,63
1 l/ha after sprouting	50	12,85	4,81	17,66	39,37	57,03	0,44
1.5 l/ha after sprouting	50	14,09	4,47	18,56	31,75	50,31	0,58
no hoeing - unteatred	30	16,43	7,02	23,45	21,06	44,51	1,11
manual hoeing	30	14,28	5,73	20,01	19,45	39,46	1,03
1.5 l/ha before sprouting	30	14,08	5,23	19,31	20,93	40,24	0,92

Analyzing various forms of carbohydrates and their total (table 4, figure1), we find that the smallest amounts are present in the roots, and in the inflorescences and reproductive organs, in formation, the maximum amounts are present (105 mg/1 g. dry substance). In the form of carbohydrates, directly reducing sugars are in the highest amount in inflorescences and forming berries (25 mg), while the roots and stems have the same concentration (20 mg glucose). Water-soluble sugars, namely sucrose, have the highest value in leaves (50 mg), followed by flowers (45 mg), stems (40 mg) and roots (35 mg / 1 g s.u.).

Table 4. The content of carbohydrate forms in the organs of broad beans plants// Conţinutul formelor de glucide din organele plantelor de bob

Specification	Roots	Stems	Leaves	Inflorescence
directly reducing carbohydrates	20	30	15	25
soluble carbohydrates	35	40	50	45
insoluble carbohydrates	30	30	30	35
total	85	90	95	105

directly reducing carbohydrates: glucose, fructose, sorbose; soluble carbohydrates: sucrose; insoluble carbohydrates: amide.

CONCLUSION

1. The highest dry matter content was recorded in the unworked - untreated variants and the lowest in the sown or treated variants. The total water content is inversely related to the dry matter content;
2. The highest content of total carbohydrates was found in the plants from the herbicide-treated variants and the lowest in the untreated variants;

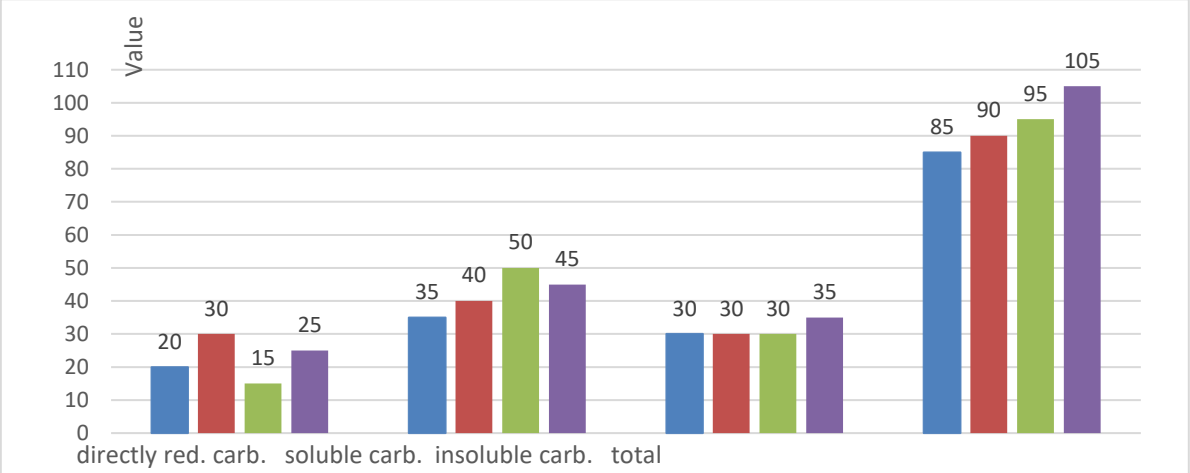

Figure 1. The content of carbohydrate forms in the organs of broad beans plants (mg/1 g dry substance) // Conținutul formelor de glucide din organele plantelor de bob (mg/1 g substanță uscată)

3. All vital processes happen normally if there is a percentage of water of 70-80% in the cells, our analyzes highlighted an optimal percentage of total water that favored metabolic processes of synthesis and polymerization of organic substances and especially of carbohydrates;
4. The organ analysis of carbohydrates by form and total, indicates an increased content of carbohydrates in reproductive organs and leaves and a lower content in roots and stems;
5. In the variants treated with herbicide, the lowest content of soluble carbohydrates and the highest content of water-insoluble carbohydrates were achieved;
6. The highest content of total carbohydrates was achieved in the plants from the varieties treated with herbicide;
7. Carbohydrate content as a qualitative indicator of broad bean plants can be used to detect the best agro technologies measures that can be applied in intensive broad bean culture, as well as to detect the variety with the most intensive growth, but also with the highest concentration of carbohydrates, both in the vegetative apparatus of the plant and in the grains.

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RESEARCH ON AGRICULTURAL LANDUSE UNDER THE CONDITIONS OF DEGRADATION THROUGH GULLIES AND LANDSLIDES AND SOLUTIONS FOR ANTI-EROSION ORGANIZATION AND SUSTAINABLE AGRICULTURAL EXPLOITATION

CERCETĂRI PRIVIND UTILIZAREA TERENURILOR AGRICOLE ÎN CONDIȚIILE DEGRADĂRII PRIN RÂNGĂȘI ȘI ALUNĂRI DE TEREN ȘI SOLUȚII DE ORGANIZARE ANTIEROZIONARE ȘI EXPLOATARE AGRICOLE DURABILĂ

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Abstract:
Starting from 2006, at SCDCES "MM" Perieni, research was carried out on the way agricultural land is used in the current ownership conditions and degradation through gullies and landslides in watersheds, or perimeters, of different sizes, and solutions for anti-erosion organization and sustainable agricultural exploitation were proposed to local authorities and farmers. The categories of anti-erosion works proposed belong to two groups: a) works of a larger scale, which require the intervention of the State, such as land reclamation works, modeling works, landscaping of slopes with landslides, torrent or gully stabilization works, etc., afforestation and planting of protection forest belts; b) works of a smaller scale, which are within the reach of farmers or administrators, such as: drawing grassy strips between stripcrops, establishing grassed waterways on the bottom of valleys or ephemeral gullies, correcting the routes of agricultural exploitation roads, etc. In the period 2021-2024, research is carried out in the framework of the project entitled "Solutions for anti-erosion organization of the territory and sustainable agricultural exploitation based on the inventory of landslides and gullies" in four hydrographic micro-watersheds. This article presents the results of the research carried out in the first two stages of the project, in the Tomești and Trestiana-Conizoaia hydrographic micro-watersheds, within the Bârlad Tableland.
Keywords: ***Geographical Information Systems, GPS measurements, gullies, landslides, landuse, land reclamation, sustainable agriculture.***

Rezumat:
Începând cu anul 2006, la SCDCES „MM" Perieni s-au efectuat cercetări privind modul de utilizare a terenurilor agricole în condițiile actuale de proprietate și degradare prin rigole și alunecări de teren în bazine hidrografice, sau perimetre, de diferite dimensiuni și soluții de organizare antierozională și exploatarea agricolă durabilă au fost propuse autorităților locale și fermierilor. Categoriile de lucrări antieroziune propuse aparțin a două grupe: a) lucrări de anvergură mai mare, care necesită intervenția statului, precum lucrări de reabilitare a terenurilor, lucrări de modelare, amenajarea versanților cu alunecări de teren, lucrări de stabilizare a torenților sau a rigolei, etc., împădurirea și plantarea de centuri forestiere de protecție; b) lucrări de anvergură mai mică, care sunt la îndemâna fermierilor sau administratorilor, precum: trasarea fâșiilor înierbate între culturi, înființarea căilor navigabile înierbate pe fundul văilor sau rigole efemere, corectarea traseelor drumurilor de exploatare agricolă etc. în perioada 2021-2024, cercetarea se desfășoară în cadrul proiectului intitulat „Soluții pentru organizarea antieroziune a teritoriului și exploatarea agricolă durabilă pe baza inventarierii alunecărilor de teren și rigole" în patru microbazine hidrografice. Acest articol prezintă rezultatele cercetărilor efectuate în primele două etape ale proiectului, în microbazinele hidrografice Tomești și Trestiana-Conizoaia, din cadrul Podișului Bârladului.
Cuvinte cheie: Sisteme de informații geografice, măsurători GPS, rigole, alunecări de teren, utilizare a terenurilor, recuperare a terenurilor, agricultură durabilă

INTRODUCTION

The relief conditions, the geological structure and the climatic conditions of the Bârlad Tableland lead to the idea that more than 70% of the territory's surface is theoretically prone to degradation through water erosion, gullies and/or landslides. According to the total erosion zoning map drawn up by Moțoc M. (1975), in Vaslui County, an area that mostly overlaps the Bârlad Tableland, the total erosion is 20-30 t/ha/year (Figure 1) .

According to Moţoc M. (1984) sheet erosion participates with 36%, deep erosion with 31%, and the remaining 33% is due to the combination of landslides – deep erosion and landslides in the forest fund – bank and thalweg erosion.

Maria Rădoane et al. in 1992 and 1995 inventoried a number of over 9,000 gullies in the Moldavian Plateau and made a map of the gully density. In that map, the authors singled out two distinct areas:

- one located in the middle basin of the Jijia and in the upper part of the Bahluieţ watershed (predominantly clayey domain);
- the other one, with the greatest susceptibility to gullying, located roughly in the Bârlad Tableland (predominantly sandy area) includes the Tutova Rolling Hills, the Fălciu Hills and the Covurlui Hills.

The application of Law 18/1991 on the reallotment of agricultural land to the previous landowners had several negative consequences, among which we mention:

- A huge fragmentation of agricultural land, through the appearance of 48 million individual plots on a surface of 9 million hectares of arable land, in 4.2 million agricultural holdings with an average surface of 2.2 ha, and consisting of 5-16 small plots, sometimes sparsely distributed, isolated from each other (Gavrilescu and Giurcă, 2000), made the new small owners economically unviable.

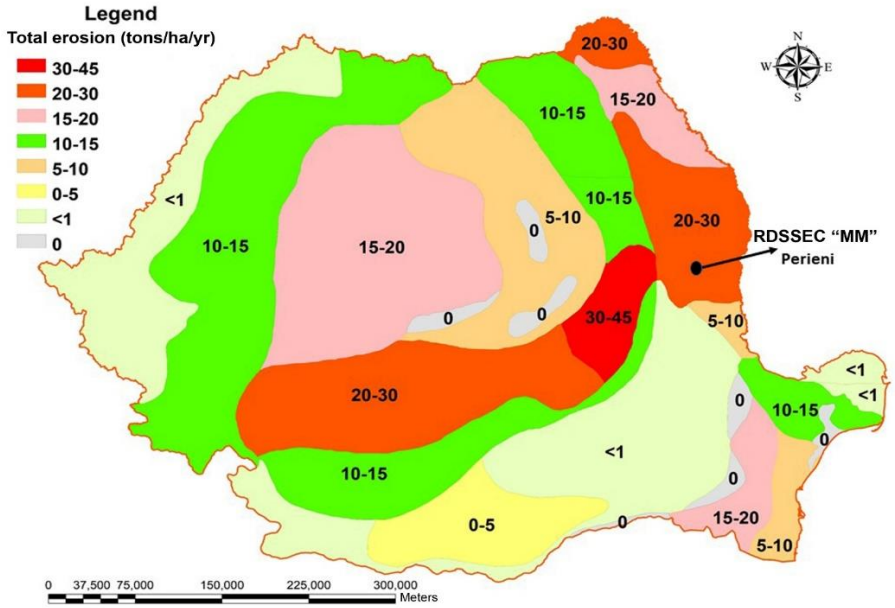

Figure 1. Zoning of total erosion (tons/ha/year) in Romania (Moţoc M., 1984)// Zonarea eroziunii totale (tone/ha/an) în România (Moţoc M., 1984)

- The effective realottment on previous sites, which in Romania, according to tradition, most often meant the location of small, narrow and long plots in the up-and-down-hill direction, made it almost impossible for small farmers to exploit the agricultural landowners in an anti-erosion system. The fact led to the destruction of the terraces and other pre-existing landscaping works. Generally speaking, in our country, the anti-erosion exploitation systems include as main measures: the execution of agricultural works in the direction of contours (level curves), stripcrops with the alternation of some good protective plants with some less good protective ones and terraces of different types, which, even in rich countries are considered too expensive. In the case of gullies or landslides, if the chosen solution is not afforestation, the work required for stabilization can be much more expensive.

In the period 2021-2024, the research is carried out in the framework of the project entitled "*Solutions for anti-erosion organization of the territory and sustainable agricultural exploitation based on the inventory of landslides and gullies*" in four micro-watersheds, namely: in 2021 - Tomești (2,127ha), in 2022 - Trestiana-Conizoaia (5,096ha), in 2023 Cârjăoani (1,847ha) and in 2024 - Valea Seacă. This

article presents the results of the research carried out in the first two stages of the project, in the Tomești and Trestiana-Conizoaia hydrographic micro-watersheds, in the Bârlad Tableland.

From an administrative-territorial point of view, the Tomești hydrographic watershed is located, in different proportions, on the territory of two communes: Pogana and Iana, in the southern half of Vaslui county. In total, the perimeter of Tomești includes a territory with an area of 2,126.7 hectares. The Trestiana hydrographic watershed is located, in different proportions, on the territory of four communes: Fruntișeni (3,279.4 ha), Grivița (1,112.4 ha), Vinderei (508.4 ha) and Zorleni (195.4 ha), in the southern half of Vaslui County. In total, the Trestiana perimeter includes a territory with an area of 5,095.7 hectares.

MATERIAL AND METHOD

A first objective of the research was the creation of a geographic information system with data from the selected basins/perimeters regarding the relief (physical-geographical conditions), the hydrographic network and vegetation, the categories of land use and the current mode of agricultural land exploitation, based on which to propose appropriate solutions for anti-erosion organization and sustainable agricultural exploitation.

Database. The following cartographic materials and documentary information were used to carry out the activities provided for in these projects:

- topographic maps in scale 1:5,000, purchased from O.C.P.I. Vaslui;
- topographic maps on a scale of 1:25,000 drawn up by the Military Topographic Directorate, existing in the archive of the research station, edition 1982-1984 (with historical value);
- geological maps prepared by I. Atanasiu, N. Macarovici, P. Jeanrenaud, Bica Ionesi and C. Ghenea (1961, 1965, 1971);
- geological map of Romania, Geological Institute of Romania (1968), scale 1:200,000, Bârlad and Iași sheets, with related explanatory notes;
- geomorphological map of Romania, Posea Gr., Badea I., Scale 1:400,000, 1980, Didactic and Pedagogical Ed., Bucharest;
- climatic data from Bârlad and Perieni weather stations (ADCON-BEIA automatic weather station from RDSSEC "MM" Perieni);
- the cadastral maps related to the communes in the perimeter, on a scale of 1:10,000, drawn up by specialists from OCPI Vaslui (1982-1983);
- soil erosion data obtained from the runoff control plots from RDSSEC "MM" Perieni;
- Google Earth Pro images with a resolution of 0.5 m georeferenced in Dealul Piscului Stereo 1970 system .

The Method used was that of geographic information systems, of three-dimensional databases in which each pixel of each digital map - layer - has behind it (metadata) all the necessary information (relief, soil, climate, etc.). The physical interface was the GIS program ArcGIS 9.3.1, ESRI (Environmental Systems Research Institute), ArcEditor license with Spatial Analyst, 3D Analyst, Geostatistical Analyst extensions. Practically, all available maps and plans were scanned, georeferenced, initially in the system used in Romania, Stereo '70 Dealul Piscului. All this has been updated, where appropriate, by high-precision and high-productivity measurements carried out with the Thales Z-Max.Net professional GPS equipment, and then added to the information obtained in the many field trips to the town halls of the communes in perimeter, but especially from farmers in the area.

A very important stage in the spatial modeling of land degradation processes, within the geographic information system, consisted in creating the digital elevation model of the terrain (figure 2, a and b), obtained by scanning, importing, georeferencing and digitizing the level curves (contours) from ANCPI topographical maps at a scale of 1:5,000.

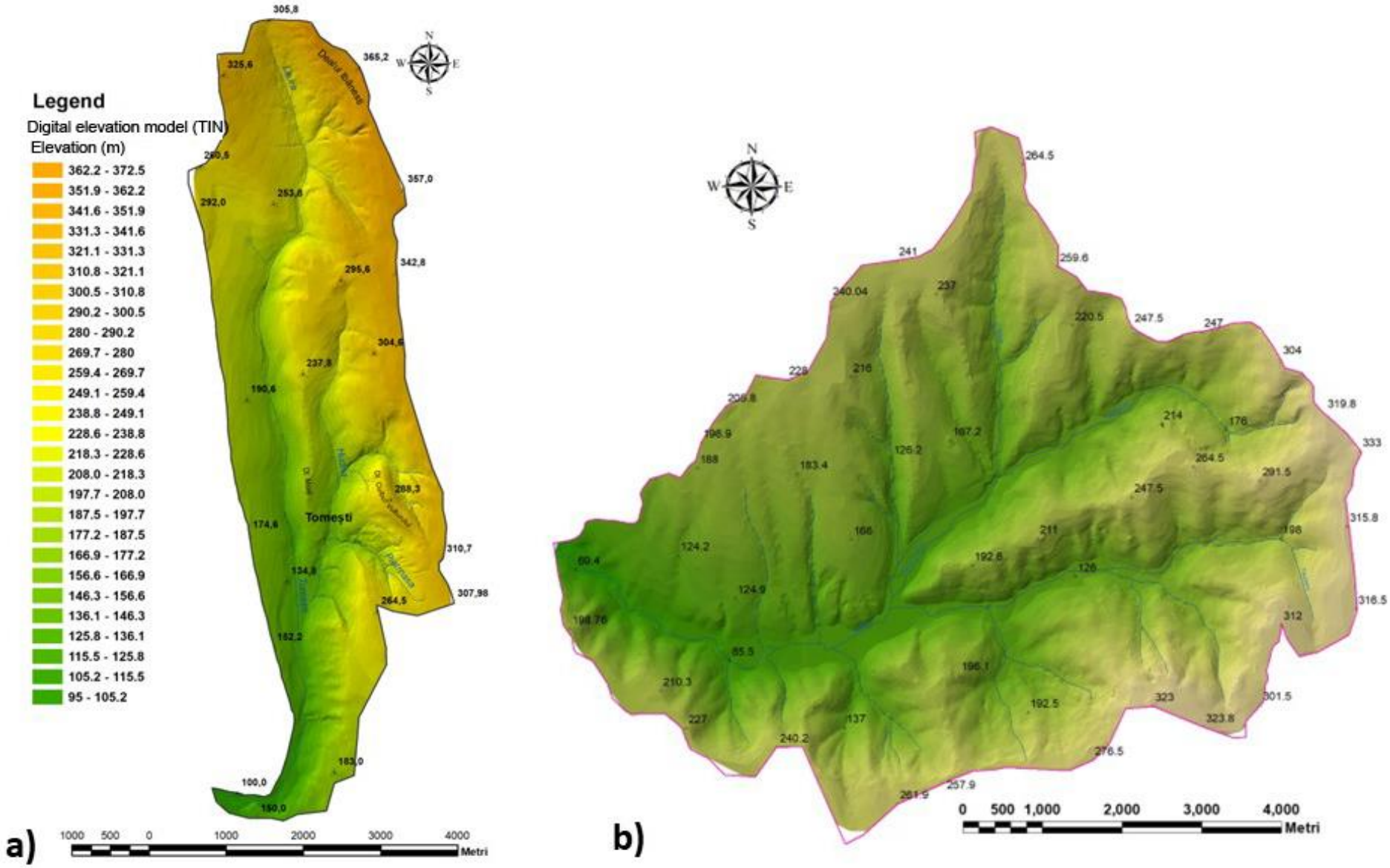

Figure 2. Digital elevation model TIN (Triangulated Irregular Network) of Tomești watershed and Trestiana-Conizoaia watershed (Barlad Tableland, Vaslui County)// Model digital de elevație TIN (Triangulated Iregular Network) al bazinului hidrografic Tomești și al bazinului hidrografic Trestiana-Conizoaia (Podis Barlad, județul Vaslui)

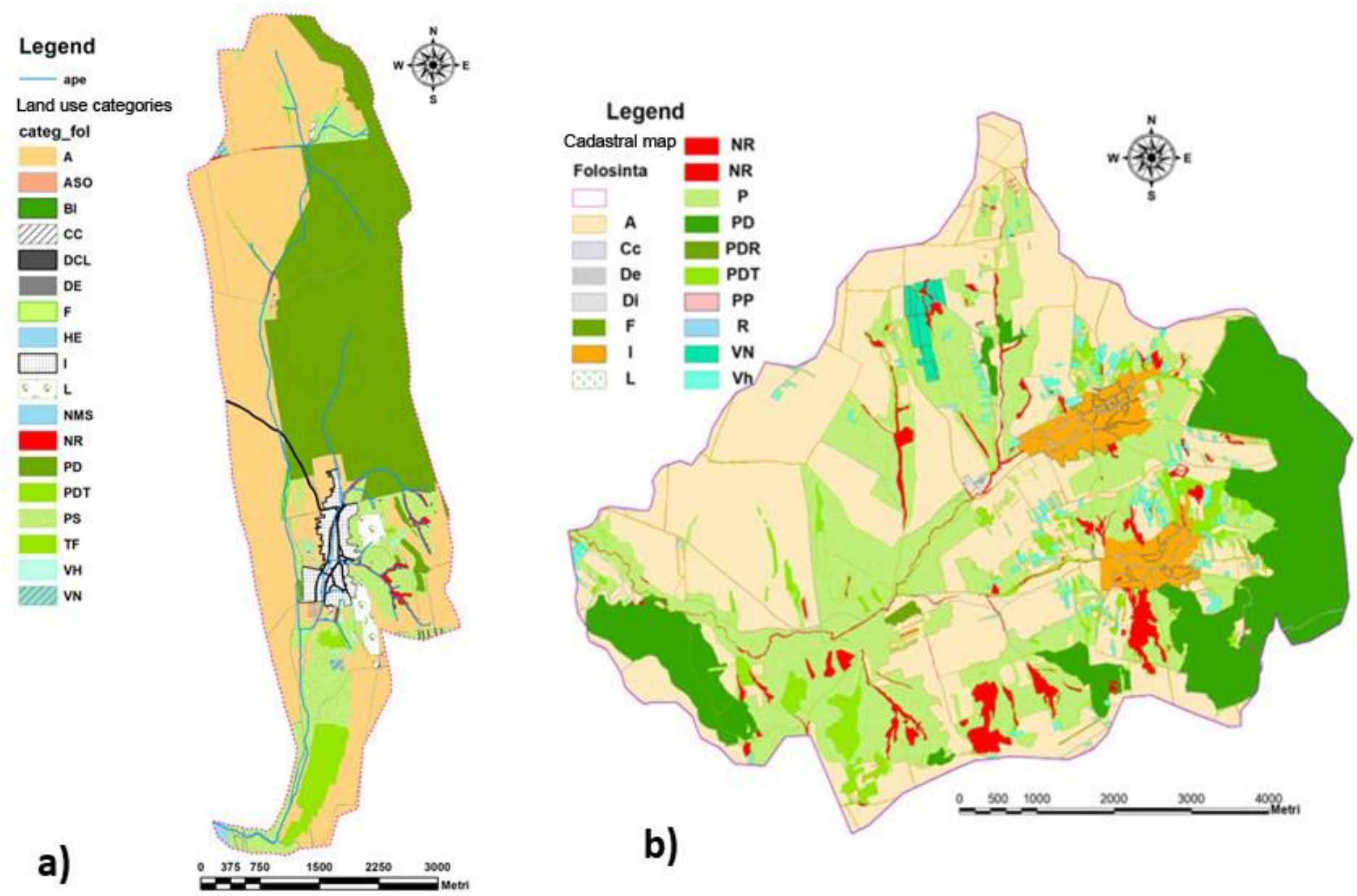

Figure 3. Cadastral maps of landuse categories in Tomeşti watershed and Trestiana-Conizoaia watershed (Bârlad Tableland, Vaslui County)// Hărți cadastrale ale categoriilor de folosință în bazinul hidrografic Tomești și Trestiana-Conizoaia

The digitization was done manually with the ArcGIS Editor program. During this operation, each level curve was assigned an altitudinal value, resulting in a vector layer, used in the actual realization of the numerical terrain model through the TIN (Triangulated Irregular Network) interpolation operation, which we believe reproduces the way more faithful to the relief forms, because it uses only the digitized elevation points, without rounding or embellishing the entered data in any way.

From figure 2, even at a simple examination it can be seen that the numerical model of the land, with this rather high resolution, obtained by interpolation using the TIN method, very faithfully recreates/reflects the relief of the land stripped of vegetation and any works human activities, allowing very easy and clear delimitation of forms of land degradation (erosion in depth and landslides).

Another particularly important stage in the creation of the Geographical Information System was the preparation of the cadastral map in digital format (figure 3 a and b and tables 1 and 2), which illustrates the categories of land use in the studied perimeter.

For this purpose, the most recent (1982-1983) cadastral maps, on a scale of 1:10,000, related to the areas of the five communes, were purchased from the Real Estate Registry and Publicity Office (OCPI) in Vaslui. Although at first sight the respective maps appear to be too old, they have proven to be particularly interesting and important for achieving the objectives of the project by reflecting the real situation before 1989, i.e. from the period that can be considered to be reference, because the maximum level of anti-erosion management of agricultural land had been reached, at a figure of almost two million hectares designed for anti-erosion. In addition to the grassy strips, from the map in figure 6, other elements of comparison can be extracted for which the cadastral maps used as a basis can be considered as a reference, such as:

- the situation of the vineyards and orchards of that period;
- the situation of forests and pastures;
- the situation of lands degraded by deep erosion (gullies) and/or landslides, which appear on cadastral maps as non-productive lands. In this sense, we can mention that these maps were not necessarily intended to reflect these degradation processes, but they can be considered to be extremely rigorous from this point of view, since the specialists who drew them up had to be very careful, instead, to the situation of the adjacent agricultural lands.

Inventory of gullies and landslides in the Tomești and Trestiana watersheds.

As part of this activity, we proposed to, first of all, carry out an inventory of the gullies and landslides in the two micro-watersheds. We must mention from the beginning that the problem of inventorying gullies and landslides is not as easy as it might seem, for several reasons:

- as Rădoane Maria, Ioniţă I., Rădoane N. have observed in several published works, regarding gullies there is a very large number (of the order of dozens) of definitions of these forms of deep erosion;
- both regarding the identification of ravines and landslides, there is a lot of subjectivity that results from the specifics of the activity or training of the specialists who do the identification (so, for example, the geomorphologist who knows the paleogeography or the geology of the area will be tempted to exaggerate the extent of the landslide phenomena and revenation, the military topographer is influenced by the imperatives of knowing the particularities of the land for military activities, and the cadastral surveyor is influenced by the constraints of the property regime or the categories of land use, etc.). For this reason, the results of the inventories differ, sometimes very much from one specialist to another;
- the degree of vegetation coverage, but especially the nature of the vegetation carpet, can sometimes be an indication of the geomorphology of the area (for example in the case of sliding crown/scarps, landslides or wooded gullies), but most of the time it is an obstacle to identification of gullies or landslides;

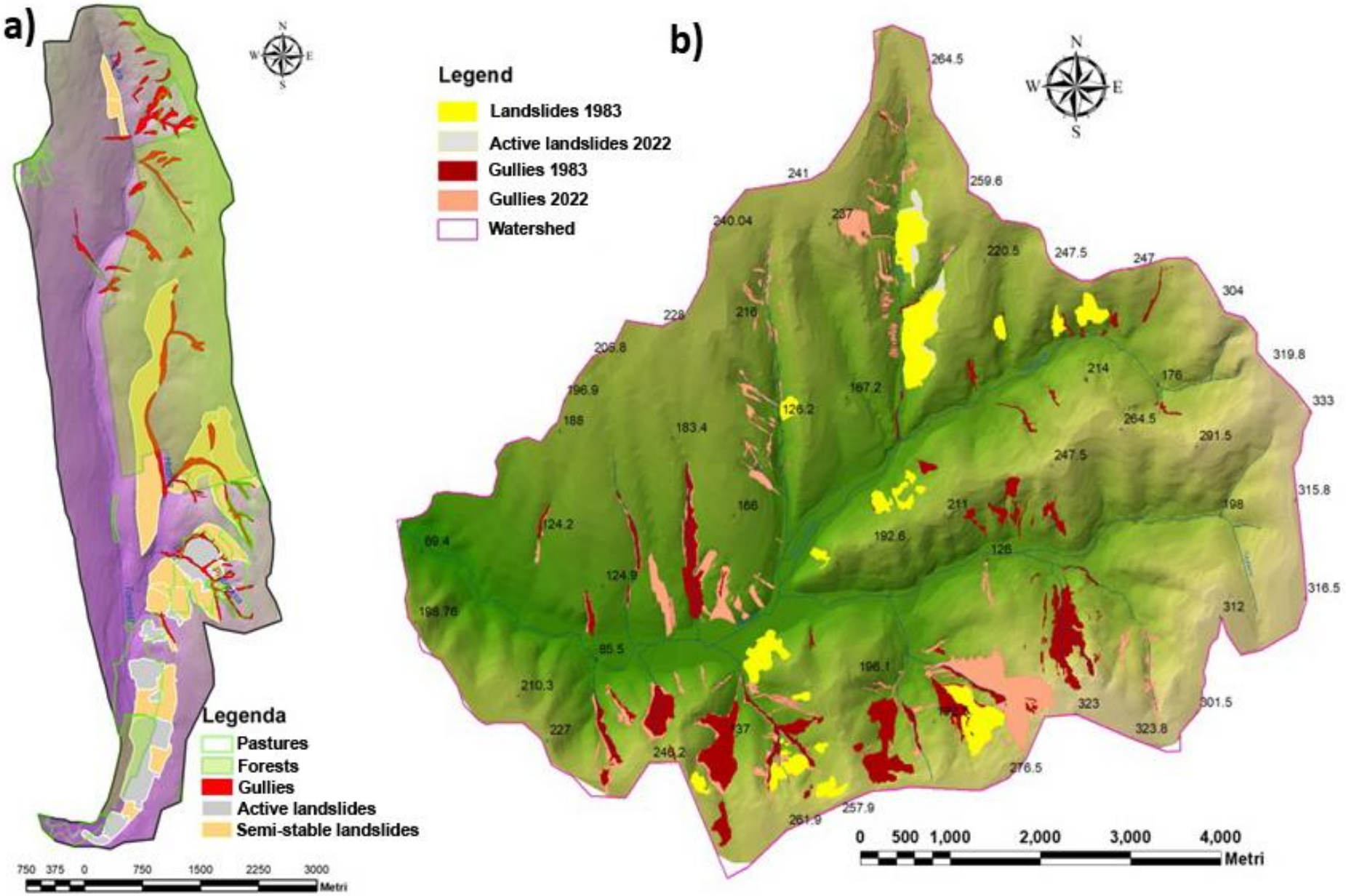

Figure 4. Gullies and landslides in 1982/83 and 2022 in Tomești and Trestiana-Conizoaia watersheds (Bârlad tableland, Vaslui County)// Ravene și alunecări de teren în 1982/83 și 2022 în bazinele hidrografice Tomești și Trestiana-Conizoaia (podisul Bârladului, județul Vaslui)

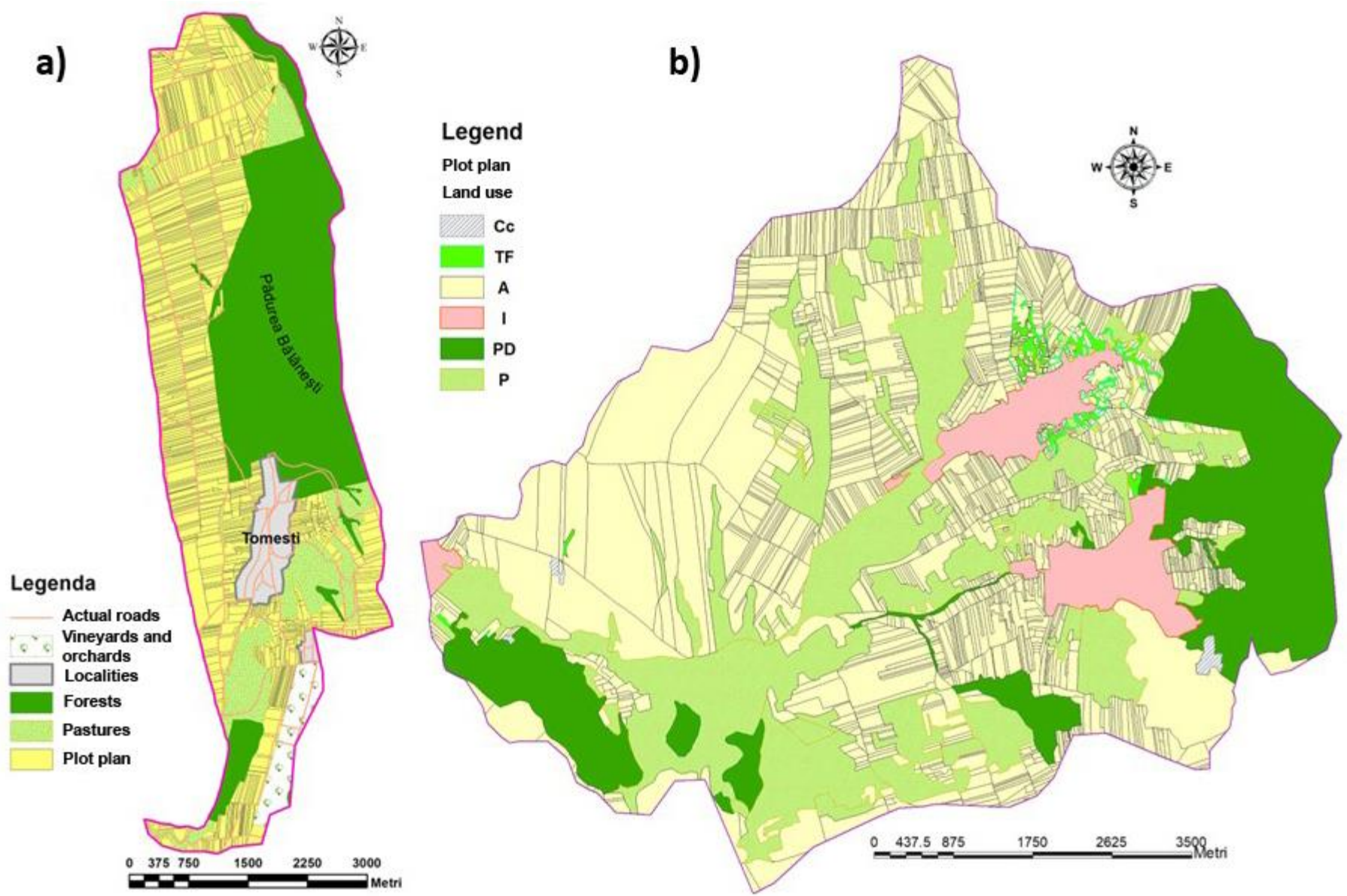

Figure 5. Actual Plot plans of Tomești and Trestiana-Conizoaia watersheds (Bârlad Tableland, Vaslui County)// Planuri parcelare actuale ale bazinelor hidrografice Tomești și Trestiana-Conizoaia (Podisul Bârladului, județul Vaslui)

- in the absence of detailed point-by-point measurements (generally unjustified or in any case very expensive due to economic and financial reasons in regional studies) of long duration regarding the dynamics (the speed of movement of the earth masses) of the processes of subsidence or sliding, the assessments regarding the current state of land degradation forms) active, semi-active, semi-stabilized, stabilized) are subjective.

For these reasons, among all the maps obtained from different documentary sources, we chose and used in the project the maps suitable for the intended purpose (establishing solutions for agricultural exploitation), using the information from geology-geomorphology and those from the cadastral maps and the own parcel plan (Figure 5, a and b).

The actual inventory was carried out by digitization on the basis of several documentary materials (topographical maps on a scale of 1:5,000, O.C.P.I. Vaslui from 1960, topographical maps on a scale of 1:25,000 drawn up by D.T.M., existing in the archive of the unit, edition 1982-1984, the cadastral plans related to the communes in the perimeter, on a scale of 1:10,000, purchased from OCPI Vaslui (1982-1983 – the most recent). All these were validated by field observations and measurements carried out with the Magellan Thales Z-Max.Net professional GPS equipment.

RESULTS AND DISCUSSION

From table no. 1 it can be seen that the main categories of land use in Tomești b.h. are: arable land (43.43% of the entire area of the watershed), forest (37.13%) and pasture (11.88%).

Table 1 . Landuse categories in Tomesti watershed, according to OCPI Vaslui cadastral maps from 1982-1983.// Categoriile de folosință în bazinul hidrografic Tomești, conform hărților cadastrale OCPI Vaslui din 1982-1983.

Crt. No.	Land use category	Area (ha)	Area (%)
1	Arable land	923.61	43,43
2	Grassed strips	0.30	0,01
3	Buildings	3.14	0,15
4	Communal road	6.46	0,30
5	Technological road	17.25	0,81
6	Fodder	3.11	0,15
7	Pool	5.61	0,26
8	Intravilan	63.99	3,01
9	Orchards	29.26	1,38
10	Swamp	1.16	0,05
11	Gullies	15.33	0,72
12	Forest	780.35	36,69
13	Young forest	9.28	0,44
14	Pasture	252.64	11,88
15	Bushes	5.39	0,25
16	Hybrid vineyard	9.92	0,47
	TOTAL	2126.80	100.00

In table no. 2 shows the situation of land use categories, expressed quantitatively in hectares, kilometers, or percentage, as the case may be. From table no. 2 it can be seen that the main categories of land use in B. h. Trestiana are: arable (44.08% of the entire area of the watershed), pasture (26.22%) and forest (16.25%).

Table 2 .Landuse categories in Tomesti watershed, according to OCPI Vaslui cadastral maps from 1982-1983.// Categoriile de folosință în bazinul hidrografic Tomești, conform hărților cadastrale OCPI Vaslui din anii 1982-1983.//

Nr. crt.	Categoria de folosință	Aria (ha)	Aria (%)
1	**Arable land**	**2,246.04**	**44.08**
2	**Pasture**	**1,336.01**	**26.22**

Nr. crt.	Categoria de folosință	Aria (ha)	Aria (%)
3	**Forest**	**828.24**	**16.25**
4	Intravilan	175.28	3.44
5	Young forest	154.11	3.02
6	Gullies	148.64	2.92
7	Hybrid vineyard	94.01	1.84
8	Technological Road	53.16	1.04
9	Noble vineyard	34.32	0.67
10	Intravilan road	17.29	0.34
11	Constructions	5.63	0.11
12	Fodder	2.46	0.05
13	Orchards	0.51	0.01
TOTAL		**5,095.7**	**100**

Tables 3 and 4 show some of the inventory data of ravines and landslides. In the perimeter of Tomești, 41 gullies were inventoried, whose channels occupy 71.71 ha, i.e. 3% of the area of the hydrographic basin.

Table 3. Summary of gullies inventory in Tomesti watershed in 2021// Rezumatul inventarului rigolelor din bazinul hidrografic Tomești în 2021

	No. Of gullies	Area (ha)	Length* (m)	Width** average/gully (m)	Depth** average/gully (m)	Width/ depth Ratio	Volume (m^3)
MIN		0.04	86,86	1.89	1,16	1.63	95,22
MAX		12.27	3,115,23	143.32	9,14	15.68	134,535,88
AVE-RAGE		1.75	552,87	9.45***	5,15	1.83	13,453,40
TOTAL	**41**	**71.71**	**22,667,78**				**551,589.41**
		3%	from/of Tomești watershed area.				

*Total length of channels - in the case of arborescent gullies, the total length of all tributaries.
**In military/topographic sense.
***Weighted average.

In table no. 3 we present some morphometric parameters of practical importance: the width and depth of the gully channels in a topographic and/or military sense (as they are inscribed in the form of that ratio on the topographic plans to see if they can be crossed on foot or with different vehicles), as and depth/width ratio. In table no. 3 I also introduced the morphometric index used in hydrology for the characterization of watercourse beds, calculated as the ratio between the width and depth of the ravine (Width to Depth Ratio).

The width/depth ratio is a key indicator for understanding the distribution of available energy in a channel and the ability of various discharges occurring in the channel to move, dislodge or transport sediment. Subunit values characterize loessoid terrains where narrow and deep ravines develop with rather vertical walls.

The unit values of the geomorphological indicator width/depth ratio would suggest that regardless of the morphometric dimensions, the cross-sections of the gullies remain approximately equilateral, a fact specific to predominantly sandy lands. The above-unit values indicate a predominantly clay substrate, due to which the ravines, in their evolution, extend laterally rather than in depth.

Determinations regarding the morphometric characteristics of gullies (especially width and depth), as well as those based on the width/depth index, especially in the case of so many ephemeral hillside gullies, are of great practical importance and are by no means just considerations descriptive, because the respective index allows the assessment of the impact of erosion in depth on the quality of agricultural lands and provides indications on the possibility/impossibility of overpassing them through ordinary works with the tractor, or not. The volume of soil and bedrock evacuated from the actual channels of the gullies was estimated at approx. 551,589.41 m^3.

Tables 4 and 5 show some of the inventory data of the gullies from the Trestiana watershed, where 193 gullies were inventoried, whose channels occupy 208.97 ha, i.e. 4% of the area of the hydrographic basin.

Table 4. Summary of gullies inventory in Trestiana watershed in 2022// Rezumatul inventarului rigolelor din bazinul hidrografic Tomești în 2022

	No. of gullies	Area (ha)	Length* (m)	Width** average/gully (m)	Depth** average/gully (m)	Width/ Depth Ratio	Volume (m^3)
MIN		0.02	11,30	3.46	1,38	2.50	
MAX		48,36	1,754.88	546,02	12.21	44.71	
AVERAGE		1,08	9.15	2,84***	0.07	4,06	
TOTAL	**193**	**208.97**	**54,441,65**				**98,820.15**
		4%	From/of Trestiana watershed area.				

*Total length of channels - in the case of arborescent gullies, the total length of all tributaries.
**In military/topographic sense.
***Weighted average.

From table no. 5 it can be seen that the number of ravines in Trestiana watershed increased in 2022 compared to 1983 from 123 to 193, which percentage means from 3.5 to 4.1% of the area of the hydrographic basin.

Table no. 5. Summary of gullies inventory in Trestiana watershed in the years 1983 and 2022// Rezumatul inventarului rigolelor din bazinul hidrografic Tomești în anii 1983 ți 2022

Category	Number / Count	Total area (ha)	(%) from total watershed
Gullies 1983	123	177.57	**3.5**
Gullies 2022	193	208.97	**4.1**

From table no. 6 it can be seen that the area affected by active landslides in 2021 is 95.74 ha, which represents 5% of the area of Tomești commune, and semi-stable landslides occupy 244.69 ha, which represents 12% of the area the watershed. In total, both landslide categories occupy 17% of the watershed area.

Table 6. Summary of landslides inventory in Tomesti watershed in the year 2021// Rezumatul inventarului alunecărilor de teren în bazinul hidrografic Tomești în anul 2021

Category	Number	Total area (ha)	(%) from total watershed	Minimum aria (ha)	Maximum area (ha)	Average aria (ha)
Active landslides	13	95.74	**4,5**	0.48	40,7	7.36
Semi-stable landslides	19	244,69	**12**	0.38	81,13	12.88
	32	**340,43**	**17%**			

According to our previous research (Hurjui C., 2001), in Vaslui county the area affected by landslides is 5.61%. In the perimeter of Tomești, the area affected by landslides (95.74 ha) is lower than the value for the county, namely 4.5%. However, the landslides identified by us as semi-stable are of equal importance when it comes to anti-erosion landscaping solutions and then the figure to be considered is 17%.

In figure 4a, where both gullies and landslides are represented, it can be seen that when gullies and landslides occur together, their action is the most destructive. That is why the area of the slope above the village of Tomești is the most spectacular and, curiously, has never been landscaped. In figure 4a, both the gullies and landslides, as well as the areas covered with pastures and/or forests, are represented, in order to be able to see to what extent the gullies and/or landslides are covered with protective vegetation.

From table no. 7 it can be seen that in 2022 the area affected by active landslides is 46.66 ha, which represents only 0.92% of the area of Trestiana. Considering the data on landslides from the year 1983 (23 in number with an area of 120.54 ha), this does not mean that the number of landslides has decreased/shrunk, but only that all those landslides inventoried for the year 1983 are currently semi-stabilized, as can also be seen from figure 4b and that only two are apparently active. In the centralizer of the data about the ravines in the Trestiana perimeter in 2022 (table no. 4) the much higher values of the width/depth ratio indicate the clayey nature of the geological substrate (even if we did not encounter relevant outcrops), a fact that explains the very large surface dimensions of of ravines, but also of

landslides and, at the same time, their superficiality. Therefore, it can be seen that such lands are maintained and exploited only as pasture.

Table 7. Summary of landslides inventory in Trestiana watershed in the year 2022// Rezumatul inventarului alunecărilor de teren în bazinul hidrografic Tomești în anul 2022

Category	Number	Total area (ha)	(%) from total watershed	Minimum area (ha)	Maximum area (ha)	Average area (ha)
Landslides 1983	23	120,54	**2,4**	0,225	30,63	5,24
Active landslides 2022	2	46,66	**0,92**	19,78	26,87	23,33

In the Trestiana perimeter, the area affected by landslides (95.74 ha) is lower than the value per county, namely 2.4% (1983 - 2022). However, the landslides identified by us as being semi-stable and shallow in terms of the depth of the sliding surfaces, have an equally great importance when it comes to anti-erosion management solutions, as they are, anyway, degraded lands.

Solutions for anti-erosion organization of agricultural lands in Tomești and Trestiana watersheds. Having accumulated all the information presented up to this point, it was possible to centralize the data from different sources and establish the anti-erosion management solutions for the agricultural lands in the Tomești and Trestiana watersheds (Figure 6 and tables no. 8 and 9). It was also necessary to draw up an individual parcel/plot plan for each micro-watershed by digitizing the plots apparently cultivated with the same crop, on orthophotoplans in a scale of 1:5,000, which we validated through discussions with farmers and local authorities (mayors) in during field visits. (figure 5 a and b).

The plot plans drawn up in the years 2021 and 2022 illustrate to a certain extent the current ownership structure of agricultural land, but especially the way in which agricultural land is worked.

Table 8. Actual and designed / provisioned landuse categories and anti-erosion works in Tomesti watershed // Categorii de folosinta a terenurilor actuale si proiectate/prevazute si lucrari antieroziune in bazinul hidrografic Tomesti

Land use category / work / measure	Existent on ANCPI cadastral maps, 1982 (m or ha)	Existent in 2021 (m or ha)	Designed/Provisioned (m or ha)
Grass strips	1,114 m	16,321 m	-
Forests	789.63 ha	791.27 ha	97.82 ha*
Forest protective belts	-	-	12.272 m
Pastures	252.64 ha	281.90 ha	-
Technological roads (earthen roads)	36,999 m	57,124 m	1,677 m**

* Afforestation is proposed to be carried out on degraded pastures.
** Roads proposed to be withdrawn into serpentines.

Table 9. Actual and designed / provisioned landuse categories and anti-erosion works in Trestiana watershed // Categoriile de utilizare a terenurilor actuale și proiectate/prevăzute și lucrări antieroziune în bazinul hidrografic Trestiana

Land use category / work / measure	Existent on ANCPI cadastral maps, 1982 (m or ha)	Existent in 2022 (m or ha)	Designed/Provisioned (m or ha)
Grass strips	2,874.65 m	2,182.33 m	7,109.00 m
Forests	828.24 ha	613.98 ha	73.58 ha*
Forest protective belts	623.46 m	623.46 m	13,750 m
Pastures	1,336.01 ha	2,159.08 ha	-
Technological roads (earthen roads)	83,822.00 m	79,873.00 m	2,403 m**

* Afforestation is proposed to be carried out on degraded pastures.
** Roads proposed to be withdrawn into serpentines.

The categories of anti-erosion works proposed (designed) belong to two groups:

a) larger-scale, more expensive structural works that require the intervention of the State or private economic-financial institutions, such as land improvement works, modeling works, landscaping of slopes with landslides, stabilization works of torrents, of gullies, etc., afforestation and even the planting of forest protection belts;

b) smaller-scale, less expensive works that are within the reach of farmers (administrators of commercial companies with an agricultural profile), such as: correction/modelling of torrents, streams, ogashes,

stabilization by various techniques of the banks and bottoms of gullies, tracing/drawing (with the help of specialists such as those from SCDCES "MM" Perieni) grassy strips to separate the strip crops, establishing grassed waterways along the valleys or ogashes, correcting some routes of roads for agricultural exploitation, etc.

CONCLUSIONS

1. The main categories of land use in B.h. Tomești, according to the cadastral map, are: arable land (43.43% of the entire area of the basin), forest (37.13%) and pasture (11.88%).
2. In the perimeter of Tomești, 41 gullies were inventoried, whose channels occupy 71.71 ha, i.e. 3% of the area of the hydrographic basin.
3. The area affected by active landslides in 2021 was 95.74 ha, which represents 5% of the area of Tomești district, and semi-stable landslides occupy 244.69 ha, which represents 12% of the area of the basin. In total, both landslide categories occupy 17% of the basin area.
4. After analyzing all influencing factors, within the anti-erosion organization solutions of the territory, the following were proposed/designed for b. h. Tomești:
   - Afforestation of areas totaling 97.82 ha instead of degraded pastures;
   - Drawing and planting protective forest curtains in a total length of 12,272 m linear meters;
   - The re-drawing of technological roads from their current form, to serpentines, in a total length of 1,677 linear meters.
5. The main categories of land use in. Trestiana watershed, according to the cadastral map, are: arable land (44.08% of the entire area of the basin), pasture (26.22%) and forest (16.25%).
6. In 2022, a number of 193 gullies occupy an area of 208.97 ha, i.e. 4.1% of the area of Trestiana watershed, and a number of 25 landslides (23 semi-stabilized and identified since 1983 and two apparently active in 2022), occupies an area of 167.20 ha, i.e. 3.3% of the area of b. h. Trestiana. Gullies and landslides occupy a relatively large area, but are shallow.
7. The area covered by forests decreased drastically (!) in Trestiana watershed, from 828.24 ha (16.25%), to 613.98 ha (12.05%);
8. The area covered with pastures increased from 1,336.01 ha (26.22%) to 2,159.08 ha (42.37%).
9. The terrains in the arable land category comprise a number of **1,728 parcels/plots (high fragmentation)**, each with an **average area of 1.21 ha** and are oriented in the hill-valley direction. The area of arable land decreased from the beginning of the 80s to the present, from 2,246.04 ha (44.08%), to 2,082.28 ha (40.86%), in favor of the so-called pastures, which the researchers westerners call them **abandoned lands**.
10. After analyzing all influencing factors, within the anti-erosion organization solutions of the territory, the following were proposed/designed:
    - Tracing/drawing/laying and/or rehabilitating grass strips in length of 7,109.00 linear meters;
    - Afforestation of areas totaling 73.58 ha instead of degraded pastures;
    - Drawing and planting protective forest belts in a total length of 13,750.00 linear meters;
    - The re-drawing of technological roads from their current form, to serpentines, in a total length of 2,403.00 linear meters.

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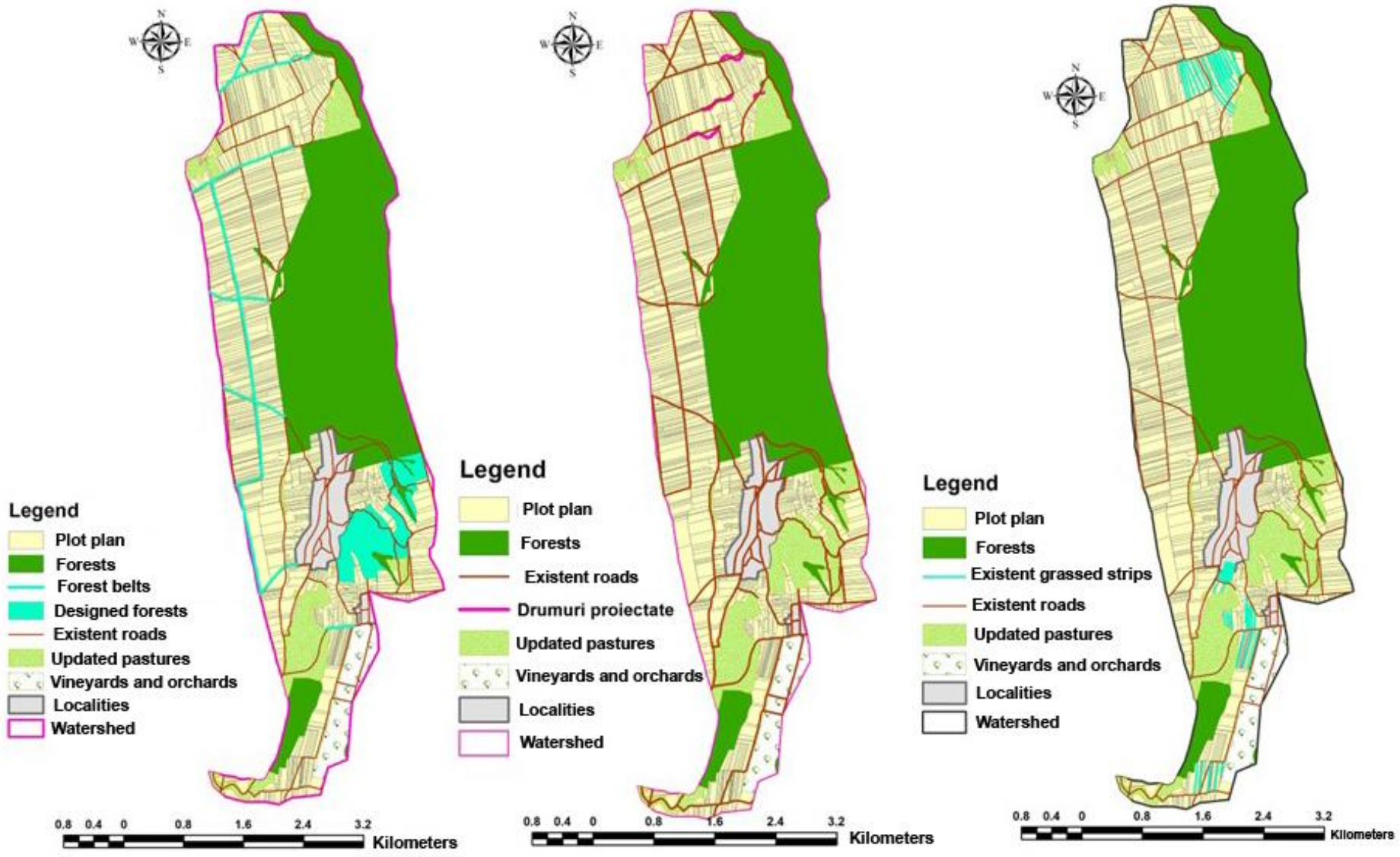

Figure 6. Actual and designed / provisioned landuse categories and anti-erosion works in Tomesti watershed.// Categorii de folosinta a terenurilor actuale si proiectate/prevazute si lucrari antieroziune in bazinul hidrografic Tomesti

ASPECTS OF WEED CONTROL IN WHEAT CROP
ASPECTE ALE CONTROLULUI BURUIENILOR DIN CULTURA GRÂULUI

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Summary
The study of the relationship between wheat and weed species is important in finding out the measures by which the competition can be reduced. Fighting only with herbicides gradually lost its importance due to the new requirements for agriculture, due to the accumulation of noxes in the soil. The luvosol contains large amounts of weed seeds reserves, and their biomass from wheat was on average 6.7 t/ha. Weed development can be stopped, not by eradication, but at levels where crop losses no longer occur. Herbicides used in wheat crop gave good results after April-May. The dose reduction in the wheat crop will be done gradually, with care, namely 25% for 2,4-D acid and 25-50% for chlorsulfuron. Late application of hormones is very critical because it is possible to destroy grain production (Ionescu, 2000). Further research is needed for other herbicides. In wheat, herbicides reduced the degree of coverage (GA) from 60% to 24%, and wheat production increased by approx. 1-2 t/ha. SU type products have a very good control over weeds, due to their broad spectrum.
Key words: *weeds, wheat, herbicides, luvosol environment, selectivity*

Rezumat
Studiul relaţiei dintre grâu şi speciile de buruieni este important în aflarea măsurilor prin care se poate reduce competiţia. Combaterea numai prin erbicide şi-a pierdut treptat din importanţă datorită noilor cerinţe pentru agricultură, datorită acumulării noxelor în sol. Luvosolul conţine cantităţi mari din rezervele de buruieni, iar biomasa acestora din grâu a fost în medie de 6.7 t/ha. Dezvoltarea buruienilor poate fi stopată, nu prin eradicare, dar reducerea la nivele la care nu mai au loc pierderi de recoltă. Erbicidele folosite în grâu au dat rezultate bune după perioada aprilie-mai. Reducerea dozelor în cultura grâului se va face treptat, cu grijă şi-anume de 25 % la acidul 2,4-D şi 25-50 % la chlorsulfuron. Aplicarea târzie a insecticidelor hormonale este foarte critică deoarece este posibilă distrugerea producţiei de boabe (Ionescu, 2000). Pentru alte erbicide sunt necesare cercetări în continuare. În grâu erbicidele au redus gradul acoperire (GA) de la 60% la 24%, iar producţia de grâu a crescut cu cca 1-2 t/ha. Produse de tip SU au un foarte bun control asupra buruienilor, datorită spectrului larg al acestora.
Cuvinte cheie*: buruieni, grâu, erbicide, mediul luvosolului, selectivitate*

INTRODUCTION

Winter wheat, a crop considered "dense", with a high degree of soil coverage, gives the image of a slightly lower annual weeding degree, of course in comparison to fallow plants, like "rare". In appearance, things are like this, but if we analyze the state of wheat weeding through its structure, some important aspects can be found, which every farmer should take into account. The species, both annual and perennial ones that make up the floristic spectrum, are characteristic of wheat. It is considered that the vegetation period of wheat is relatively long (autumn wheat covers practically all 4 seasons of the year). During this time, unwanted species sprout at a very diverse level, as follows: some weeds are specific for autumn, others for spring, others for autumn-spring, and others for early summer (Anghel, 1972). The particularly high virulence of some dicotyledonous species on wheat is also taken into account, then the resistance to varying degrees of some species to some herbicides, etc.

Considering these various and very important aspects, it is considered that even for the winter wheat crop, the best results in reducing the degree of weeding are obtained by accepting and promoting the integrated management of weeds (MIB) (Şarpe, 1983; Barberi, 2002). Regardless of the wheat cultivation area, the appearance of certain weed species can be observed even around the emergence of crop plants. In these autumn conditions, with the gradual decrease in the length of the day and the temperatures, both the installation and the coexistence between the wheat plants and the autumn weeds take place. The degree of infestation in this period of the year with autumn weeds, as

well as with walking weeds, can be from a relatively low one (here crop rotation plays an important role) to a very high one (in the case of monoculture). However, in the autumn period, a real danger of affecting the wheat crop cannot be appreciated, because with the appearance of negative temperatures, some sprouted weeds are destroyed.

The spring period is considered the most critical for autumn wheat, because the degree of weeding in late spring produces the most obvious influences of weeds on the physiology and morphology of wheat plants (Berca, 1994; Auld, 1996; Ionescu, 2000). In order to avoid the concrete damage that weeds cause to wheat, the most appropriate herbicides will be chosen and applied. The best time to apply the active ingredients is when "wheat is at the end of twinning and beginning of rooting, and the weeds are at the rosette stage" (Sharpe, 1983). In the course of several decades, a multitude of herbicides specific to the floristic spectrum of the autumn wheat crop, as well as different periods of application, have been obtained and used. Very diverse and complex research carried out both in other parts and in our country, highlighted the best strategies, of interweaving with chemical and non-chemical means (mainly cultural methods). Their goal was to reduce the levels of weeding to the lowest possible levels, to increase productivity, to reduce the cost price per unit of product: mainly grains and secondary straw. In the new conditions, to protect the agricultural environment and to ensure its sustainability (for the recent and long-term perspective), the application of new rules, also valid for winter wheat, is required (Altieri, 1995).

Currently, the idea is accepted that for the concrete development of an appropriate MIB for each agricultural area, experiments as diverse as possible, of an ecological, physiological, morphological etc. View point are necessary. namely for each method considered as the best for reducing the degree of weeding. This paper presents a series of results obtained through ecology and weed control studies characteristic of the Luvicsoil in the south of the country. From their presentation, it is hoped that for the present and the future, wheat culture will be included in new European parameters.

MATERIAL AND METHOD

In one of the multi-year studies several series of researches were carried out which generally included aspects of winter wheat weeding. Thus, on the one hand, weed species from the categories: annual dicots, perennial dicots and annual monocots were quantitatively determined. Perennial monocots were present sporadically and mostly in the form of small, dispersed and irregular hearts. Based on the data obtained from the weeds that accompanied the wheat annually, the correlation was established between the degree of coverage of the unwanted vegetal carpet and the losses of useful wheat production. Another direction of research refers to how the high degree of infestation influenced the growth and development of wheat plants. The analyzed variants were placed at the beginning of the experiments, namely as untreated controls within the experiments with herbicides established for the entire national network by the Fundulea Institute, including in Pitesti.

Another specific researched direction refers to the exclusive use of chemical methods - with the help of herbicides, to reduce the degree of weeding, but also to protect the soil and wheat plants. Of course, after a relatively large number of years (about 5-6 decades), permanent improvements were found - both from the companies, but also from the researchers in the field, so that the practitioners had and have at their disposal the most modern, effective and cheap variants that can be very easily adapted to specific situations in own soils cultivated with winter wheat. In separate experiments, several herbicides were studied - classical, but also promising, with the aim of addressing the new EU issue of reducing herbicide doses, regardless of the active substance, the crop and the European area. In the present case, in wheat, several lower proportions were experienced for two herbicides: 2,4-D acid (a hormonal herbicide) and chlorsulfuron (SU). The experimental variants were placed in the station's research field, according to the Latin rectangle method, in 4 repetitions, with a surface area of 25 m^2 each.

The plant samples (weeds and wheat) were collected in the different moments of the vegetation, as well as in the maturity phase with the metric frame, from all repetitions. The dry

substance was obtained each time by oven drying, according to the common method (Clawson), 6-8 hours at 105^0C. The statistical processing was done by the variance analysis method (Anova test), and the Excel program was used to express the average data. The varieties of wheat used were different from year to year, but in the vast majority of them the creations of the station prevailed, namely: Albota and Trivale.

RESULTS AND DISCUSSION

Considering the specific degree of competition of wheat with weeds, especially in the early moments of the spring vegetation, it was considered appropriate to study its infestation with specific species, in the natural conditions of the luvosol eco-environment. From the multitude of species present in a crop area (Anghel, 1972), most of them usually cause obvious damage (Rusu, 2010) to wheat. The interaction between the two camps: wheat and the vegetal carpet, can be studied either separately depending on a chosen weed, or a close botanical group of weeds, or for the whole unwanted vegetal carpet (Mortensen, 2000). When considering the means of weed control in a crop, it is preferable that the weeding be considered primarily as a whole.

Natural weeding of the wheat crop. From the respective experiences, all the present species were harvested in the final phase, namely with the metric frame. After they were all weighed together, a separation was made into three categories: DA- annual dicots, DP- perennial dicots and MA- annual monocots. The way the weeds in the untreated control evolved quantitatively is shown in figure 1. The graph shows that the weeds had quite different annual values in terms of quantity. The smaller amounts were obtained on the drier climate, while the higher amounts, over 8-10 t/ha s.u. they were formed in wet, favorable years. The annual structure between the three categories of weeds was also different, fluctuating, demonstrating the variability of appearance, the evolution of their vegetation in relation to the degree of interspecific competitiveness (Sagar, 1968; Wilson, 1998; Christensen, 2009) and what ultimately results. The structure shows the dominance of annual dicotyledons constantly represented by: *Matricaria inodora, Galeopsis tetrahit, Centaurea cyanus, Viola arvensis*.

The perennial dicotyledons, permanently present in the wheat vegetation, as well as in the final phase - at harvest, were represented by *Cirsium arvense*, *Sonchus arvensis* and *Convolvulus arvensis*. The annual monocots of the type: *Echinochloa crusgalli, Digitaria sanguinalis, Setaria glauca*- as dominant, appeared towards the end of the wheat vegetation and only on the background of the penetration of sunlight among the almost ripe (mature) wheat plants.

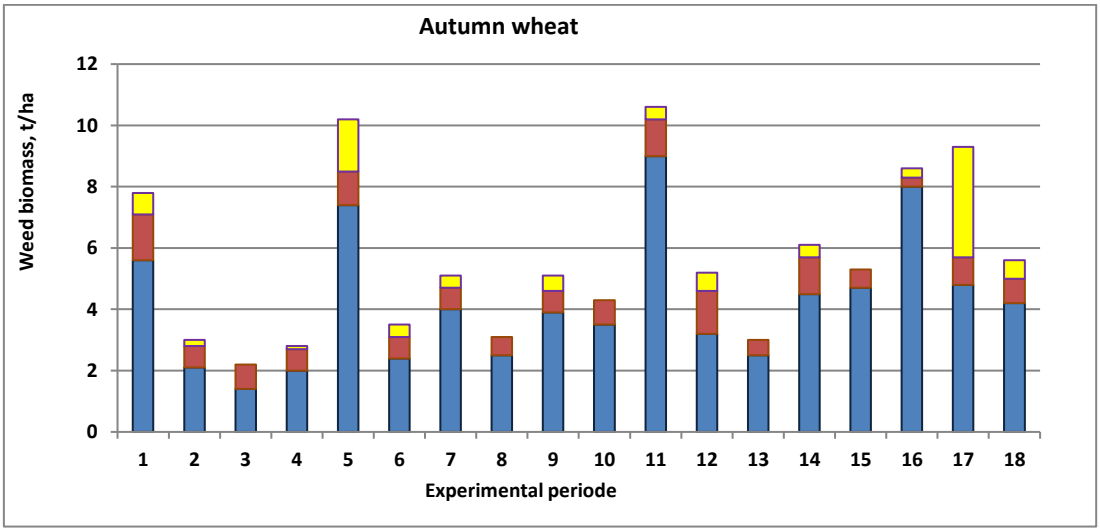

Figure 1. Weeds biomass evolution in time: blue - AD, red - PD, yellow - AM] // Evoluţia biomasei buruienilor în funcţie de categoria botanică: (albastru- dicotile anuale; roşu- dicotile perene; galben- monocotile anuale

[

A direct relationship was established between the degree of weeding of the weed complex and the production of wheat grains obtained depending on the different degrees of weeding (figure 2). From the graph it can be seen that if the weeds formed between 0.5 and 1 t/ha s.u., the damage started to be clearly highlighted. At higher amounts of weeds: between 5 and 7 t/ha wheat production was drastically reduced, to below 1 t/ha s.u. grains.

The impact weeds that appeari both in autumn and especially in spring can produce on wheat (Wilson, 1998), is shown below (Figure 3). The average rate of accumulation shows delays, it takes place at much lower values, and the period of deposition of nutrients in the grains has been reduced.

Overall, average natural wheat weeding reduced biomass accumulation to about one-third (1/3) of normal.

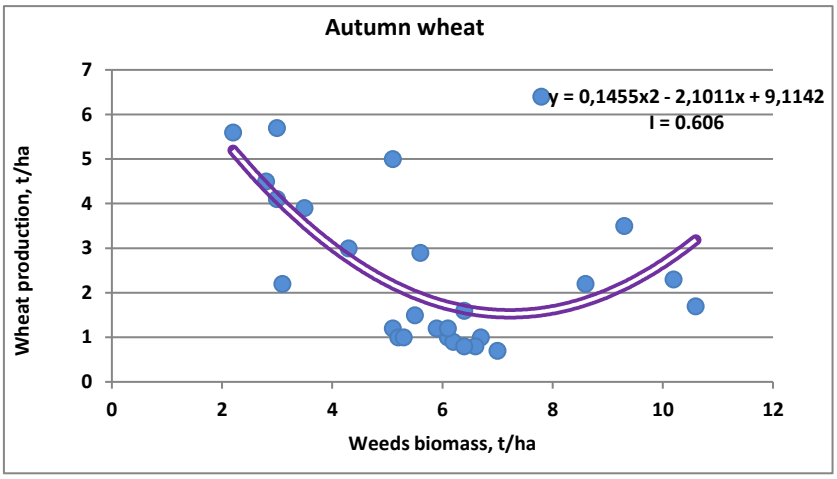

Figure 2. Relationship between weeds biomass and wheat loss of yield// Relaţia dintre gradul de îmburuienare şi pierderile de producţie la grâul de toamnă

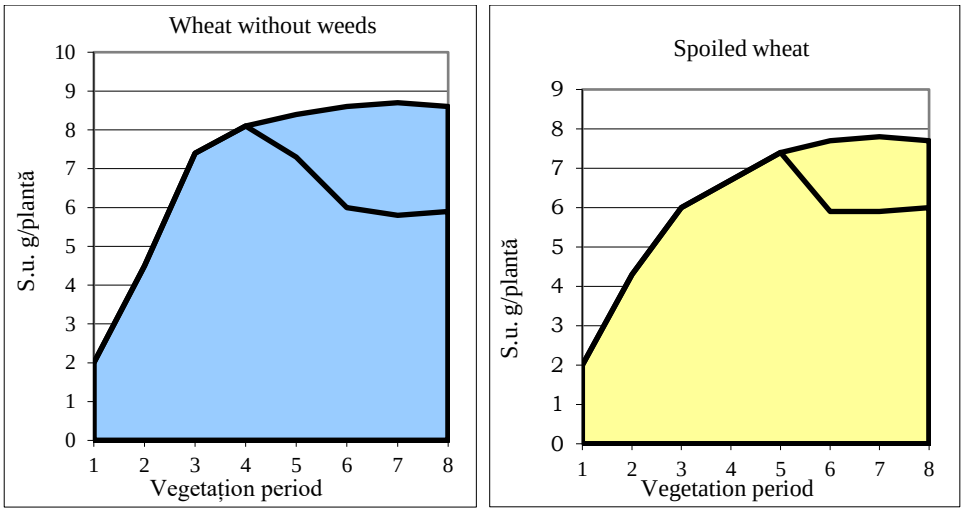

Figure 3.Diagrams of wheat plant biomass formation, without weed competition (left) and under condition of weed encroachment (right) // Diagramele formării biomasei plantei de grâu, fara concurenţa buruienilor (stânga) şi în condiţii de îmburuienare (dreapta); (1-2= aprilie, 3-5= mai, 6-8= iunie)

Chemical methods to reduce the degree of weeding in wheat culture. As is known, currently there is a veritable arsenal of wheat-specific herbicidal active substances, characterized by high degrees of effectiveness and selectivity. Both the companies in the field and the research can offer the best and appropriate options for weed control in the wheat culture. The specialized European Commission accepted some products applied to the crop to be reduced as much as possible. In our country, too, some variants of reducing herbicides on wheat have been tried, with little conclusive results. In the present example (figure 4), the effectiveness of two treatments in different doses is presented: 0- without herbicide, 25%, 50%, 75% and 100% of the normal doses. The evolution of the effectiveness expressed by GA of no controlled weeds demonstrates that wheat can be dispensed with

in the case of 2,4-D acid, but only in certain special conditions of reduced weeding as a result of a very successful agrotechnical crop, at the recommended dose, at 75% of this, while with chlorsulfuron, in the same special agri-technics successful conditions, the dose can sometimes be reduced by 25-50%. Research of this kind is promising and will have to be carried out in as many weeding conditions as possible and in as many ecological areas as possible.

Another aspect that is not yet fully clarified refers to the timing of herbicide application in the winter wheat crop. The researches carried out everywhere with herbicides - especially hormonals ones, but also with different varieties, have highlighted the danger of physiological damage to wheat plants and especially to the ear when the respective application is made in advanced phases of the vegetation, around the earing of the wheat. In the conditions of the season, it is true that only in the years when nature sensitized the plants, the hormonal herbicides of the 2,4-D acid type together with dicamba (figure 5), demonstrated approximately the destruction of grain production.

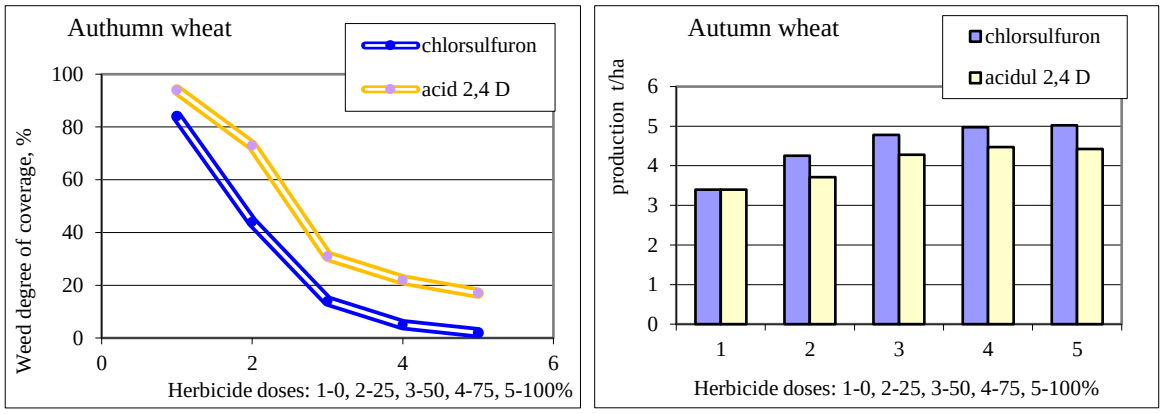

Figure 4. The efficacy of specific herbicides function of different doses, in winter wheat crop// Eficacitatea erbicidelor specifice grâului în funcție de doza aplicată

The data obtained over several years demonstrate the fact that herbicides used appropriately in wheat culture have led to very favorable results in reducing the degree of weeding specific to luvicsoil. Thus, the grain production gained as a result of the herbicide increased by about 15%, while the final degree of coverage (GA) with the unwanted vegetation decreased from about 60% (multiannual average), to about 14-18% (figure 6).

Through a comparison between the different chemical methods (herbicides), both more classic and newer, slight differences were found (figure 7). The differentiation took place as a result of the fact that new products, such as those in the SU class (sulfonylureas), have a wider spectrum of dicotyledonous control (DA and DP). Some of the SUs, as in the case of chlorsulfuron, ensure safe environment, combating both through plants and through the soil.

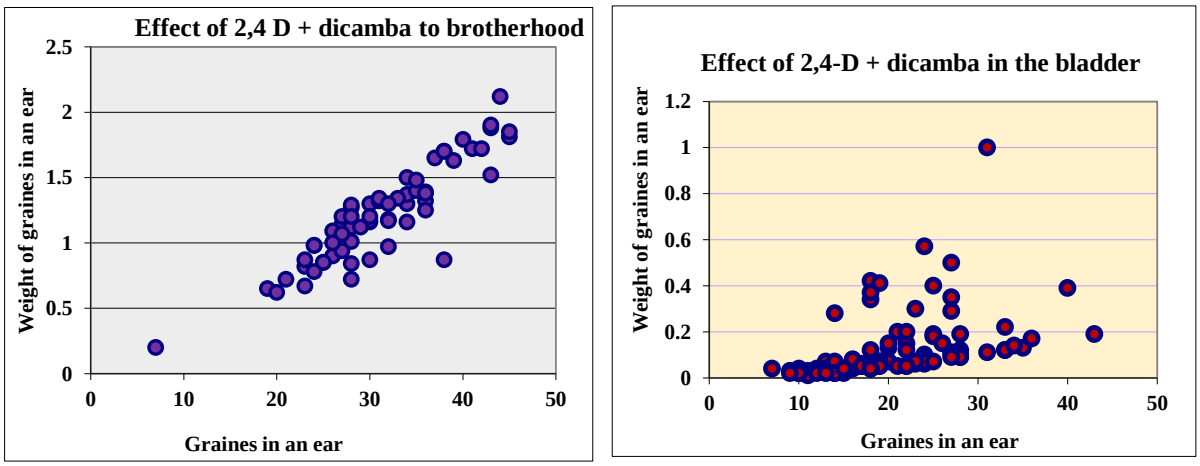

Figura 5. Correlations between grains number and grains weight from wheat treated with herbicide 2,4-D + dicamba, late application // Corelații între numărul și greutatea medie aboabelor (g) din spicul mediu de grâu prin aplicarea târzie a erbicidului 2,4-D+dicamba

Water regime and weeding. In a study over several years, the correlation of the total bimass of weeds was analyzed in this area where the rainfall regime is quite high, including during the wheat vegetation period (figure 8). The graph clearly shows the connection between the rains that fell on the wheat vegetation and the unwanted biomass formed.

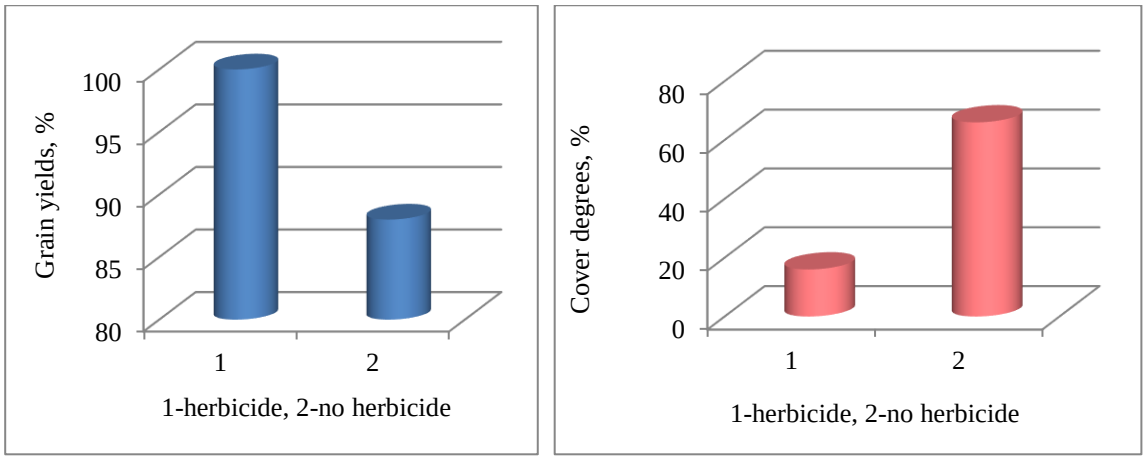

Figure 6. The herbicide efficacy by wheat grain yields and by covered degrees of weeds at harvesting // Influența erbicidării asupra producției de boabe de grâu și asupra gradului de acoperire a buruienilor, la recoltare

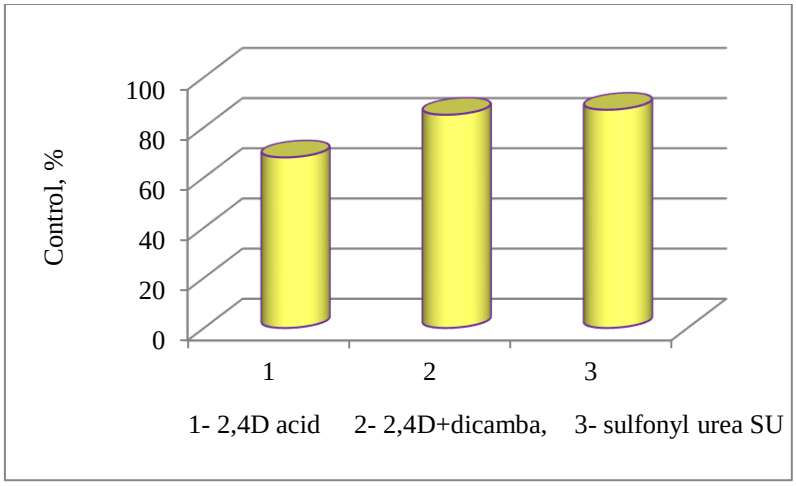

Figure 7. The weeds control degrees from wheat crop with differing herbicides// Gradul de combatere al buruienilor din cultura grâului cu diferite erbicide

CONCLUSIONS

1. Wheat is weeded every year with characteristic species, at levels considered to be moderately high. The main causes are: the high reserve of seeds in the soil and the relatively low power of wheat to compete with weeds. The multi-year study of natural weeding, however, resulted in fluctuating biomass values due to climatic causes - drought or rainy regime. The limits between which the total biomass of weeds was located were 2.1 t/ha dry weight and 11.0 t/ha dry weight.
2. The structure of the weeds was as follows: 75% annual dicotyledons - very competitive with wheat, 16% perennial dicotyledons and 9% annual monocotyledons, out of a multiannual average of 6.7 t/ha dry weight. With this structure, it was expected that the production loss of wheat grains would be approximately at relatively low levels.
3. Chemical control of weeds through appropriate herbicides achieves very good protection resulting in a clean field until harvest. In the crop dense by wheat, weeds can appear later, usually through reinfestations, as in the case of sweet chamomile, but from an economic point of view, they no longer cause significant damage. Towards the maturity of wheat, annual monocots also appear.

4. The problem of reducing herbicide doses is current and requires new experiments, in as diverse ecological conditions as possible. From the data obtained so far in the station, it was found that the researched products protected the wheat against weeds, in slightly smaller doses, namely with only 25-rare 50% reduction as compared to the normal (legal) doses.
5. Regardless of the option of the method - chemical, cultural, biological etc., it will be considered to reduce the weeding of the wheat crop to the levels where economic damages are no longer produced. This recommendation was accepted in cases where it is no longer necessary to eradicate all weed species, namely for reason of preserving biodiversity in agricultural fields.

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THE VARIATION OF SOME MORPHOLOGICAL CHARACTERISTICS OF THE A.50-15 WHEAT LINE UNDER CURRENT CLIMATE CONDITIONS

VARIAȚIA UNOR CARACTERE MORFOLOGICE ALE LINIEI DE GRÂU A.50-15 ÎN CONDIȚII CLIMATICE ACTUALE

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Rezumat
The morphological characteristics expressed in different climatic conditions, and especially those of drought, could be used in the progress of the improvement of the new lines and varieties of winter wheat. The wide genetic dowry and growing conditions of wheat usually lead to the characteristic expression of plant morphology in close connection with periods of drought. In the last three years, the A.50-15 line has encountered different situations, namely from the most favorable to the drought. Thus, the year 2019 was more favorable from a climatic point of view, the year 2020 was the most favorable environment, and the year 2021 the least favorable. Against this diverse background of ensuring the amounts of precipitation, morphological characteristics of the plants of this new line were manifested specifically. Thus, the dimensions of the straw were expressed relatively evenly in the three years, the dominant ones being those at 60-65 cm. The thickness of the straw at the base was 3 mm in the second year (2020), compared to the other two years, by 3.5-4 mm. The length of the ear had a dominant value of 8.5 cm in the favorable year and 8 cm in the two less favorable years. The weight of the ear expressed the modal value at 4 g in the first year, while in the other two years it stood at 2-2.5 g. The number of grains in the ear had the modal value at 75 in the first year, being 30 grains higher. much more than the other two years. The weight of the grains in one of their ears was dominant at 3 g in the first year and at 2 g in recent years. The number of spikelets dominated at 19 in the years with drought effect and 21 in the favorable year. The aristas had dominant lengths of 7-8 cm in all three years. The grain length was 7 mm in the dry years and 6.5 in the more favorable year. The thickness of the grain was similar to 3 mm, with a slight tendency to increase in the favorable year. The mass of a thousand grains dominated by 38 g in 2020 and 42 g in the other two years. The correlations obtained between all the determined morphological characters demonstrated specific variability both by very significant positive and by negative values in all three degrees of significance. However, very close positive links show a relatively high level of adaptability of this new wheat line to the changing climate. The statistical indices of the studied morphological characters demonstrated, especially those with productive justification, at average values of the coefficients of variation, namely between 10% and 20%. These aspects in fact demonstrate the good adaptability to these climatic conditions with more and more obvious accents of drought.
Keywords**: **grains, spike, spikelets, variability, wheat

Rezumat
Caracteristicile morfologice exprimate în diferite condiții climatice, și în special cele de secetă, ar putea fi utilizate în progresul ameliorării noilor linii și soiuri de grâu de toamnă. Zestrea genetică largă și condițiile de creștere ale grâului conduc de obicei la expresia caracteristică a morfologiei plantelor în strânsă legătură cu perioadele de secetă. În ultimii trei ani, linia A.50-15 a întâmpinat situații diferite, și anume de la cele mai favorabile secetei. Astfel, anul 2019 a fost mai favorabil din punct de vedere climatic, anul 2020 a fost cel mai favorabil mediu, iar anul 2021 cel mai puțin favorabil. Pe acest fundal divers de asigurare a cantităților de precipitații s-au manifestat în mod specific caracteristicile morfologice ale plantelor acestei noi linii. Astfel, dimensiunile paiului s-au exprimat relativ uniform în cei trei ani, cei dominanti fiind cei de la 60-65 cm. Grosimea paiului la bază a fost de 3 mm în al doilea an (2020), față de ceilalți doi ani, cand a avut 3,5-4,0 mm. Lungimea spicului a avut o valoare dominantă de 8,5 cm în anul favorabil și 8 cm în cei doi ani mai puțin favorabili. Greutatea spicului a exprimat valoarea modală la 4 g în primul an, în timp ce în ceilalți doi ani a fost de 2,0-2,5 g. Numărul de boabe din spic a avut valoarea modală de 75 în primul an, fiind cu 30 de boabe mai mare, mult mai mult decât în ceilalți doi ani. Greutatea boabelor într-unul dintre spicele lor a fost dominantă la 3 g în primul an și la 2 g în ultimii ani. Numărul de spiculete a dominat la 19 în anii cu efect de secetă și 21 în anul favorabil. Aristocrații au avut lungimi dominante de 7-8 cm în toți cei trei ani. Lungimea boabelor a fost de 7 mm în anii secetoși și de 6,5 mm în anul mai favorabil. Grosimea bobului a fost similară cu 3 mm, cu o ușoară tendință de creștere în anul favorabil. Masa a o mie de boabe a dominat de 38 g în 2020 și 42 g în ceilalți doi ani. Corelațiile obținute între toate caracterele morfologice determinate au demonstrat variabilitate specifică atât prin valori pozitive foarte semnificative, cât și prin valori negative în toate cele trei grade de semnificație. Cu toate acestea, legăturile pozitive foarte strânse

arată un nivel relativ ridicat de adaptabilitate a acestei noi linii de grâu la schimbările climatice. Indicii statistici ai caracterelor morfologice studiate au inregistrat, în special cei cu justificare productivă, valori medii ale coeficienților de variație între 10% și 20%. Aceste aspecte demonstreaza de fapt buna adaptabilitate la aceste conditii climatice cu accente din ce in ce mai evidente de seceta.
Cuvinte cheie: boabe, țeapă, spiculeți, variabilitate, grâu

INTRODUCTION

Cultivated for a long time (Bonjean & Angus, 2001; Curtis et al., 2002), wheat [*Triticum aestivum* (L.) Thell ssp. *vulgare* (Will.) M.K.], (pro syn. *Triticum hybernum* L., *T. macha* Dekap. & Menab., *T. sativum* Lam., *T. sphaerococcum* Percival, *T. vulgare* Will., common wheat, bread wheat) is one of the most important crops (Farooq et al., 2015; Ihsan et al., 2016). *Triticum* derives from *threshing* (*bruising*), sorting, and summer *aestivum*. The threshing wheat is also called *spelta*. With the genes from *Aegilops tauschii*, they give the bread wheat the cold resistance it needs in temperate climates. As a surface, wheat occupies the first place, being met in a multitude of conditions (Reddy & Raghavendra, 2006; Tester & Langridge, 2010). The purpose of its cultivation is the production of grains (Fang & Xiong, 2015) used in the production of bread. The nutrient content of the grains is diverse and balanced, having a special importance in human food. Over time, the plant has undergone obvious evolutions, namely through various new characters (Bray, 1997; Wasson et al., 2021), and recently (Nikolaeva et al., 2010; Petrov et al., 2018) with significant resistance for drought (Fischer et al., 2005; Săulescu et al., 2006). Thus, wheat is considered one of the most diverse cereals from a genetic point of view (Kulkarni et al, 2017), it has types of autumn and spring, with coated grains but also bare. The genome is hexaploid 2n = 6x (6x7) = 42, with six sets of AuAuBBDD chromosomes. The diploid form 2n = 2x = 14 has 2x7 chromosomes, one from each parent, and through hybridization we have reached to the evolved forms tetraploid (2n = 4x = 28 chromosomes) and hexaploids. The variety of this new line is *erythrospermum* Körn, with white, awn spike, glabrous glume and red bean/ grain. It also contains the modern *RHt* gene, introduced by Borlaug (1960s) from the *Norin 10* variety of Japanese origin. It determines short stems, suitable for rich fertilization and mechanized harvesting, both necessary for new, very productive creations. The inflorescence of the plant is a terminal spike, distich, 4-18 cm long, with sessile spikelets, caught solitary on the rachis, in a zig-zag pattern. The spikelet is 10-15 mm long, being compressed laterally with two glume and several flowers. The glume is the tip like a short, blunt tooth, but also a 3-5 cm edge. Each flower has a palea and a lemma.

Depending on the variety, the lemma extends in the form of an awn, or as a hood. When the palea and the lemma adhere to the grain, it becomes so dressed. The bean (caryopsis) is ellipsoidal in shape, with a central channel on one side. The bean is 4-12 mm long and 1.5-4.0 mm thick. The mass of one thousand grains (MTG) is between 15-60 g. The plant generally forms stems with heights between 50 cm and 150 cm. The research carried out to observe the variation of some characters of the new wheat line plants in different water deficit conditions, included: the stem through the total length of the straw, the length and thickness of the basal internode (upper third), the sub-apical internode length and the apical internode length, length and weight of spike, number of spikelets / spike, length of outer glume, length of lower palea (lemma) and length of awns, number of grains / spike, weight, mass of one thousand grains (MTG) and grain size by length and thickness.

MATERIALS AND METHODS

The variants have been cultivated in the last three years with the new line A.50-15. The experience was set up according to the block method, with variants of 25 m^2 in 4 repetitions. The technology used was the one recommended by the station. At full maturity, 25 plants / strains from each repetition were randomly selected (100 in total), cut and brought to the laboratory. The 100 stems were measured and determined: total straw length, basal internode length and thickness, sub-apical internode length, apical internode length, spike length and weight, number of spikelets in spike, length of glume, palea and awn, the number of grains in an ear and their weight, the mass of one thousand grains (MTG), as well as the dimensions of the grains: length and thickness. The morphological characters obtained were analyzed by the method of histograms (or frequency

polygons, PF%). In their expression, the class intervals established according to the specific string of values obtained were used.

The study highlighted several aspects, namely: the highest frequencies, the limits of the intervals of variability of the studied characters and the specificity of each character of the wheat ecotype in the analyzed area. The correlations were established between the analyzed characters, with the help of which their tendencies within this ecotype could be observed. Excel was used to express values. The significance of the correlation coefficients was obtained by comparing with the r_{max} values (Weber, 1961) for the levels of 5%, 1% and 0.1% of the transgression probabilities. In the statistical calculation of all the values obtained, the analysis of variance (Anova test) on the variation strings was used. Statistical parameters were calculated using the formulas: $\bar{a} = \Sigma x / n$, where $\bar{a}$ = average of the determinations, and x = the determined values, S^2 (variance) = $1 / (n-1) [\Sigma x^2 - (\Sigma x)^2 / n]$, S (standard error) = $\sqrt{(S^2)}$, S% (coefficient of variation) = $S / \bar{a}.100$.

RESULTS AND DISCUSSIONS

Climatic characterization of autumn wheat vegetation. In general, the cultivation area has a favorable climate throughout the beginning from vegetation to flowering (Figure 1 - Walter-Lieth climate-gram). Rainfall in the autumn should ensure optimal emergence and tillering. The rains that fall in the spring and until the wheat matures should be favorable, which would lead to the normal morphological manifestation of each genotype. On the other hand, this continuous favorable rhythm began to be more and more fragmented by periods, either with some excesses or with drought, sometimes quite prolonged. Under these conditions, each new cultivar reacts morphologically through certain trends. Knowing them could define certain degrees of tolerance and even the resistance of the respective line to the climatic accentuations (drought) that have been taking place lately (Farooq et al, 2014). On the other hand, the comparison between evaporation transpiration potential- ETP and the rainfall regime in the wheat vegetation highlights the possibilities that the plant had both in the formation of the plant habitus and the respective production elements (Figure 2).

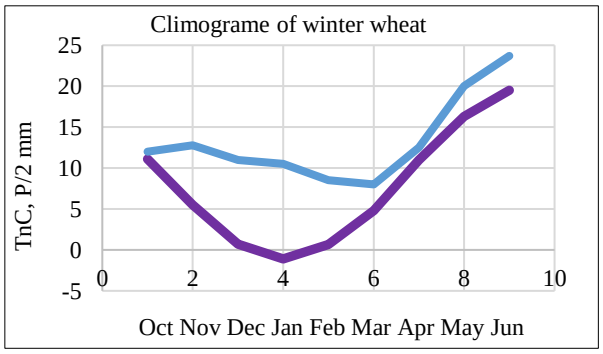


Figure 1. Climograma Walter-Lieth // Walter Lieth Clinograma

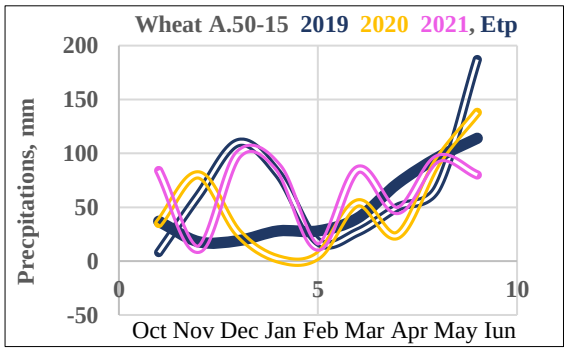


Figure 2. Precipitații anuale și valorile ETP// Annual precipitation and ETP values

As the volume of precipitation approached the necessary, for consumption (Fang & Xiong, 2015), the favorability of that year was more obvious. Of the three years analyzed, 2019 was the closest condition needed. The rich autumn precipitations favored on the one hand the passage of the first vegetation period of the wheat, and on the other hand there was the accumulation of an important reserve of water in the soil for the resumption of vegetation. An important peak was noted this year in June, which contributed to the formation of morphological features of the plant in general and of the ear in particular, namely at high levels. The year 2020 started well with rains in November, after which the drought set in April was also dry. When deposited in the grain, the A.50-5 line had precipitation closer to the required in May and June, which ensured a good level of grain formation. In the last year, the quantities of water that fell for the first period were closer than necessary and were maintained until March, after which the drought set in. Finally, lower amounts of water affected

the deposition of nutrients in the grains (Fischer et al., 2005). In conclusion, the first year of cultivation had better favorability, and the next two years had relatively lower degrees of favorability.

Variability in wheat straw size. The wheat stalk or straw consists of several internodes (5-7) with increasing lengths towards the ear. In general, the straw has lengths between 50 cm and 150 cm, with lower values for new creations obtained for intensification conditions. The measurements showed that in the three years of cultivation the straw at this new line of winter wheat was between 55 and 80 cm. The dominant frequencies were the straws of 60-65 cm, very close in the three years (Figure 3). Due to these dimensions of wheat straw, line A.50-15 can be considered to meet both the qualifier of evolved and intensive. The diameter of the basal internode had modal values between 3 and 4 mm, being thinner in the second year, average in the last year and thicker in the first year (Figure 4).

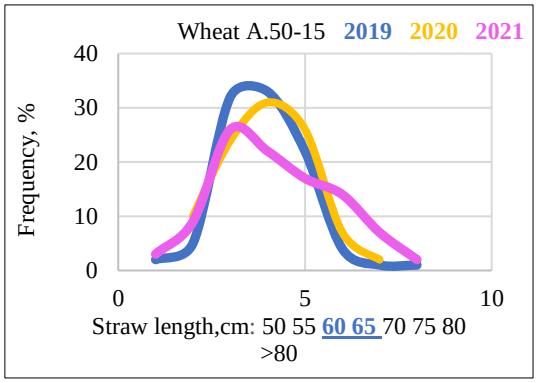


Figure 3. Straw length frequencies // Frecvențele lungimii paiului

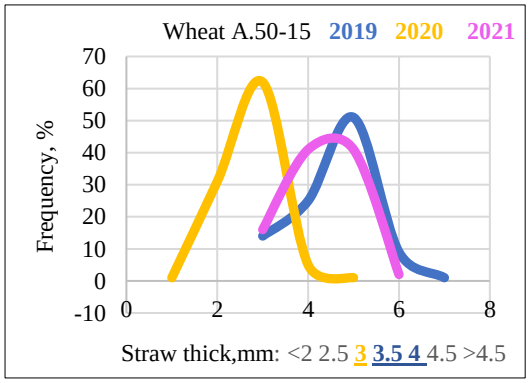


Figure 4. Straw thickness frequencies // Frecvențele grosimii paiului

Variability of wheat ears. The appearance and size of the ear of this wheat line are characteristic. Thus, its length had dominant values of 8 cm in years with insufficient rainfall and 8.5 cm in the first year (2019). In general, its variability was between 6.5 cm and 11.5 cm (Figure 5). The biomass of the analyzed ears was generally between 1.5 g and 4.5 g (Figure 6). The high values expressed weights of 2-2.5 g in the two years with drier periods and 4 g in the more climatically favorable year.

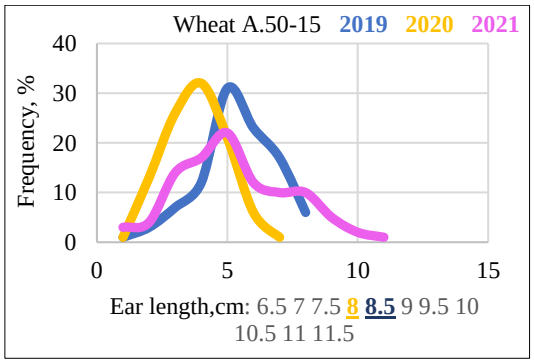


Figure 5. Ear lenght frecvency //Frecvențele lungimii spicului

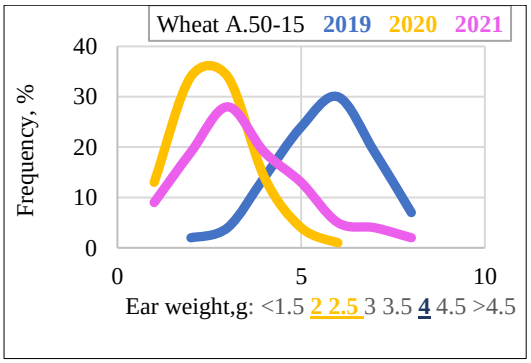
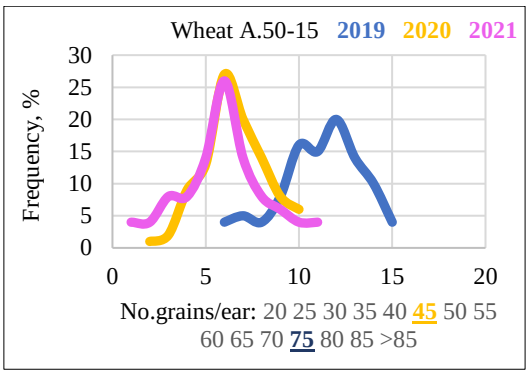


Figure 6. Ear weight frecvency // Frecvențele masei spicului

The ears formed grains depending on the climate favorability (Săulescu et al., 2006), expressed by the amounts of precipitation distributed during the nine months of vegetation. Their number had a relatively wide range, namely between 20 and over 85 from a spike of line A.50-15. The highest frequencies were obtained at 45 grains / ear in the last two years and 75 grains in the very favorable year (first year) (Figure 7). The weight of these grains generally followed the same mode of expression due to the different favorability of the three years of cultivation. The limits of variability over the whole research period were between 1 g and over 3.5 g (Figure 8).



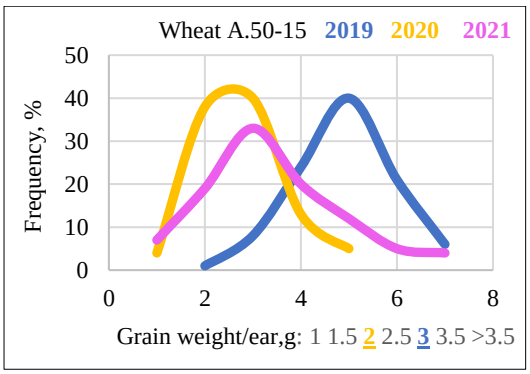
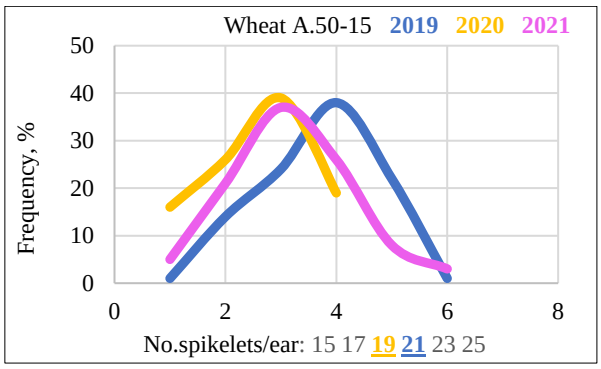


Figure 7. Frecvențele no.boabe/spic //No.grains/ear frecvency **Fgure 8Grain weight / ear frecvency**//Frecvențele masei boabelor/spic

They dominant ears had grains weight 2 g in the years 2020-2021 and 3 g in the more favorable year 2019. In the expression of these values of the number and weight of the grains a morphological importance had the number of spikelets formed in each ear of line A.50-15. Thus, in the three years, spikelets formed between 15 and 25 / ear. The high values were 19 spikelets in the last two years of culture and 21 spikelets in the first year (Figure 9). Among the pieces of the spike are the length of the awn, which could generally express a relatively specific character of the new lines obtained in the conditions of the research station. The limits between which the lengths of the awn were formed, were 4 and 11 cm (Figure 10). Dominant were the lengths of 7 cm in years with periods of drought and 8 cm in the most favorable year.

Variability in the size and absolute mass of wheat grains. The grain size also had some characteristics. Thus, the grain length was generally between 5 and 8 mm. In the favorable year 2019 the dominant grains measured 6.5 mm, while in the other two years the grains had dominated by lengths of 7 mm (Figure 11). The grain thickness was between the general limits of 2.4 mm and 3.8 mm (Figure 12) The modal value for the whole period was 3 mm grain thickness.

The mass of one thousand grains (MTG) showed slight differences depending on the favorability of the three years of cultivation. In general, the values ranged from 22 to 50 g (some grain biomass exceeded 50 g) (Figure 13). The dominant values were 38 g in the year with longer periods of drought (2020) and 42 g in the first and third agricultural year. The present data show that line A.50-15 forms grains with relatively high biomass, a positive premise for productive performance (figure 14).



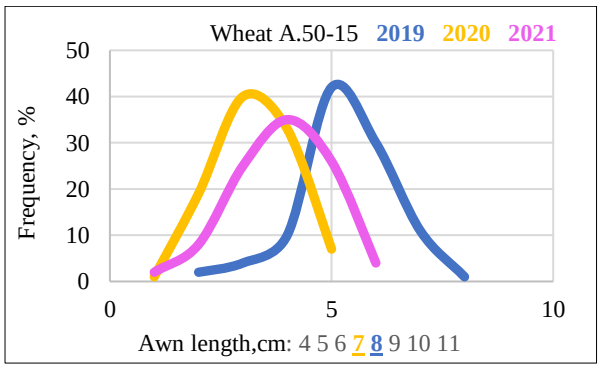


Figure 9. No. Spikelets/ear frecvency //Frecvențele no. de spiculețe/spic **Figure 10.Awn lenght frecvency//** Frecvențele lungimii aristei

Correlations between the main morphological characters. If we analyze the whole set of correlations between all the analyzed characters, we find both positive and negative situations. Very obvious positive correlations were observed between the characteristics of the spike: length, number of spikelets, number of grains, grain weight and the base diameter of the straw. Insignificant positive correlations were observed between the straw length and some characteristics of the production capacity per ear. The absolute mass of the grains was positively correlated with the weight of the ear and the grains, as well as with the dimensions of the grains (Table 1).

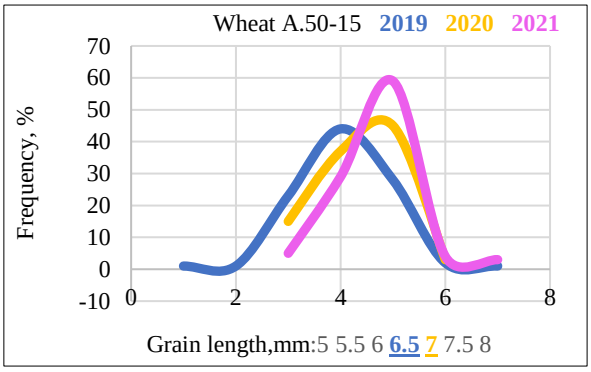


Figura 11. Grain lenght frecvency//Frecvențele lungimii bobului

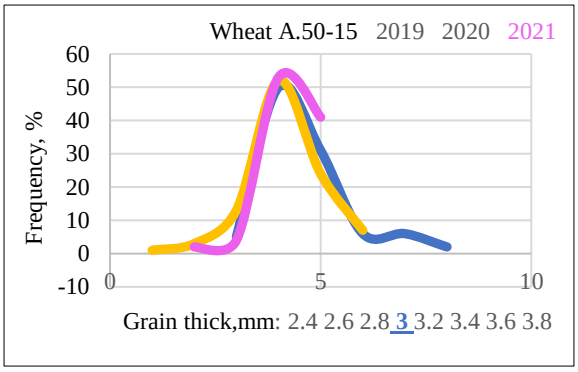


Figura 12. Geain thick frecvengy //Frecvențele grosimii bobului

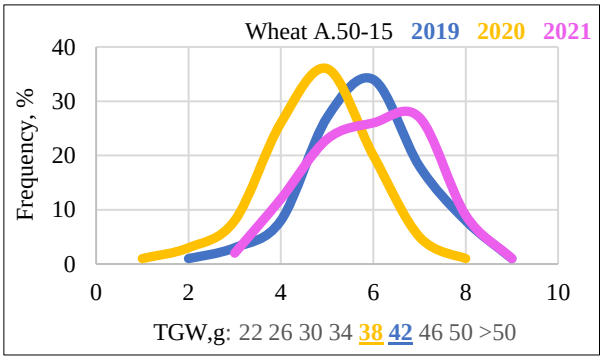


Figura 13. TGW frecvency//Frecvențele masei a o mie de boabe

Figura 14. Line A.50-15 flowering period // Linia A.50-15 perioada înfloritului

Statistical analysis of morphological characters variability at the wheat line A.50-15. The results obtained in the morphological analysis of some characters in winter wheat showed specificity. Thus, the length of the straw measured 62-64 cm. Variability demonstrated low to medium coefficients. The internode at the base measured 10-11 cm, with a small to large variation, and its thickness was 2.7-3.6 mm (10-11% variation). The sub-apical internode had an average length of 15-20 cm (2-14% variability), and the apical internode measured 22-32 cm (highly variable). These data show that this wheat line has a medium to small port, suitable for intensification.

Table 1. Correlations between the main characters of the new wheat line A.50-15 // Corelații între principalele caractere ale noii linii de grâu A.50-15

Caracterul	Basis int. cm	Sub-apical cm	Apical, cm	Basis ø, mm	Ear L. cm	Ear W. g	No. spikelets	Glume mm	Palea mm	Awn cm	No. grains	G. boabe	Grain L. mm	G.rain T. mm	MTG g
	2019														
Straw size cm	.425	.325	.342	.032	-.075	.041	-.028	-.252	.057	-.037	-.106	.102	-.008	.145	.372
Internode 3	1	.211	-.134	.332	.115	.973	.220	-.022	.207	.042	.258	.334	.192	.065	.170
Internode 2		1	.052	-.036	-.098	.008	-.228	-.151	-.022	.038	-.153	.031	-.017	.095	.305
Apical int.,cm			1	-.120	.077	-.001	-.090	-.118	-.096	-.020	-.121	.173	-.070	-.060	.258
Ø basis, mm				1	.450	.612	.543	.235	.302	.017	.642	.563	.150	.090	.003
Length ear, cm					1	.619	.615	.586	.146	.179	.696	.529	.163	.020	-.117
Weight ear, g						1	.628	.212	.205	.119	.867	.970	.139	.113	.334
No. spikelets							1	.193	.277	.094	.617	.547	.007	.080	-.238
Glume, mm								1	-.107	.256	.315	.132	.061	.080	-.258
Palea, mm									1	.245	.306	.154	.331	-.050	-.206
Awn, cm										1	.109	.068	.204	.005	-.036
No. grains											1	.797	.060	-.311	-.124
Grains weight g												1	.136	.168	.471
G. length, mm													1	.392	.305
G. thick, mm														1	.170
	2020														
Straw size cm	.521	.525	.288	.166	.078	.141	.135	.014	.005	.022	.093	.155	.205	.182	.204
Internode 3	1	.212	-.248	.062	.062	.116	.048	.010	.044	.048	-.119	-.132	.081	.010	-.074
Internode 2		1	0.442	.310	.297	.331	.202	.047	.051	.086	.168	.349	.336	.338	.449
Apical int.,cm			1	.182	.254	.368	.201	.200	.213	.195	.254	.368	.105	.230	.376
Ø basis, mm				1	.398	.426	.363	.310	.187	.214	.420	.449	.152	.308	.272
Length ear, cm					1	.654	.648	.311	.239	.297	.689	.656	.233	.287	.316
Weight ear, g						1	.711	.351	.327	.531	.873	.967	.457	.531	.610
No. spikelets							1	.339	.214	.412	.815	.676	.262	.392	.192

Caracterul	Basis int. cm	Sub-apical cm	Apical, cm	Basis ø, mm	Ear L. cm	Ear W. g	No. spikelets	Glume mm	Palea mm	Awn cm	No. grains	G. boabe	Grain L. mm	G.rain T. mm	MTG g
Glume, mm								1	**.590**	**.310**	**.412**	**.353**	**.197**	**.244**	**.130**
Palea, mm									1	.067	**.366**	**.326**	**.307**	.082	.141
Awn, cm										1	**.502**	**.509**	**.321**	**.325**	**.287**
No. grains											1	**.844**	**.307**	**.341**	**.237**
Grains weight g												1	**.440**	**.524**	**.709**
G. length, mm													1	**.491**	**.401**
G. thick, mm														1	**.525**
	2021														
Straw size cm	**.731**	**.455**	**.291**	.167	**-.264**	.054	-.047	-.055	.022	.091	-.049	.087	.128	**.247**	**.417**
Internode 3	1	.078	**-.195**	**-.224**	**-.439**	-.181	-.122	-.189	-.041	-.187	**-.194**	-.156	.010	.049	.069
Internode 2		1	.079	-.058	-.036	.088	-.044	.136	.123	.102	-.002	.104	**.225**	.030	**.269**
Apical int.,cm			1	.024	.033	.092	-.047	.028	-.022	.178	.005	.111	.078	**.198**	**.343**
Ø basis, mm				1	**.605**	**.557**	**.603**	**.352**	**.247**	**.343**	**.583**	**.536**	.107	**.229**	.133
Length ear, cm					1	**.776**	**.751**	**.393**	**.413**	**.485**	**.757**	**.745**	**.298**	.187	**.309**
Weight ear, g						1	**.865**	**.358**	**.361**	**.638**	**.935**	**.994**	**.283**	**.437**	**.568**
No. spikelets							1	**.338**	**.355**	**.606**	**.889**	**.841**	**.208**	**.270**	**.295**
Glume, mm								1	**.428**	**.201**	**.316**	**.341**	**.250**	.153	.152
Palea, mm									1	**.258**	**.348**	**.347**	.177	.103	.095
Awn, cm										1	**.633**	**.641**	.183	**.231**	**.395**
No. grains											1	**.935**	**.138**	**.365**	**.276**
Grains weight g												1	**.269**	**.456**	**.580**
G. length, mm													1	.089	**.424**
G. thick, mm														1	**.457**
	DI 5 % = .190 **DL 1 % = .250** **DL 0.1 % = .320**														

Table 2. Statistical indexes of the straw and ears of the A.50-15 line// Indicii statistici ai paiului și spicelor liniei A.50-15

Indices*	Straw, internods					Ears		
	Length	Basal	Sub-apical	Apical	Ø base	Length	Weight	No. spikelets
	2019							
Mean	**62.24**	**10.81**	**17.28**	**29.69**	**3.61**	**8.47**	**3.57**	**19.88**
s²	112.9	4.70	6.93	322.2	0,130	0.57	0.42	4.45
s	10.62	2.17	2,64	17.95	0,370	0.76	0.65	2.11
VC %	**17.1**	**20.1**	**1.5**	**60.4**	**10.2**	**9.0**	**18.2**	**10.6**
	2020							
Mean	**63.49**	**11.09**	**15.03**	**21.66**	**2.67**	**7.75**	**2.10**	**17.79**
s²	30.66	2.32	2.23	2.85	0.08	0.45	0.29	3.73
s	5.54	1.52	1.49	1.69	0.285	0.67	0.53	1.93
VC %	**8.7**	**13.7**	**9.9**	**7.8**	**10.7**	**8.6**	**25.3**	**10.9**
	2021							
Mean	**64.20**	**9.91**	**19.67**	**32.01**	**3.48**	**8.50**	**2.56**	**18.95**
s²	58.7	19.62	7.03	17.1	0.145	1.35	0.85	5.99
s	7.66	4.43	2.65	4.14	0.38	1.16	0.92	2.45
VC %	**11.9**	**44.7**	**13.5**	**12.9**	**11.0**	**13.7**	**36.0**	**12.9**

S^2, variance, s- standard error, VC- variation coefficient

The length of the spike was 7.8-8.5 cm, with reduced to medium variability. The weight of the ears was 2.10-2.57 g, but with a medium to high variability. The number of spikelets/from ear was 18-20 (11-13% variability) (table 2). The length of the glume was 9-10 mm (8-10% CV), that of the palea (lemma) 9.93-9.96 mm with little variability, and that of the awn 6.3-8.3 cm (low-medium). The number of grains formed in a spike was 45-69 with a medium to high variability. The weight of the grains in a spike was 1.62-2.97 g, with medium-high variability. The grains had the average dimensions of 6.5-6.7 / 2.99-3.07 mm. The variability of grain sizes was small (less than 10%). The mass of one thousand grains was on average 35-40 g with variable variability (Table 3).

Table 3. Statistical indixes of spikelets and grains of A.50-15 line // Indicii statistici ai spiculețelor și boabelor liniei A.50-15

Indices*	Spikelet pieces			Grains				
	Glume	Palea	Awn	No./ear	Greutate	Length	Thick	MTG
	2019							
Mean	**10.21**	**9.96**	**8.31**	**68.81**	**2.97**	**6.76**	**3.07**	**38.86**
s²	1.040	21.72	0.36	128.9	0.27	0.18	0.01	53.24
s	1,020	4.67	0.60	11.36	0.52	0.43	0.10	7.30
VC %	**10.0**	**46.9**	**7.2**	**16.5**	**17.5**	**6.4**	**3.3**	**18.8**
	2020							
Mean	**9.31**	**9.93**	**6.26**	**45.08**	**1.62**	**6.50**	**2.99**	**35.24**
s²	0.54	0.68	0.78	75.3	0.18	0.17	0.03	22.03
s	0.73	0.82	0.88	8.68	0.42	0.41	0.18	4.69
VC %	**7.9**	**8.3**	**14.1**	**19.0**	**26.1**	**6.3**	**6.1**	**13.3**
	2021							
Mean	**9.03**	**9.95**	**6.88**	**49.08**	**1.95**	**6.72**	**3.01**	**39.8**

Indices*	Spikelet pieces			Grains				
	Glume	Palea	Awn	No./ear	Greutate	Length	Thick	MTG
	2019							
s²	0.57	0.715	1.147	223.2	0.537	0.164	0.019	25.93
s	0.76	0.845	1.071	14.94	0.733	0.405	0.137	5.092
VC %	**8.4**	**8.5**	**15.6**	**30.4**	**37.1**	**6.03**	**4.5**	**12.8**

S^2, variance, s- standard error, VC- variation coefficient

CONCLUSIONS

1. The new winter wheat line, A.50-15, has recently been cultivated during three different climatic years: the first favorable year, the second favorable average year and the third unfavorable year. During these years the precipitation regime was different due to the periods of drought in the vegetation of the plants.
2. The morphological characters thus expressed were specific. Thus, the stem / straw had similar dominant lengths of 60-65 cm. At the height of the plant, the basal internode contributed by 10-11 cm, the sub-apical internode by 15-20 cm, and the apical one by 22-32 cm, with influence depending on the favorability of the culture year. The thickness of the basal internode was 2.7-3.4 mm, which shows a good resistance in the wheat field, especially in the favorable climate year. The 7.8-8.5 cm long spikelets weighed 2.1-3.6 g and is characterized as medium to long and heavy. The number of spikelets of 18-20, shows a density of 0.44 spicules at 1 cm length of the spike. Spikelets pieces: 9-10 mm jokes, 10 mm blades and 6-8 cm edge describe characters specific to the new line studied. The number of grains in an ear was from 45 in the dry year and 69 in the favorable year, weighing 1.62-2.97 g, highlighted a new line of wheat with high production capacity. The mass of a thousand grains was 35-40 g and is considered medium to large. The grains, measuring 6.5-7 mm long and 3 mm thick, describe average characters.
3. Simple correlations were established between all the studied characters, with some differentiations. The correlations between the characters of the ear were very significant positive, which demonstrates the great productive possibilities that this variety has even in the years with periods of drought. The characteristics of the straw were insignificantly correlated, sometimes negatively with the spike and the grains and are explained by the genetic improvement obtained by reducing the size of this variety.
4. The studied statistical indicators showed a new line of wheat with a small to medium port, with medium to long spikes, sufficiently compact, with many grains and with an absolute mass exceeding 42-44 g in climatically favorable years. over 50 ears of grain, weighing up to 3 g, that describe a new, productive variety with good valences and in new periods of drought.

THANKS

We hereby convey our sincere thanks to the entire wheat breeding team at the station. Through the perseverance they showed, they managed to obtain new varieties (Albota and Trivale) in a relatively short period of time, but also whole series of winter wheat lines characterized by tolerance to aluminum ions, characteristics of the special ecology of this type of soil. Here we mention the researchers Enescu Steluța, Popa Florica, Grigore Marian and Voica Maria, whom we thank for the effort and selflessness they showed in this improvement work. The front line, A.50-15 is one of these achievements.

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ANALYSIS OF STEEL TYPE INFLUENCE ON THE STRESS AND SAFETY PARAMETERS FOR THE CONSTRUCTION OF EQUIPMENT FRAMES FITTED WITH CURVED PROFILE DIGGING SPADES

ANALIZA INFLUENȚEI TIPULUI DE OȚEL ASUPRA PARAMETRILOR DE TENSIUNEA ȘI DE SIGURANȚĂ PENTRU CONSTRUCȚIA ECHIPAMENTELOR ECHIPATE CU CAZMALE PROFILATE CURBE

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Abstract:
To establish a new vegetable or cereal culture, a series of works must be carried out, the most important of which is plowing, also called the basic work of the soil, which, as it is carried out in the current technology, has many disadvantages, including the cost of the work, which implies a higher consumption of diesel and the negative effect on the structure of the soil, because the natural process of soil stabilization after plowing usually takes a few weeks. Under these conditions, within the framework of a project implemented under Measure 16: Cooperation, Submeasure 16.1: Support for the establishment and functioning of operational groups (GO), for the development of pilot projects, new products", an eco-innovative technology is promoted that performs the basic work of the soil in vegetable crops with a technical equipment provided with curved profiled plows. The construction of the curved profiled equipment frame was made from UNP (or "Universal NormalProfile"), INP (or "I NormalProfile"), L (or equal-wing angle) profiles following static analysis using SolidWorks software, with emphasis on von Mises stress and safety aspects analysis, for different grades of hot rolled steel: S235 / S275 / S355 according to EN10025. The analysis allowed us to better understand the 3D geometric model of the technical equipment frame's behavior depending on the demands it is subjected to and to verify the behavior of the chosen materials. The purpose of this work is to make available to specialists in the field, a quick tool for solving simple structural problems, without resorting to complex mathematical relationships that are characteristic of strength calculations.
Keywords: Static analysis, finite elements, stress von Mises, factor of safety.

Rezumat:
Pentru înființarea unei noi culturi de legume sau cereale trebuie efectuate o serie de lucrări, dintre care cea mai importantă este aratul, numită lucrarea de bază al solului, care, așa cum se realizează în tehnologia actuală, prezintă multe dezavantaje, inclusiv costul lucrării, care presupune un consum mai mare de motorină și efectul negativ asupra structurii solului, deoarece procesul natural de stabilizare a solului după arat durează de obicei câteva săptămâni. În aceste condiții, în cadrul unui proiect implementat în cadrul Măsurii 16: Cooperare, Submăsura 16.1: Sprijin pentru înființarea și funcționarea grupurilor operaționale (GO), pentru dezvoltarea de proiecte pilot, produse noi", a fost aplicată o tehnologie eco-inovatoare care efectueaza lucrarea de baza a solului în culturile legumicole cu un echipament tehnic prevăzut cu pluguri profilate curbate. Constructia cadrului utilajului profilat curbat a fost realizata din UNP (sau "Profil Normal Universal"), INP (sau "Profil Normal I"), profile L (sau unghi cu aripi egale), în urma analizei statice folosind software-ul SolidWorks, cu accent pe analiza von Mises și a aspectelor de siguranță, pentru diferite calități de oțel laminat la cald: S235 / S275 / S355 conform EN10025. Analiza ne-a permis să înțeleagă mai bine modelul geometric 3D al comportamentului cadrului echipamentului tehnic în funcție de solicitările la care este supus și să verifice comportamentul materialelor alese. Scopul acestei lucrări este de a pune la dispoziție specialiștilor în domeniu, un instrument rapid de rezolvare. probleme structurale simple, fără a recurge la relații matematice complexe care sunt caracteristice calculelor de rezistență.
Cuvinte cheie: Analiză statică, elemente finite, stres von Mises, factor de siguranță.

INTRODUCTION

The effects of ploughing on crop growth and soil properties need to be compared over a long period of time to determine their impact in the short and long term [8].

Today, farmers in Europe are adopting innovative technologies for field horticultural works, aiming mainly at more efficient, economical, less labor-intensive and more economically friendly management [4].

Due to the long-term use of conventional tillage (plowing) internationally, important cereal-growing regions are threatened by soil degradation [5]. At the same time, intensive agriculture, which is increasingly being practiced, accelerates greenhouse gas emissions and the loss of carbon (C) from the soil, especially with aggressive tillage [7].

It is assumed that the adoption of soil conservation works (working with the chisel, plow with spring-tooth and direct seeding) will restore soil fertility, maintain crop yields, and increase sustainability [1].

In these conditions, the authors of the paper propose a new soil working technology using a device equipped with rotary tines, which, when applied in exploitation, leads to the regulation of the productivity of arable lands and energy consumption, conservation of the upper layer of the soil against erosion, and increase of soil fertility [10].

MATERIALS AND METHODS

The research materials and methods consist of the use of the reading sheets of the research phases of the project ECO-INNOVATIVE TECHNOLOGY PROJECT THAT PERFORMS THE BASIC WORK OF THE SOIL IN VEGETABLE CROPS WITH TECHNICAL EQUIPMENT PROVIDED WITH PROFILED CURVED PLOWS supported by non-refundable European funds through the National Rural Development Program (PNDR), Measure 16-Cooperation, sM 16.1. Support for establishing and operating operational groups (GO), for developing pilot projects and new products, according to the financing contract no. C16100000011884200003/20.04.2021.

The SOLIDWORKS software was used for the modeling of the technical equipment frame provided with curved profiled spades, and for the static analysis with finite elements SOLIDWORK SIMIULATION, which are developed by SW Corporation - USA, part of the French company Dassault Systèmes - DS [11].

Using CAD software, the design was modeled during the design stage, along with material choices and physical attributes, and the results of the calculations performed were examined and verified by specialists in the final design stage before the physical frame of the technical equipment was executed.

RESULTS AND DISCUSSION

In Figure 1 is presented an aspect of the 3D geometric model of the technical equipment provided with curved profiled blades for the base work of the soil.

There are several possibilities for modeling mechanical systems containing metal structures in SOLIDWORKS. To create the frame of the technical equipment provided with curved profiled blades for the basic soil work, each entity was drawn separately, and then the entities were assembled using the Assemblies module. For each component, a supplementary information field could be completed containing the name of the respective component, who made it, and other observations. Figure 2 presents the 3D geometric model of the technical equipment frame designed with the help of the SOLIDWORKS program, which was made by assembling previously defined references, a method called top-down design (bottom-up).

After the stage of creating the 3D geometric model, we moved on to the stage of structural analysis with the help of the structural simulation application SOLIDWORKS SIMULATION, which involved importing the geometry of the created model, defining the material, defining the appropriate restrictions for the discretizations, running the program for calculating the Von Mises stress analysis, displacement, relative elongation, safety factor and visualization of the results in the form of diagrams [6].

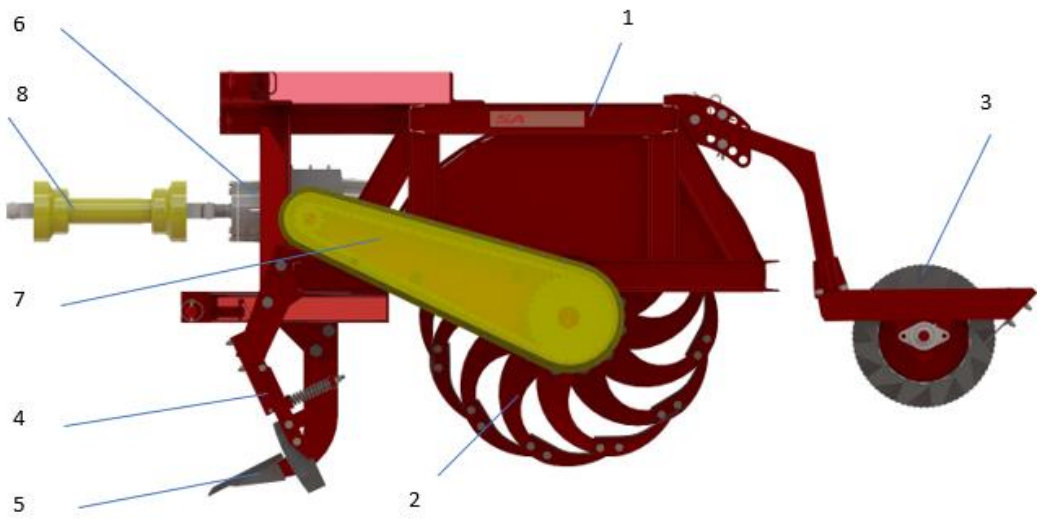


Fig. 1. Technical equipment provided with curved-profiled digging spades for basic soil work, left-side view// Echipament tehnic dotat cu lame de sapat profilate pentru lucrarea de bază a solului-, vedere din partea stângă //1-framework, 2- assembled spade rotor, 3-toothed roller Packer, 4- inclined knife assembly, 5- rippers with chisels, 6- conical reducer 132KW, i=0,55, 7- chain drive 16B-2, 8- cardan transmission T6-65CP // Echipament tehnic prevazut cu cazma de săpat cu profil curbat pentru lucrarea de baza a solului, vedere din stânga 1-cadru, 2- rotor de cazma asamblat, 3-dinți Roller Packer, 4- ansamblu cuțit înclinat, 5- cuțit / daltă, 6- reductor conic 132KW, i=0,55, 7- transmisie cu lanț 16B-2, 8- transmisie cardan T6-65CP

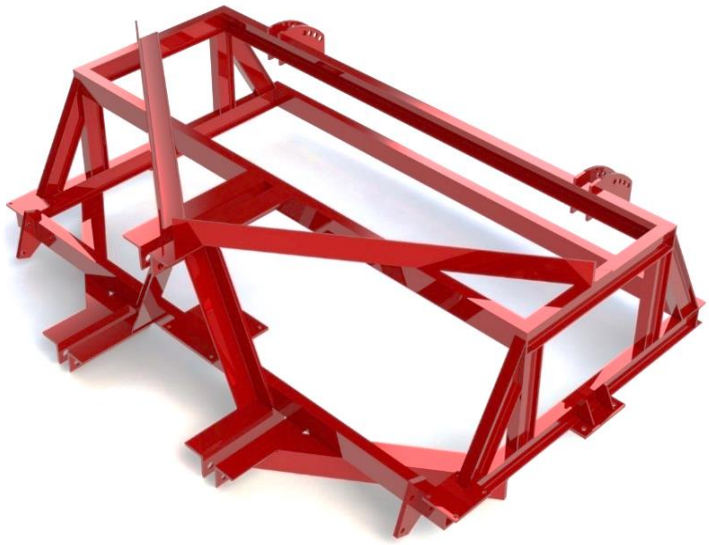
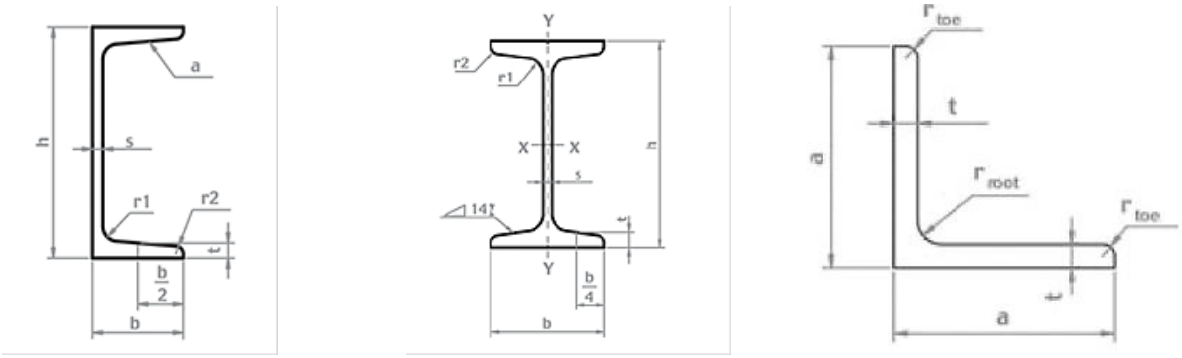


Fig. 2. 3D Geometric model of the technical equipment frame equipped with curved profile drills for basic soil work// Modelul geometric 3D al cadrului echipamentului tehnic echipat cazmale profilate curbe pentru lucrarea de bază al solului

The constructive optimization method involved the following operations:
- selecting the static option as the analysis type, solid for the discretization type and the FFEPlus solver [3].;
- The selection of some materials from the SolidWorks library and the automatic assignment of these properties to the main landmark, the side knife, which is the most subject to wear during use [2].

For any type of finite element analysis using SOLIDWORKS-SIMULATION, it is indispensable to assign a material. The UNP 100 (or "Universal NormalProfile"), INP100 (or "I NormalProfile"), L100 (or equal wing angle) profiles for different qualities of hot-rolled steel: S235JR / S275JR / S355J2G3 according to EN10025 were chosen for the construction of the equipment frame [9].

In Figure 3, the dimensions of the chosen metal profiles are presented.



a. UNP100
h=100 mm, b=50 mm

b. INP 100
h=100 mm, b=50 mm

c. L100
a=100 mm

Fig. 3. Metal profiles chosen for the construction of the equipment frame provided with curved profile spades for basic groundwork// Profile metalice alese pentru construirea cadrului echipamentului prevăzut cu cazmale profilate curbe pentru lucrări de baza ale terenului

For the linear static analysis of the frame, where the stresses and deformations of a loaded structure can be evaluated, the following characteristics were indispensable, as shown in Table 1.

Tabel 1 - Parameters for frame simulation modeling // Parametri pentru simularea modelării cadrului

Name:	**1.0037 (S235JR)**	**1.0044 (S275JR)**	**1.0570 (S355J2G3)**
Model type:	Linear Elastic Isotropic	Linear Elastic Isotropic	Linear Elastic Isotropic
Default failure criterion:	Max von Mises Stress	Max von Mises Stress	Max von Mises Stress
Yield strength:	2.35e+08 N/m^2	2.75e+08 N/m^2	3.15e+08 N/m^2
Tensile strength:	3.6e+08 N/m^2	4.1e+08 N/m^2	4.9e+08 N/m^2
Elastic modulus:	2.1e+11 N/m^2	2.1e+11 N/m^2	2.1e+11 N/m^2
Poisson's ratio:	0.28	0.28	0.28
Mass density:	7800 kg N/m3	7800 kg/m^3	7800 kg/m^3
Shear modulus:	7.9e+10 N/m^2	7.9e+10 N/m^2	7.9e+10 N/m^2
Thermal expansion coefficient:	1.1e-05 /Kelvin	1.1e-05 /Kelvin	1.1e-05 /Kelvin

- S235JR class steel is universal steel and for machine construction, manufactured in accordance with the EN 10025 standard, it can be welded without restrictions, without subsequent heat treatment and without heating;
- S275JR class steel is a structural steel, which meets the requirements of the EN 10025 standard, it can be welded without restrictions, without subsequent heat treatment and without heating;
- S355J2G3 steel is carbon manganese steel. It is characterized by excellent strength and weldability. S355J2G3 is unalloyed structural steel according to EN10025.
- the application of the appropriate load in accordance with the actual mode of operation (from operation), the simulation scenario was adapted accordingly. The load was applied at the points corresponding to the mode of operation;
- using the meshing procedure to decompose the model into discrete elements. In general, a finite element model is defined by a mesh, which is completely made of a geometric arrangement of elements and nodes. Nodes represent points, where characteristics, such as displacements, are calculated;
- running analysis study to calculate stress, factor of safety and displacement, which is based on geometry, material, load, constraint conditions and discretization type.

The 3D geometric model introduced directly into linear static structural analysis supported loads and supports, but the discretization could not be performed only after eliminating some interferences. After running the analysis studies, the results for configurations 1, 2 and 3 could be graphically visualized (Fig. 4, 5 and 6).

Equivalent von Mises stress and equivalent plastic strain show that von Mises stress and strain play a significant role in numerical simulations.

Table 2 presents the minimum and maximum values for the equivalent von Mises stress obtained from the static analysis for the three steel grades of the metal profiles.

Table 2 – The equivalent von Mises stress distribution / N/m^2// Echivalentul distribuției stress-ului von Mises/N/m^2

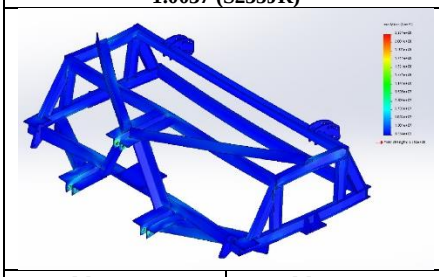
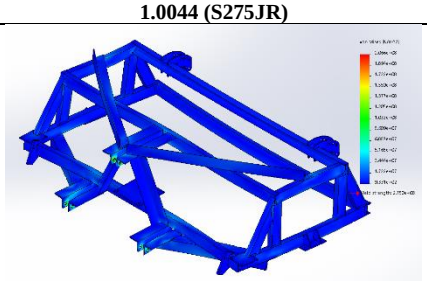
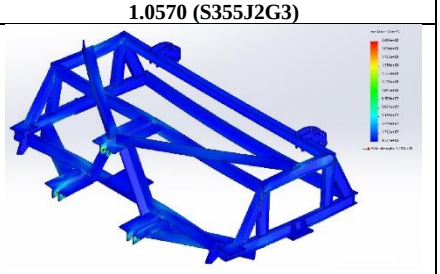
1.0037 (S235JR)		**1.0044 (S275JR)**		**1.0570 (S355J2G3)**	
					
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
9.334e+02	2.281e+08	9.331e+02	2.066e+08	9.331e+02	2.066e+08

Table 3 presents the minimum and maximum values for the specific deformation intensity distribution obtained from the static analysis for the three steel quality variants of the metal profiles.

Table 3- The distribution of specific strain intensity / mm // Distribuția intensității de deformare specifică / mm

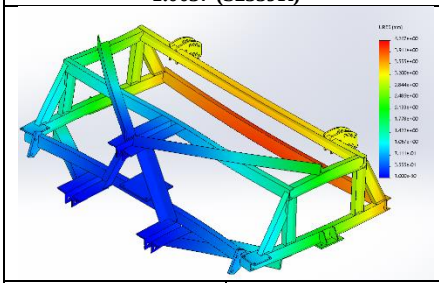
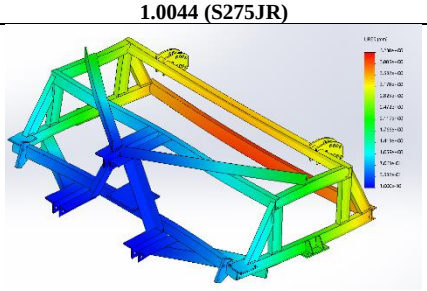
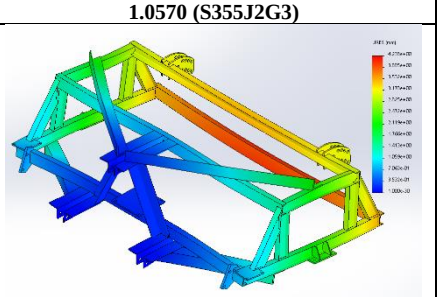
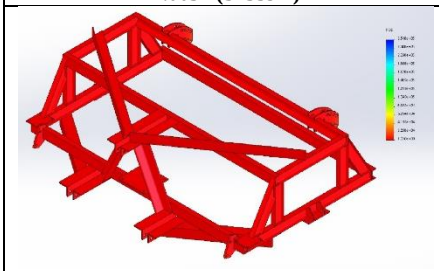
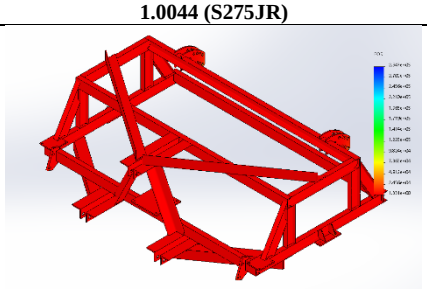
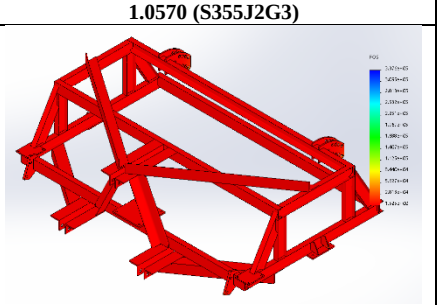
1.0037 (S235JR)		**1.0044 (S275JR)**		**1.0570 (S355J2G3)**	
					
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
0.000e+00	4.267e+00	1.000e-03	4.238e+00	1.000e-03	4.238e+00

Table 4 presents the minimum and maximum values for the power factor distribution obtained from the static analysis for the three steel quality variants of the metal profiles.

Table 4- Power factor distribution //Distribuția factorului de putere

1.0037 (S235JR)		**1.0044 (S275JR)**		**1.0570 (S355J2G3)**	
					
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1.030e+00	2.518e+05	1.331e+00	2.947e+05	1.525e+00	3376e+05

The results of the analysis on technical-economic criteria for the choice of steel quality of the profiles UNP 100 (or "Universal NormalProfile"), INP100 (or "I NormalProfile"), L100 (or the angle with equal wings) from which the frame of the technical equipment equipped with shovels is manufactured curved profiles for the basic soil work are presented in table 5. The price offer for the profiles was obtained from the company BADUC Str. Vigoniei, no. 5-7, Sector 5, Bucharest.

Table 5- Results of the techno-economic analysis // Rezultatele analizei tehno-economice

Name	**Unit of measurement**	**Configuration value**		
		1.0037 (S235JR)	**1.0044 (S275JR)**	**1.0570 (S355J2G3)**
The power factor	-	1,030	1,331	1,525
Estimated price	lei / m^2	175,94	182,41	192,64
The ratio: Price / power factor	-	170,81	137,79	126,32

The comparison of these indicators led to the choice of the optimal variant (configuration 3 was chosen, which has the lowest ratio Price / Safety Coefficient: 126.32).

The use of S355J2G3 rolled steel profiles for the frame of the technical equipment equipped with curved profile digging spades for basic soil work gives it properties with good mechanical strength, high toughness, very good hardness and a price/quality ratio based on the Win-Win concept of the customer-supplier relationship.

CONCLUSIONS

- Designing the technical equipment frame using hot-rolled metal profiles involved knowledge of the safe, durable, and economical specifications, including the materials, manufacturing technology, and geometric dimensions;
- The authors' proposed technical-economic indicator (material consumption per unit of safety coefficient) for the analysis of the optimal variant, represented by the price ratio and the safety coefficient, contributes to reducing the validation time of the design and manufacturing costs;
- The results of the research presented in the paper offer specialists in the field with a quick tool for solving simple structural problems, without resorting to complex mathematical relationships that are specific to resistance calculation.

ACKNOWLEDGEMENTS

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TECHNOLOGICAL SOLUTIONS FOR GRASSLAND IMPROVEMENT IN FAGARAS COUNTRY AREA

SOLUȚII TEHNOLOGICE PENTRU ÎMBUNĂTĂȚIREA PAJIȘTILOR DIN ZONA ȚARA FĂGĂRAȘULUI

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Rezumat:
În lucrare sunt prezentate soluții tehnologice și echipamente tehnice pentru îmbunătățirea pajiștilor permanente prin renovare totală dintr-un dispozitiv experimental al Institutului de Cercetare-Dezvoltare pentru Pajişti Braşov, amplasat în comuna Drăguş, județul Braşov (o locație reprezentativă pentru zona Ţara Făgăraşului). De asemenea, sunt scoase în evidență producţiile şi calitatea furajelor obținute pe parcursul a 3 ani , 2016, 2017 și 2018, diferențele în producția de substanță uscată și calitatea furajelor, în cei trei ani între variantele îmbunătățite prin reînsămânțare (V2 şi V3) și varianta martor (V1) fiind distinct sau foarte semnificative. Rezultatele prezentate în această lucrare și interpretarea statistică a acestora arată justețea punerii în practică a tehnologiilor zonale de îmbunătățire prin resămânțare totală, atât din punct de vedere al valorii nutritive, dar și al producției furajelor obținute, comparativ cu varianta martor.

Cuvinte cheie: îmbunătățire, pășuni, tehnologie, reînsămânțare totală, calitate furaj

Abstract:
The paper presents technological solutions and technical equipment for improving the permanent grasslands by total renovation from an experimental field of the Research-Development Institute for Meadows Brasov, located in Drăguş village, Brasov County (a representative location for Ţara Făgăraşului area). Also, are highlighted the productions and the quality of the fodder obtained during 3 years, 2016, 2017 and 2018, the differences in the production of dry matter and the quality of the fodder, in the three years, between the improved variants by reseeding (V2 and V3) and the control variant (V1) being distinct or very significant.
The results presented in this paper and their statistical interpretation show the good reason of the implementation of zonal improvement technologies by total reseeding, both in terms of nutritional value and feed production, compared to the control variant.

Key words: improvement, grassland, technology, total reseeding, feed quality

INTRODUCTION

The Fagaras Depression, also known as "Tara Oltului" is a contact depression, being considered the largest and best individualized among all the contact depressions of Transylvania. It is bounded to the south by the Fagaras Mountains, and to the north by the Olt River and the Transylvanian Plateau. The other limits that outline the surface of this territory are the Persani Mountains to the east and the Transylvanian Plateau, which arches, approaching the mountains, in the vicinity of Olt River from Red Tower, to the west.

The reseeding of permanent grasslands with valuable species and mixtures of perennial grasses and legumes is the main solution to improve and intensify the production of degraded and poorly productive grasslands.

Reseeding the degraded surfaces with mixtures of forage plants is the simplest and most economical measure to combat soil erosion and improve its physical-chemical properties.

From the analysis of the data related to the main agrochemical characteristics of the soil, it is observed that one of the limiting factors of production and quality, predominant in the Brasov area, is soil acidity.

On these soils, ameliorative works to correct its acidity are recommended, carried out before or simultaneously with the operations to improve permanent degraded pastures by total renovation.

Therefore, in the experimental device in the Fagaras (Dragus) Depression, the categorically operation included in the improvement technology is liming, using different assortments and amounts of amendments depending on the soil reaction.

MATERIAL AND METHOD

The experimental assembly of Research-Development Institute for Grasslands , located in UAT(Territorial Administrative Unit) Drăguș (a representative location for Făgăraș Depression), consists of a demonstrative lot (approximately 27 ha) and an experimental field. It allows the dissemination of research results over a relatively large area, located in the same stationary area conditions.

Fig. 1 Location Map of demonstrative and experimental fields from Făgăraș // Zone Amplasarea dispozitivului experimental **Drăguş** din **Depresiunea Făgăraş**

Location: UAT Drăguș
Latitude: 45o 44' 05.66" ... 45o 44' 07.22" N
Longitude: 24o 46' 00.47" ... 24o 46' 30.13" E
Altitude: 516 ... 541 m

The main agrochemical properties of the soil in the Dragus experimental field are presented in table 1.

Table 1. The main agrochemical soil properties of experimental field Drăguş // Principalele însuşiri agrochimice ale solului din câmpul experimental Drăguş

No.	Sampling depth	pH (H_2O)	Al	Ah	SB	V_{ah} (%)	HUMUS %	NITROGEN INDEX	P-AL	K-AL
		me per 100 g soil							ppm	ppm
1	0...10 cm	4,8		10,5	4,8	31,3	11,84	3,70	10,8	90,0
2	10...20 cm	4,9		10,0	4,0	28,5	7,87	2,24	7,4	36,0

From the data presented in table 1, it results that the soil on which the experimental field is located, in the 0...10 cm profile, is strongly acidic, poorly supplied in P and medium supplied in K, and in the 10...20 cm zone it is strongly acid, very poorly supplied in P and poorly supplied in K.

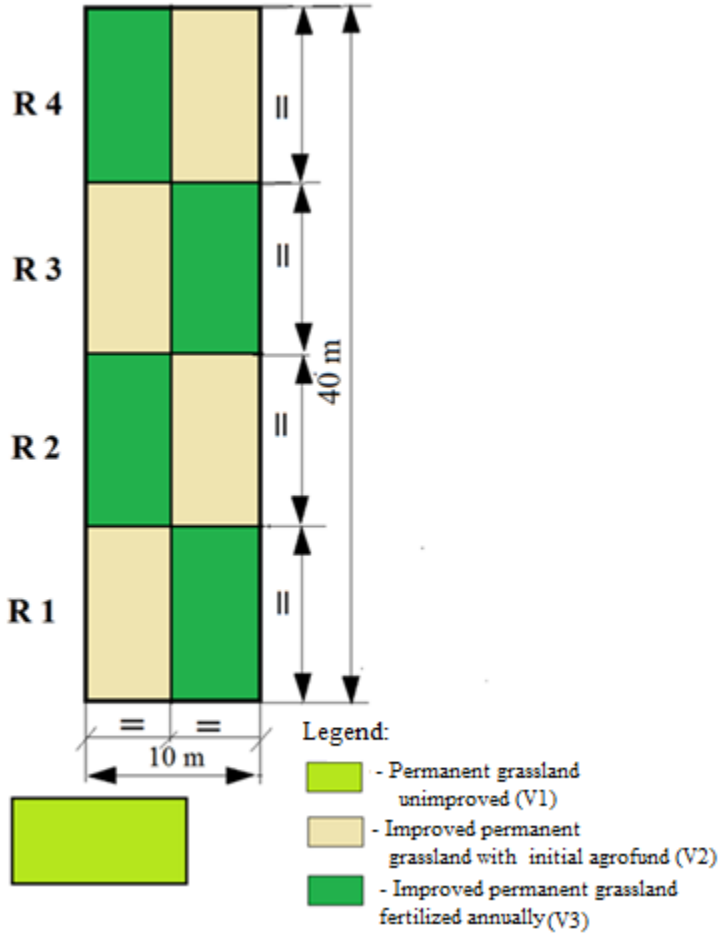

Fig.2 Schematic diagram of the experimental field Drăguș – Făgăraș Depression// Schema amplasării câmpului experimental Drăguș - Depresiunea Făgăraș

The experiment was established in the spring of 2016, on a surface with a slope between 0...2%, with three variants (Fig. 2), in four repetitions:

V 1- Unimproved permanent grassland;

V 2- Permanent grassland improved by total renovation, limed with 3.5 t/ha and fertilized with 30...35 t/ha of manure in the previous year;

V 3- Permanent grassland improved by total renovation, limed with 3.5t/ha and fertilized with 30...35 t/ha of manure in the previous year; fertilized in the years of operation with NPK 50 complex chemical fertilizers; 50;50;50 kg/ha in spring).

For the Dragus experimental device, a suitable mixture for a mixed hay-pasture mode of exploitation was established, composed of:

Grasses: *Festuca pratensis 19%;*
Festuca arundinacea 23%;
Dactylis glomerata 19%;
Phleum pratense 12%.

Legumes: *Trifolium pratense 16%;*
Trifolium repens 5%;
Lotus corniculatus 6%.

A gross seeding rate of 32 kg/ha was used, representing an average of 28 kg/ha of the mixture with a cultural value of 100%.

The technological sequences carried out (Fig. 3) for the total renovation consisted of:

- autumn plowing **(a);**
- harrow plowing with disc harrow (**b**);

- liming with 4.5t/ha of CaCO3 amendment (**c**);
- preparing the seed bed with a disc harrow, 2 passes (**d**);
- rolled before sowing (**e**);
- sown with the grain seeder (**f**);
- rolled after sowing (**g**);
- annual fertilization, in the spring, with NPK 50 complex chemical fertilizers; 50; 50;50 kg/ha (**h**).

Fig. 3 Aspects with the technological sequences from Drăguș demonstrative- experimental field // Aspecte cu secvențele tehnologice din dispozitivul experimental Drăguș

Fig. 4 Detail view of the grassy carpet in the demonstration field Drăguș, used in haymaking system // Vedere a covorului ierbos din lotul demonstrativ Drăguș, valorificat în regim de fâneață

In Fig. 4 is shown an aspect with the grassy carpet from the Drăguș demonstrative plot, used as haymaking.

RESULTS AND DISCUSSION

To determine the climatic characteristics of the Drăguș area, Brasov county, the data from the Făgăraș meteorological station (table 2), belonging to the National Meteorological Administration, the only one serving this territory, were used.

Table 2. Geographical location of Făgăraș meteorological station // Localizarea geografică a stației meteorologice Făgăraș

Station name	Latitude	Longitude	Altitude
Făgăraș	$45^{0}50^{i}$ N	$24^{0}56^{i}$ E	428 m

The analysis of the climatic parameters was carried out on the basis of those parameters that could have consequences, either positive or negative, on the socio-economic activities in the region or the productivity of the lands. The data were compared with multi-year averages for each parameter.

In the first part of the 2015...2016 agricultural year, conditions were less favorable from the point of view of the water regime, against the backdrop of a winter with quantitatively reduced solid precipitation and a snow cover that was maintained only two months, a fact reflected in the process phenologically, but especially the productivity of both in grasslands and agricultural crops. Compared to the previous year, the vegetation period is characterized by a moderate thermal regime and low amounts of precipitation, which contributed to the development of the plants in hostility conditions.

For the Dragus area, it can say that the 2016...2017 agricultural year was good from a thermal point of view, allowing the successful practice of agricultural activities, both on pastures and other crops, especially since the thermal values in the cold season were moderate, except for the months of December and January, with negative minimums below -20^{0}C. However, they influence productivity according to another climatic parameter, namely precipitation.

Referring to precipitation, it can be noted that, compared to 2015...2016, an agricultural year with a water deficit, the 2016...2017 agricultural year has a moderate water regime and in some months a surplus (for example May), a fact that contributed to the development of crop plants in good conditions and the increase of average productivity per ha compared to the previous year.

The agricultural year 2017...2018 was good from a thermal point of view, allowing the successful practice of grassland cultivation and other agricultural crops, especially since the thermal values in the cold season were moderate.

From the point of view of precipitation, the agricultural year 2017...2018 was a pluviometric surplus, the lowest amounts of precipitation were recorded in August in Făgăraș (10.2 l/m^2), and in April in Bâlea Lake (35.3l/m^2); the highest amounts of precipitation were reported in the months of June and July. Thus, it registered record amounts of precipitation (Făgăraș station in June 334.9 l/m^2; at Bâlea Lake, the amounts exceeded 800 l/m^2 in the same interval).

We can practically talk about a first normal pluviometric period of the 2017-2018 agricultural year and a second pluviometric surplus.

The production of dry matter obtained in the Drăguș experimental field, during the period 2016...2018, on the three variants, is presented in table 3. It recorded values between 4.18 (variant V1 in 2018) and 14.68 t/ ha SU (variant V3 in 2017).

In 2016, variants V2 and V3 achieved production increases in dry matter of 33% and 35%, respectively, compared to the control plot V1.

Table 3. Dry matter yield realized in Drăguș experimental field in 2016-2018 period, t/ha DM // Producția de substanță uscată obținută în câmpul experimental Drăguș în perioada 2016-2018, t/ha SU

Variant	Year		
	2016	2017	2018
V1	6,72	6,22	4,18
V2	8,95	9,56	8,02
V3	9,10	14,68	10,05

In 2017, V2 and V3 had increases in dry matter production of 53% and 136%, respectively, compared to V1, the control plot, unimproved permanent grassland. Comparing the two improved grassland variants, V2 and V3, V3, the annually fertilized variant, shows a 54% increase in production. In 2018, variants V2 and V3 achieved increases in dry matter production of 92% and 142%, respectively, compared to V1, the control variant. Comparing the two improved grassland variants, V2 and V3, on V3, the annually fertilized variant, a 26% increase in production was achieved.

Table 4 shows the production of dry matter and nutritional parameters, for the years 2016, 2017 and 2018, at variants V1, V2 and V3 from the experimental field Drăguș - Făgăraș geographical plateau. It is observed that both variants, V2 and V3, compared to the control variant V1, show statistically assured differences for the crude protein content, as follows: in 2016, the differences are very significant, and in 2017, the differences are significant.

Table 4. Quality parameters of forages from the Drăguș experimental field // Parametrii nutritivi (% din SU) ai furajelor din Câmpul experimental Drăguș

Year	Variant	DM [t/ha]	CP [%]	CA [%]	CF [%]	ADF [%]	ADL [%]	NDF [%]	DMD [%]	OMD [%]
2016	V1-cp	6.72	8.8	6.9	38.8	42.3	5.7	58.3	44.2	40.4
	V2	8.95**	15.2***	9.6***	33.4^{000}	38^{00}	4.9	50.7^{00}	61.8***	58.1***
	V3	9.10***	16.3***	9.7***	32.6^{000}	38.8^{0}	5.2	52.4^{0}	63.2***	58.0***
2017	V1-cp	6.22	14.0	10.5	34.0	38.9	5.6	59.6	52.8	53.0
	V2	9.56***	16.1*	10.6	30.7^{00}	34.9^{0}	6.3	50.5^{00}	55.7	49.5
	V3	14.68***	15.8*	10.1	31.9	36.5	6.4	54.3^{0}	54.1	48.0
2018	V1-cp	4.18	13.0	9.2	34.2	35.4	5.5	55.0	61.5	50.6
	V2	8.02***	14.1	9.7	32.3	35.1	4.9	56.3	61.6	54.4
	V3	10.05***	14.0	10.1*	31.3^{0}	38.0	5.5	60.2^{0}	59.4	52.5
LD 5 % LD 1 % LD 0.1 %		1.26 1.72 2.34	1.52 2.13 3.01	0.86 1.20 1.70	2.19 3.07 4.34	3.01 4.22 5.97	1.02 1.43 2.02	4.69 6.57 9.29	4.47 6.27 8.87	5.22 7.33 10.35

LD 5 % = 5.22 LD 1 % = 7.33 LD 0.1% = 10.35

DM- Dry Matter; CP- Crude Protein; CA- Crude Ash; CF- Crude Fiber; ADF-acid detergent fiber; ADL-acid detergent lignin; NDF-neutral detergent fiber; DMD-dry matter digestibility; OMD-organic matter digestibility.

Table 5 shows the results of the Student test (factor A-variant, factor B-year), carried out on the productions obtained in the Drăguș experimental field.

Table 5. Student test results from experimental field Drăguș, Făgăraș Country// Rezultatele testului Student din câmpul experimental Drăguș

Factor B – Year	Factor A – variant	Dry Matter, DM		Differences [t/ha]		Significations
		t/ha	%			
b1 – 2016	a1 – V1	6.72	100	-		
	a2 – V2	8.95	133.2	2.23		**
	a3 – V3	9.10	135.4	2.38		***
b2 – 2017	a1 – V1	6.22	100	-		
	a2 – V2	9.56	153.7	3.34		***
	a3 – V3	14.68	236.0	8.46		***
b3 – 2018	a1 – V1	4.18	100	-		
	a2 – V2	8.02	191.9	3.84		***
	a3 – V3	10.05	240.4	5.87		***

LD 5 % = 1.26 t/ha; LD 1 % = 1.72 t/ha; LD 0.1 % = 2.34 t/ha

From the data presented in table 5, it can be seen that both the V2 and V3 variants show significantly higher production increases than the control variant, V1, regardless of the experimental year, as follows: V2 variant - each experimental year shows distinctly significant increases (between 33 .2% and 91.9%), and for Variant V3, regardless of the experimental year, the increase is very significant (between 35.4% and 140.4%).

CONCLUSIONS

1. The degraded grasslands, located in the Făgăraș Depression, can be improved by total renovation by carrying out some improvement operations that will diminish or annihilate the effect of the

limiting factors of the production and quality of fodder, using mixtures of grasses and legumes of perennial fodder, suitable for the type of exploitation, promoting biodiversity conservation and environmental protection.

2. In the Drăguș experimental field, the differences in dry matter production and forage quality, in these three years 2016, 2017 and 2018, between the variants improved by reseeding (V2 and V3) and the control variant (V1) are distinct or very significant, a fact that justifies the full application of these technological sequences.
3. The location of the experimental assembly had as a criterion that the obtained results could be extrapolated over an area as large as possible, characterized by similar stationary area conditions.

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RESEARCH ON THE BEHAVIOR OF SOME TRITICALE VARIETIES UNDER THE CONDITIONS OF A.R.D.S. SECUIENI BETWEEN 2017-2022

CERCETĂRI PRIVIND COMPORTAREA UNOR SOIURI DE TRITICALE ÎN CONDIȚIILE DE LA S.C.D.A. SECUIENI ÎN PERIOADA 2017-2022

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Abstract

The triticale species is recognized for its utilization of soils less suitable for wheat cultivation, high adaptability to climate and soil conditions, high yields and resistance to diseases and pests.

At A.R.D.S. Secuieni the Romanian triticale varieties and lines were monitored to establish every year their adaptability. The new triticale varieties tend towards high yield, making very good use of less favorable areas for cultivation.

The varieties Zaraza, Tulnic, Utrifun and Haiduc were distinguished by the high yields in optimal growing conditions, while the varieties Oda FD and Tulnic were distinguished by the stability of yields in the pedoclimatc conditions of Central Moldova.

Key words: triticale, climate change, yields, stability, adaptability

Rezumat

Specia triticale este recunoscută datorită valorificării solurilor mai puțin prielnice culturii grâului, a adaptabilității mari la condițiile de climă și sol, a producțiilor mari și a rezistenței la boli și dăunători.

La S.C.D.A. Secuieni se testează an de an cultura națională cu soiuri și linii de triticale românești în vederea stabilirii adaptabilității acestora. Noile soiuri de triticale tind spre producții ridicate, valorificând foarte bine și zonele mai puțin favorabile de cultură.

Soiurile Zaraza, Tulnic, Utrifun și Haiduc s-au remarcat prin producții mari în condiții optime de cultură, în timp ce soiurile Oda FD și Tulnic s-au remarcat prin stabilitatea producțiilor în condițiile pedoclimatice din Centrul Moldovei.

Cuvinte cheie: triticale, schimbări climatice, producții, stabilitate, adaptabilitate

INTRODUCTION

Yield stability is a problem that interests all agricultural specialists and must be an objective of agricultural research, paying special attention to areas with less favorable climatic conditions (Săulescu, 1984).

There has always been a concern for the renewal of cereal varieties, they are becoming more and more productive, being more adapted to the climatic conditions. According to data from the specialized literature, their yields have increased linearly since the 1960s, especially in areas with favorable conditions where the availability of water in soil was not limited and where the cultivation technology was adapted according to the demands of the variety (Zhou and et al., 2007; Fischer and Edmeades, 2010; Matus et al., 2012). Also, the cereal yield has increased a lot in the last decades and in areas where precipitation has been limited (Mediterranean areas), a fact that is due to the increased performance under water stress of the newly created varieties (Nouri et al., 2011; Sánch - García et al., 2013; Hawkesford et al., 2013).

Climate changes in the last period of time have accentuated these extreme variations, with serious consequences on agricultural yield (Săulescu et al., 2006). The physical and chemical properties of the soil (high content in clay, low permeability, low pH, high content of free aluminum ions), associated with the climatic factors that are so different from year to year, cause significant fluctuations in the cereals yields. In this context varieties react differently depending on the ability to adapt to the pedoclimatic condition of the area (Voica, 2009).

The triticale species, through the characteristics inherited from rye: crop good establishment, fast growth and development even at lower temperatures, both in autumn and early spring, allow it to develop a fairly deep early root system, which facilitate them to use the water from the deeper layers of the soil much more efficiently, compared to other cereals (Ittu et al., 2007).

Among cereal crops, triticale is one of the great accomplishments by research in the field of theoretical and applied genetics and which has wide potential possibilities for increasing the yield per surface unit (of products for human nutrition and animal feed), especially in areas with conditions of culture less favorable for other cereals (Ittu et al., 1986, 2001; Ittu and Săulescu, 1988, 2000).

The strong interactions between genotype and environment, in the breeding process, contribut to the varieties creation with specific adaptability to favorable and unfavorable climatic conditions (Tessemma et al., 1998).

The nutritional value of the triticale grain is mostly given by the increased content in protein substances that exceeds the wheat content, as well as the structure of essential aminoacids and especially by the richer content in lysine. Nutritional value, the high digestibility of carbohydrates and protein substances give priority to triticale seeds in feeding non-ruminant animals, pigs and birds. Research carried out in this regard has shown that the protein-energy ratio is generally higher in triticale feeds than in traditional concentrates (Brouwer, 1977). The strong growth rate in the first development phases and the rich vegetative mass of the plants compete with the weed growth that are suppress, thus contributing to clearing the land of weeds (Gaşpar and Butnaru, 1985).

The identification of more valuable varieties than the existing ones is a major objective in the breeding of agricultural species, it being known that the variety participates directly in increasing yield (Leş and Oproiu, 1987).

This paper presents results regarding the yield obtained by some triticale varieties based on multi-year testing in comparative cultures in order to expand the most adapted genotypes for the area of Central Moldova.

MATERIAL AND METHOD

The research was carried out between 2017-2022 at A.R.D.S. Secuieni and followed the behavior of ten varieties of winter triticals, created by N.A.R.D.I. Fundulea (Haiduc, Cascador F, Negoiu, Pisc, Zori, Zvelt, Oda FD, Utrifun, Tulnic and Zaraza), in the pedoclimatic conditions of Central Moldova. The comparative culture was placed according to the method of randomized blocks, in three repetitions, without repeating the basic scheme. The experimental plot had a harvestable surface of 8 m^2.

The placement of the experiments was carried out on a cambic chernoziom soil type, with a pH in water of 6.26; the humus content of 1.46; nitrogen parameter – 17.8 ppm; mobile phosphorus - 36 ppm; potassium – 185.9 ppm. Basic fertilization was done in autumn with NPK were 36 kg N/ha and 92 kg P_2O_5/ ha and in the spring were administered 67 kg N/ha.

The ten varieties studied were analyzed in each of the five years, both from the point of view of yields capacity and morphophysiological characters.

In the experiments, the crop technology specific to the area was applied. The data obtained were processed and statistically interpreted according to the variance analysis method, and the coefficient of variability was determined to assess the stability of the yield (Ceapoiu, 1968).

The unit's area of influence has recently been experiencing an increase in average monthly temperatures due to the decrease in precipitation, and studies on the adaptability of crops to the new environmental conditions are needed.

In the last five years we are facing a continuous increase in average monthly temperatures compared to the multi-year average.

The 2019/2020 year was characterized as the warmest, of the last five years studied, and the warmest months were January and February, months that record deviations of +3.2°C and +3.8°C, respectively, compared to the multi-year average (Figure 1) .

Regarding the rainfall regime, the area of influence of the unit faces a continuous lack of rainfall, starting from 2017/2018 year, when the rainfall that fell in June (140.4 mm) and July (137.7 mm) restored the deficit accumulated up to that date, but starting from August 2018, rainfall has considerably reduced, registering at the end of the year a deviation from the multi-annual average of 6.0 mm. The rainfall deficit increased from one year to the next, so in 2021/2022 year, the amount of rainfall registered from September 1, 2021 to August 31; 2022 was of 260.8 mm, approximately half of the multi-year average of 531.9 mm (Figure 2).

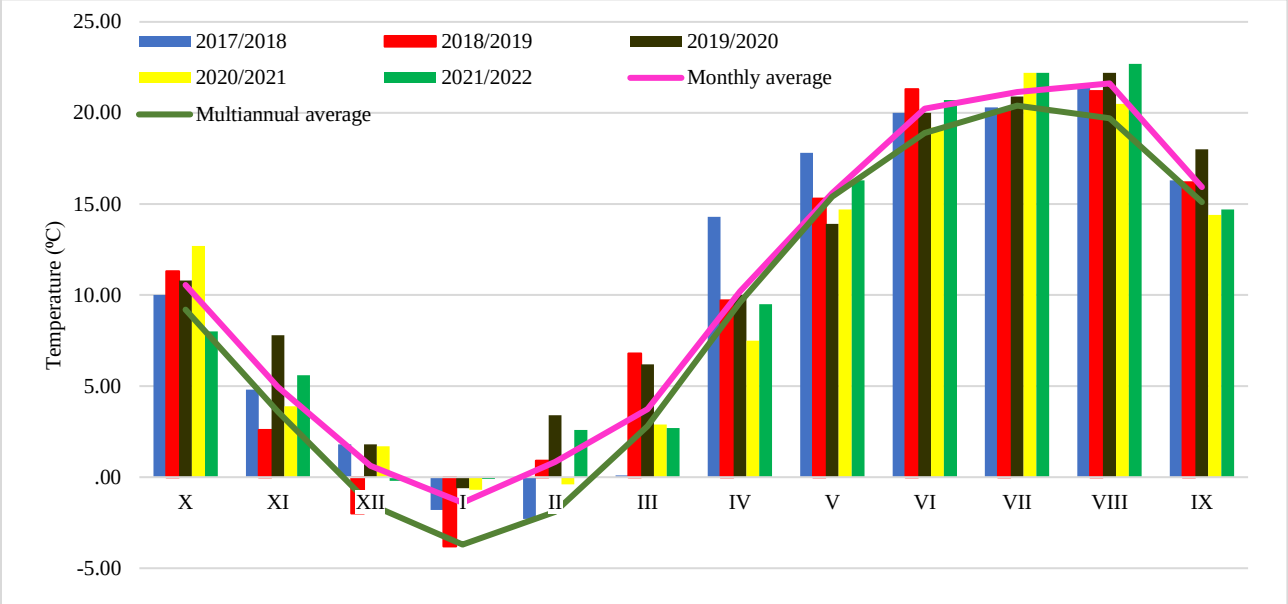

Figure 1. Average temperatures recorded between 2017-2022 at A.R.D.S. Secuieni and the multi-year average (1962-2022) // Temperaturile medii înregistrate în perioada 2017-2022 la S.C.D.A. Secuieni și media multianuală (1962-2022)

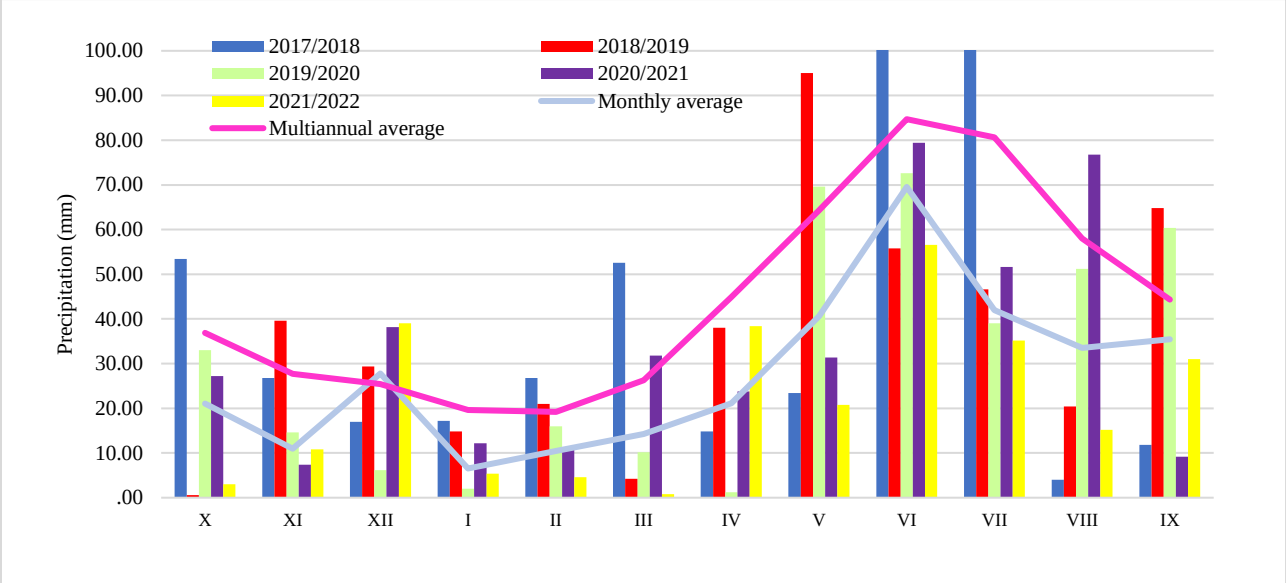

Figure 2. Average rainfall recorded between 2017-2022 at A.R.D.S. Secuieni and the multi-year average (1962-2022) // Precipitațiile medii înregistrate în perioada 2017-2022 la S.C.D.A. Secuieni și media multianuală (1962-2022)

RESULTS

The yields obtained at the ten varieties of triticale were influenced by the amount of rainfall recorded during the vegetation period and the thermal regime.

On average, in the five years studied, the Haiduc variety stands out for a high number of grains/ear (43.6), being a variety with a large ear, of a matte white color, with a pyramidal aristade and with a nutant position at maturity (Table 1).

The weight of grains/ear is a yield parameter influenced by the variety, the applied technology and also the climatic conditions. Under the conditions of A.R.D.S. Secuieni, the varieties Haiduc and Utrifun recorded the highest weights of grains/ear, of 2.06g and 2.03g, respectively (Table 1).

The mass of one thousand grains recorded average values between 40.29 (Zori) and 47.39 (Negoiu) and the hectoliter mass recorded values between 72.90 (Haiduc) and 78.30 (Zaraza). According to the wheat grading plan from C.N.G.S.C. (2017) the Zaraza variety falls into grade 1, with HM > 77 kg/hl, the Tulnic, Utrifun, Zori and Zvelt varieties fall into grade 2 (HM <77, >75) and the other 5 varieties fall into grade 3 (HM < 5,>72) (Tab. 1).

Table 1. The average values of some yiled indices recorded in the period 2017-2022 at A.R.D.S. Secuieni // Valorile medii ale unor indici de productivitate înregistrați în perioada 2017-2022 la S.C.D.A. Secuieni

Varieties	Number of grains/ear	Grains weight/ear (g)	TGW (g)	HM (kg/hl)
Haiduc (Ct.)	43.6	2.06	44.78	72.90
Negoiu	39.6	1.72	47.39	73.16
Oda FD	39.2	1.75	44.38	73.56
Pisc	39.3	1.78	46.13	73.76
Tulnic	37.5	1.69	44.80	76.00
Cascador F	36.5	1.54	42.32	74.36
Utrifun	40.2	1.69	43.60	75.52
Zori	42.9	1.70	40.29	75.92
Zvelt	41.5	1.87	45.84	76.34
Zaraza	42.7	2.03	47.22	78.30

In the first year of experimentation, triticale varieties recorded yields with values between 6636 kg/ha (Pisc) and 8807 kg/ha (Zaraza). The varieties Tulnic, Utrifun, Zori and Zaraza obtained statistically significant increases in yield and interpreted as very significant.

In 2018/2019 year, the yields obtained were between 5813 kg/ha (Cascador F) and 7117kg/ha (Pisc) (Tab.2).

The 2019/2020 year was characterized as a very hot and dry year. The triticale was sown in a dry soil, and the lack of precipitation in April (only 1.2 mm was recorded in the second decade) led to the drying of the brothers, thus recording crop losses. The control variety - Haiduc recorded the highest production (8683 kg/ha), being characterized as an earlier variety, stable, adapted and productive in the conditions of the Central area of Moldova (Pochișcanu et al. 2016).

The Zaraza variety stood out in 2020/2021 year, registering an increase in yields statistically interpreted as very significant. The Utrifun variety recorded an average yield of 9089 kg/ha, registering an increase in yield statistically interpreted as distinctly significant and the Zvelt variety obtained an average yield of 8296 kg/ha, the increase in yield being statistically interpreted as significantly positive (Table 2).

Of the five years studied, the 2021/2022 year was the driest, with negative precipitation deviations throughout the triticale vegetation period. The increases in yields were statistically interpreted as very significant and were recorded for the varieties Tulnic, Utrifun and Zaraza. The varieties Oda FD, Cascador F, Zori and Zvelt obtained increases in yield that were statistically interpreted as distinctly significant (Tab. 2).

On average, in the five years studied, the climatic conditions recorded were very different and the varieties Tulnic, Utrifun and Zaraza surpassed the control variety-Haiduc (Table 2).

Table 2. The yiled of some triticale varieties registered at A.R.D.S. Secuieni in the period 2018-2022 and their comparison with the control Haiduc // Producțiile unor soiuri de triticale înregistrate la S.C.D.A. Secuieni în perioada 2017-2022 și comparația acestora cu martorul Haiduc

Varieties	Yields (kg/ha)					
	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	Average
Haiduc (Ct.)	7105	6584	8683	7000	4949	6864
Negoiu	7139	6962	6904°°°	5408°°	4086°	6100
Oda FD	7054	6541	7070°°°	6908	6108**	6736
Pisc	6636	7117	6939°°°	5590°	4763	6209
Tulnic	8172***	6474	6753°°°	7293	6657***	7070
Cascador F	7018	5813°	5572°°°	5012°°	6260**	5935
Utrifun	8373***	6180	4679°°°	9089**	6552***	6975
Zori	8234***	6781	4964°°°	6630	6004**	6523
Zvelt	7304	6461	4706°°°	8296*	6209**	6595

Varieties	Yields (kg/ha)					
	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	Average
Zaraza	8807***	6175	6689°°°	11221***	7119***	8002
LSD 5%	484	734	680	1077	718	739
LSD 1%	687	1043	967	1531	1021	1050
LSD 0.1%	995	1510	1400	2217	1478	1520

Two of the varieties analyzed (Oda FD and Tulnic) can be characterized as having a small variation in yields (CV<10). High coefficient of variation (>20), determined by large variations in yield from one year to the next, were recorded by the varieties Negoiu, Cascado F, Utrifun and Zaraza, which in optimal growing conditions achieve very high yields, but which in drought conditions do not adapts equally well (Figure 3).

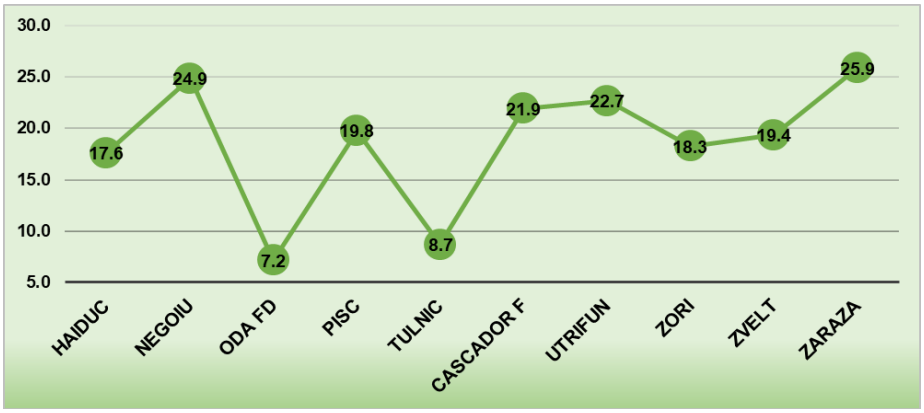

Figure 3. The coefficients of variation recorded in the period 2017-2022 for triticale varieties under the conditions of A.R.D.S. Secuieni // Coeficienții de variație înregistrați în perioada 2017-2022 la soiurile de triticale în condițiile de la S.C.D.A. Secuieni

Classifying the varieties according to the yield performances obtained at A.R.D.S. Secuieni, the first place is occupied by the Zaraza variety (8002 kg/ha) and the last place is occupied by the Cascador F variety (5935 kg/ha). The high fluctuation of yields was determined primarily by the different response of the varieties to the very different climatic conditions during the five years of testing (Figure 4).

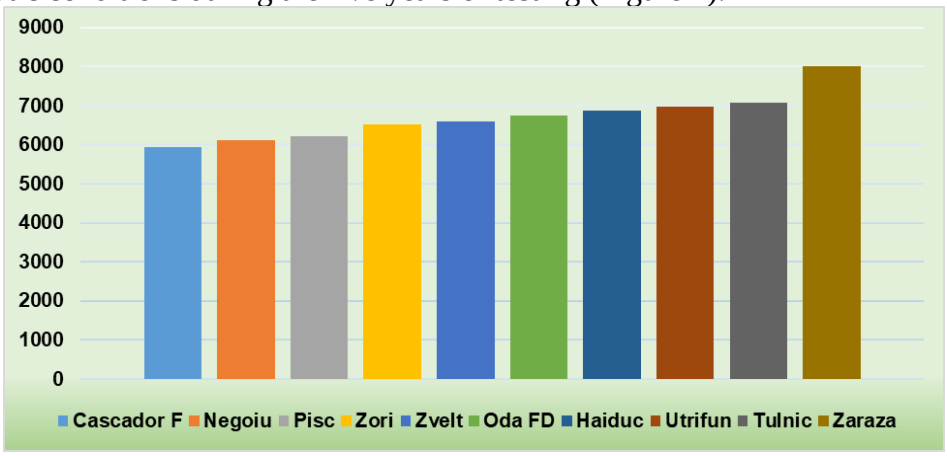

Figure 4. Classification of triticale varieties according to average yield obtained in the period 2017-2022 at A.R.D.S. Secuieni // Clasificarea soiurilor de triticale după producțiile medii obținute în perioada 2017-2022 la S.C.D.A. Secuieni

CONCLUSION

1. The 2017-2022 period was characterized by very large fluctuations in rainfall and temperatures, as a result of which triticale yields varied from one year to another.
2. The average yields obtained at triticale varieties were between 5935 kg/ha, obtained by the Cascador F variety and 8002 kg/ha, obtained by the Zaraza variety.
3. The varieties Oda FD and Tulnic showed the highest adaptability to pedoclimatic conditions, and the varieties Zaraza and Negoiu showed the lowest adaptability.

4. It is recommended to cultivate varieties with wide adaptability to the environmental conditions in order to reduce the risks of decreased yield in unfavorable years.

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RESEARCH ON THE BEHAVIOR OF SOME ROMANIAN VARIETIES OF SOYBEAN, UNDER PEDO-CLIMATIC CONDITIONS AT A.R.D.S. SECUIENI, IN THE PERIOD 2018-2022

CERCETĂRI PRIVIND COMPORTAMENTUL UNOR SOIURI ROMÂNESCĂ DE SOIA, ÎN CONDIȚII PEDO-CLIMATICE LA SCDA SECUIENI, IN PERIOADA 2018-2022

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Abstract
During 2018-2021 in the experimental field of the ARDS Secuieni (Agricultural Research and Development Station) were experienced a number of fifteen soybean varieties (Onix, Eugen, Felix, Darina, Cristina, Mălina, Carla TD, Larisa TD, Caro TD, Ilinca TD, Bia TD, Ada TD, Teo TD, Miruna TD and Felicia TD) creation of the ARDS Turda, in order to establish their adaptability to the pedo-climatic condition of the area. The varieties adapted well to A.R.D.S. Secuieni in the pedo-climatic conditions obtaining, in average yields of 2172 kg/ha. The results showed a hight adaptability to varieties Eugen(2.380 kg/ha) and Larisa TD (2.356 kg/ha).

Key words: soybean, adaptability, yield.

Rezumat
În perioada 2018-2021 în domeniul experimental al SCDA (Stația de Cercetare-Dezvoltare Agricolă) au fost experimentate un număr de cincisprezece soiuri de soia (Onix, Eugen, Felix, Darina, Cristina, Mălina, Carla TD, Larisa TD, Caro TD, Ilinca TD, Bia TD, Ada TD, Teo TD, Miruna TD și Felicia TD) crearea SCDA Turda, pentru a le stabili adaptabilitatea la condițiile pedo-climatice ale zonei. Soiurile s-au adaptat bine la S.C.D.A. Secuieni în condițiile pedo-climatice obținându-se producţii medii de 2172 kg/ha. Rezultatele au arătat o mare adaptabilitate la soiurile Eugen(2.380 kg/ha) și Larisa TD (2.356 kg/ha).

Cuvinte cheie: soia, adaptabilitate, producție.

INTRODUCTION

Soybean is a cultivated herbaceous plant belonging to the Fabaceae, Fabioideae botanical family, subfamily, *Glycine L*. genus, the most important species of this plant is *Glycine max.* L. synonym *Glycine hispida* (Moench.) Maxim.

Etymologically, the word "soy" comes from Dutch, and is an adaptation of the term "shoyu" (soy sauce), which comes from Japanese, a word that in turn derives from the Chinese language "jiàngyóu".

The plant itself is native to East Asia, where it represents, moreover, an important culture with a rich tradition. Some sources state that around 2853 BC, the legendary Emperor of China, Shennong, proclaimed five plants as sacred: rice, wheat, barley, millet and soybean.

The species is indispensable in the food of Asians who nickname it "meat without bones" or "chinese beef", but which entered Europe only at the beginning of the 1700 AD, and in the United States in 1765 AD.

The true virtues of soy were discovered outside of Asia only at the beginning of the 1900's.

Today, soybean is a valued and demanded crop worldwide due to its ecological plasticity (Cealac and Budac, 2013).

In Romania in the last four years, the cultivated area with this species has an upward rhythm, in 2020, reaching 174 610 ha, this is the direct cause of the soybean breeding programs that aim to create early, productive varieties with stable production and acclimatized to the culture climate (Mureșan et al., 2014).

The present paper presents the results obtained after multi-year experiments in pedo-climatic conditions specific to A.R.D.S. Secuieni of some soybean genotypes patented by A.R.D.S. Turda for the purpose of expansion in the zonal culture of those with high adaptability.

RESEARCH MATERIAL AND METHOD

The experience were carried out during the agricultural period between 2018-2022 and aimed at adapting fifteen Romanian soybean varieties to the pedo-climatic conditions specific to Central Moldova, namely: Onix, Eugen, Felix, Darina, Cristina, Mălina , Carla TD, Larisa TD, Caro TD, Ilinca TD, Bia TD, Ada TD, Teo TD, Miruna TD and Felicia TD.

The placement of the comparative crops in the field was made according to the randomized block method, in 3 repetitions, where the experimental plot had a harvestable area of 10 square meters.

Pedology of the experimental field of A.R.D.S. Secuieni is characterized by the cambic phaeosium soil type, with a medium texture, slightly acidic (pH 6,14), with a low humus content (2,3%), being a poorly fertile soil, poorly supplied with nitrogen (0,134% Nt) , but with a considerable content in phosphorus (74 ppm) and potassium (221 mg/kg) in forms accessible to plants.

In the field, the crop's technology specific to the cultivation area in the Center of Moldova was followed, and the data obtained were processed and statistically interpreted according to the method of variation analysis (Jităreanu, 2016).

From a climatic point of view, the period 2018–2022 was characterized as hot and very dry. During the soybean growing seasons, the deviation from the multiannual average of temperatures was between 0,4 °C (2020/2021) and 1,5 °C (2021/2022), being characterized as normal and warm.

Table 1.Average temperatures recorded at ARDS Secuieni// Temperaturile medii înregistrate la SCDA. Secuieni

Year	Temperature (^{0}C)					The average of the vegetation period	+/-	Charact.
	V	VI	VII	VIII	IX			
2018	17,8	20,0	20,3	21,5	16,3	19,2	1,4	☼
2019	15,3	21,3	20,1	21,2	16,2	18,8	1,0	☼
2020	13,9	20,0	20,9	22,2	18,0	19,0	1,2	☼
2021	14,7	19,2	22,2	20,5	14,4	18,2	0,4	N
2022	16,3	20,7	22,2	22,7	14,7	19,3	1,5	☼
Multianual average	*15,4*	*18,8*	*20,4*	*19,5*	*15,0*	*17,8*	_	_

N = normal; ☼ = warm;

Regarding the rainfall regime, in the period from the sowing of the soybean crop to its physiological maturity, the deviation from the multi-year average of the rainfall recorded values between -21.5 mm (2018/2018) and -180, 1 mm (2021/2022), so that these vegetation periods were characterized as dry (2018/2018), respectively very dry (in the rest of the years experienced).

Table 2. The rainfall regime recorded at ARDS Secuieni// Regimul de precipitații înregistrat la SCDA Secuieni

Year	Rainfall (mm)					Σ_{pp} / vegetation period	+/-	Charact.
	V	VI	VII	VIII	IX			
2018	23,4	140,4	137,8	4,0	11,8	317,4	- 21,5	D**
2019	95,0	55,8	46,6	20,4	64,8	282,6	- 56,3	VD***
2020	69,6	72,6	39,0	51,2	60,4	292,8	- 46,1	VD***
2021	31,4	79,4	51,6	76,8	9,2	248,4	- 90,5	VD***
2022	20,8	56,6	35,2	15,2	31,0	158,8	- 180,1	VD***
Multianual average	65,7	85,0	82,3	60,2	45,7	338,9	-	

*D = Dry; VD*** = Very dry

The important aspect that must be emphasized is that in July 2020, in the Secuieni area, the layer of cumulus-nimbus clouds (Cb) generated the hailstorm that plagued the agricultural sector, soybean production being greatly reduced, being at the level of 31% of the production of 2019, respectively 29% of the production of 2018.

Also, the year 2021 was marked by the storms that occurred from the end of June to the second mid of July, characterized by strong wind gusts and whirlwinds, but which did not lead to a decrease in production of grains to this crop.

OBTAINED RESULTS

Among the productivity elements studied are number of pods/plant, number of grains/plant, weight of grains/plant, hectolitre weight and thousand kernel weight.

Regarding the number of pods/plant, during the experimental period the Felix variety stands out with an average number of 37 pods/plant, at the opposite pole are the Teo TD and Miruna TD varieties with an average number of 27 pods/plant (fig. 1).

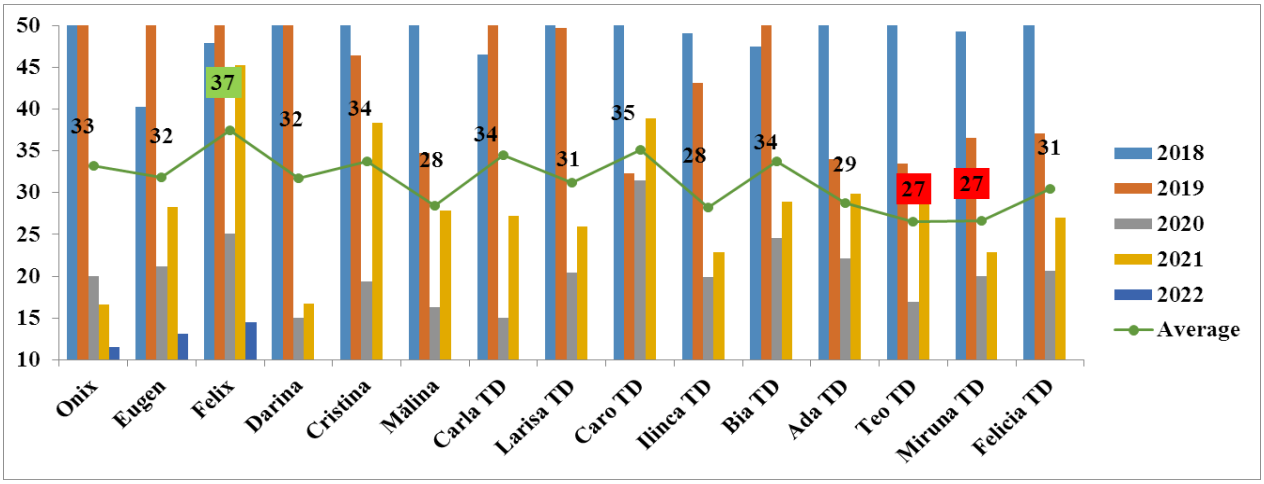

Figure 1 – **Number of pods/plant**, 2018-2022// Număr păstăi/plantă, 2018-2022

The number of grains/plant oscillated within large limits, on average having values between 47 grains (Teo TD variety) and 86 grains (Felix variety) (fig. 2).

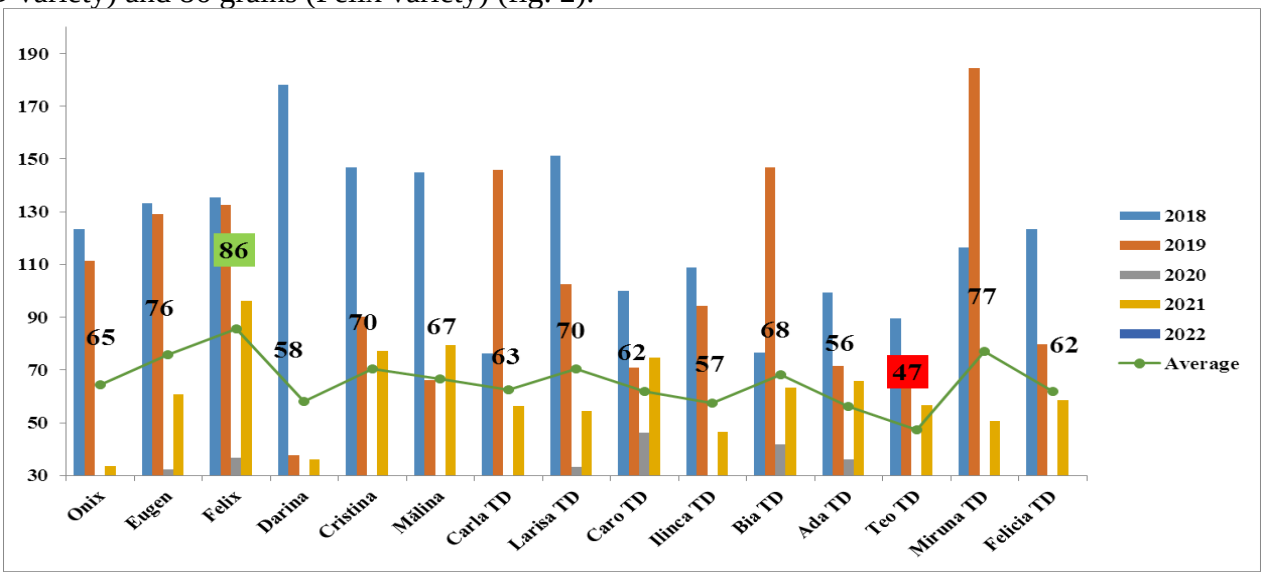

Figure 2 – Number of grains/plant, 2018-2022// Număr boabe/plantă, 2018-2022

The average weight of grains/plant, a quality index directly proportional to the number of pods/plant and the number of grains/plant, also recorded the highest average value (15,4 g) in the Felix variety, twice more than in the case of the average value obtained for the Teod TD variety (7,7 g) (fig. 3).

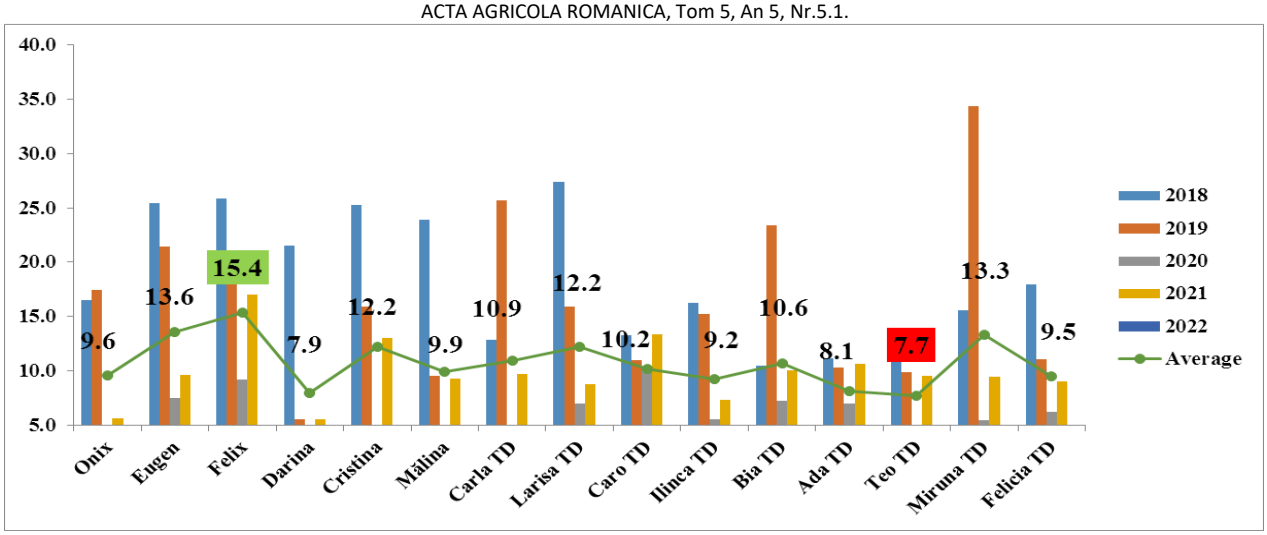

Figure 3 – Grain weight/plant (g), 2018-2022// Greutate boabe/plantă (g), 2018-2022

In the 2018-2022 agricultural period, the Darina variety stands out with the highest average hectolitre weight of 76,4 kg/hl, followed by the Miruna TD and Felicia TD varieties (76,2 kg/ha). For this quality index, the lowest average value was 74,7 kg/hl (Carla TD variety) (fig. 4).

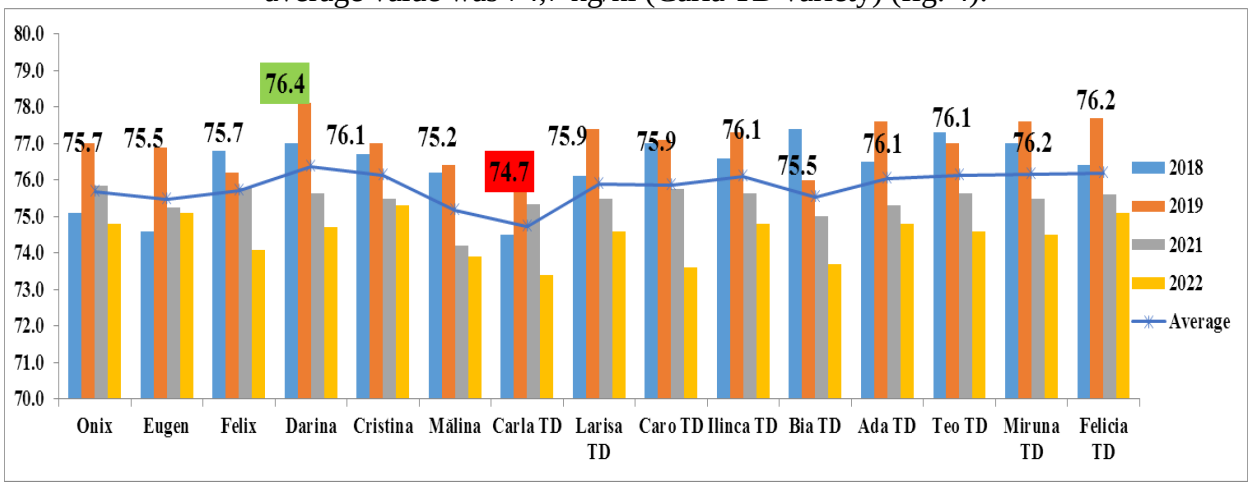

Figure 4 – Hectoliter mass (kg/hl), 2018-2022 // Masa hectolitrică (kg/hl), 2018-2022

The thousand kernel weight had average values between 154,4 g (Onix variety) and 182,2 g (Felix and Miruna TD varieties) (fig. 5).

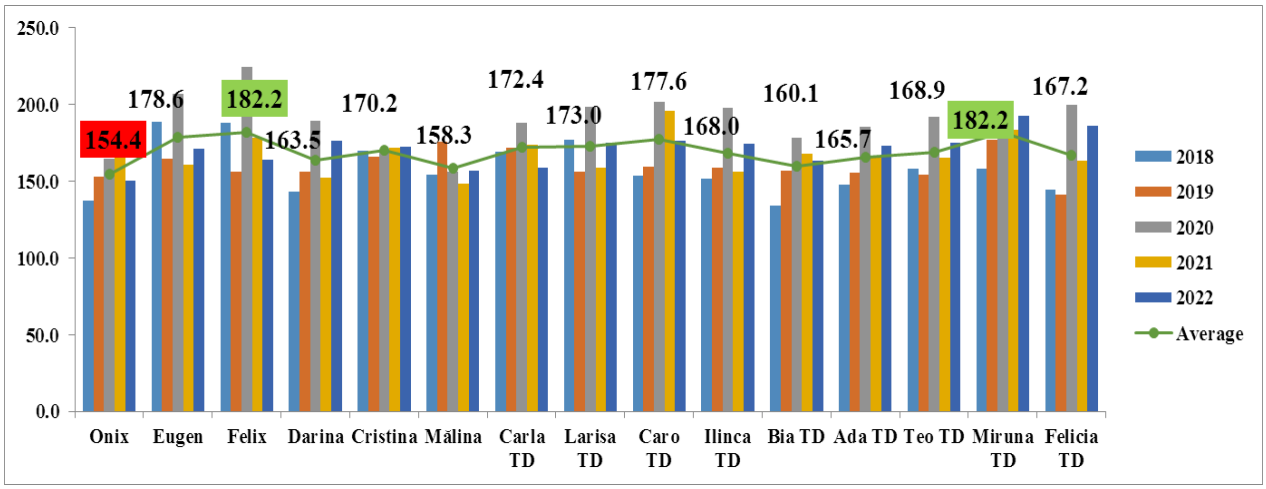

Figure 5 – Mass of a thousand grains (g), 2018-2022// Masa de o mie de boabe (g), 2018-2022

In the year 2018, the yields of the tested varieties varied between 2671 kg/ha (Cristina variety) and 3758 (Ada TD variety). Compared to the control (the average of the experience) there was a statistically significant increase yields (Ada TD variety), and in some varieties the yields obtained were lower, compared to the control, the yields differences were negatively significant (Cristina, Carla TD and Felicia TD).

In the second year of experimentation, 2019, among the genotypes studied, the Bia TD variety stands out, with a yield of 3604 kg/ha, statistically assured and interpreted as very significant, having a yield increase, compared to the control, of 559 kg/ha, and in the Darina variety, there was a yield's decrease by 552 kg/ha, the difference being negative and very significant.

The year 2020, a year marked by the extreme weather phenomenon, namely hail, which plagued the soybean crop and negatively influenced yields, the average value of which did not exceed 900 kg/ha. The average yield of soybeans in 2020 was 933 kg/ha, being at the level of 31% of the 2019's yield, respectively 29% of 2018's yield.

In the year 2021, the average yield of the experimental soybean varieties was 3036 kg/ha, the increases or differences in yield of the experimental varieties compared to the control were not statistically ensured. The highest yield was recorded for the Eugen variety (3660 kg/ha), and the lowest yield was recorded for the Bia TD variety (2576 kg/ha).

In the last year of the experiment, 2022, a very dry and hot year, the average yield had the lowest value of the experiment period, 611 kg/ha. The highest value of grain yield was recorded in the Mălina variety (1134 kg/ha), and the lowest yield value was found in the Teo TD and Felicia TD varieties (293 kg/ha).

Table 3. Average productions recorded in the experimental soybean varieties// Producțiile medii înregistrate la soiurile experimentale de soia

Crt. No.	Variety	Yield (kg/ha)					
		2018	2019	2020	2021	2022	Multianual average
1	Onix	3019	3094	841	3079	627	2132
2	Eugen	3298	3164	866	3660	913	2380
3	Felix	3274	3410**	857	2779	850	2234
4	Darina	3160	2493ooo	789	2902	566	1982
5	Cristina	2671o	3185	757	3045	950	2122
6	Mălina	3386	3083	794	3058	1134*	2291
7	Carla TD	2769o	2688oo	796	3093	613	1992
8	Larisa TD	3473	3345*	988	3498	474	2356
9	Caro TD	3577	2977	1621***	2699	418	2259
10	Ilinca TD	3279	3114	956	3041	418	2162
11	Bia TD	3438	3604***	978	2576	725	2264
12	Ada TD	3758*	2990	1116	2942	402	2242
13	Teo TD	3010	3102	853	2995	293	2051
14	Miruna TD	3705	2749o	902	2961	491	2162
15	Felicia TD	2701o	2673oo	877	3217	293	1952
16	Media (Ct)	3235	3045	933	3036	611	2172
DL 5%		489	228	202	640	474	562
DL 1%		660	308	272	862	639	757
DL 0,1%		875	408	362	1144	849	1005

On average, during the five years of experimentation, the yield of the varieties studied varied between 1952 kg/ha (Felicia TD variety) and 2380 kg/ha (Eugen variety), values not statistically guaranteed.

Following the experimentation of the 15 varieties, the Cristina variety stands out as the most stable in terms of grain production, the amplitude being 2428 kg/ha, while the Ada TD variety has the highest value of the amplitude (3354 kg/ha) (fig. 6.)

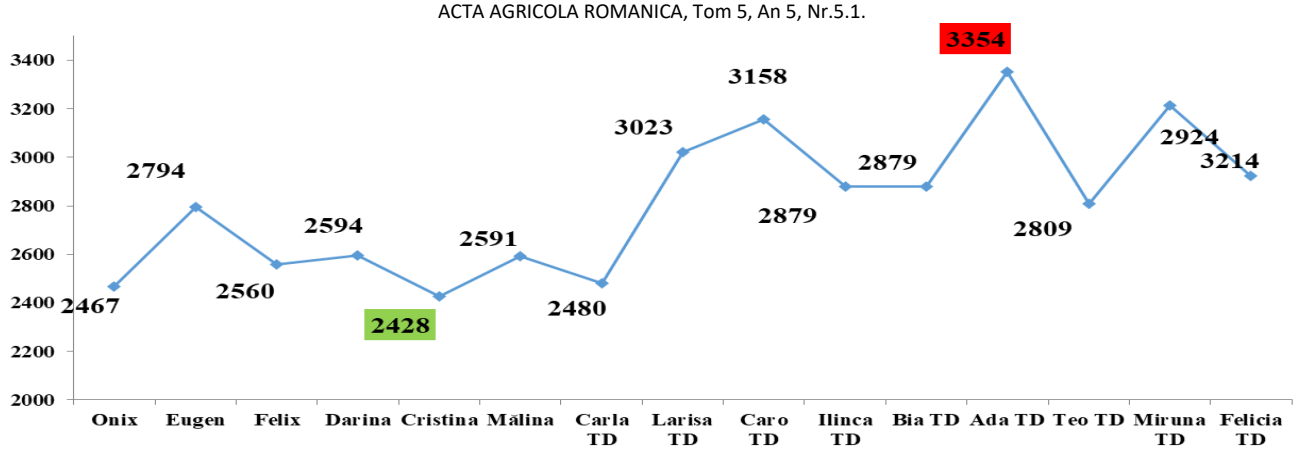

Figure 6 – Amplitude of soybean yields (kg/ha), 2018-2022// Amplitudinea producției de soia (kg/ha), 2018-2022

The quality indices of soybeans refer to the content in protein (%), oil (%) and fiber (%), being also considered the "plant of the future", intended to solve the global protein deficit.

The protein content of the 15 Romanian soybean varieties tested had average values of over 40,0%. The highest protein content of over 42% was recorded in the varieties Miruna TD (42,7%), Bia TD and Larisa TD (42,4%), Eugen (42,3%), Caro TD (42,2%) and Ada TD(42,0%).

Also, in the Darina, Felix, Mălina, Onix, Carla TD, Ilinca TD, Teo TD and Felicia TD varieties, the average protein content was between 40,5% and 41,8% (fig. 7).

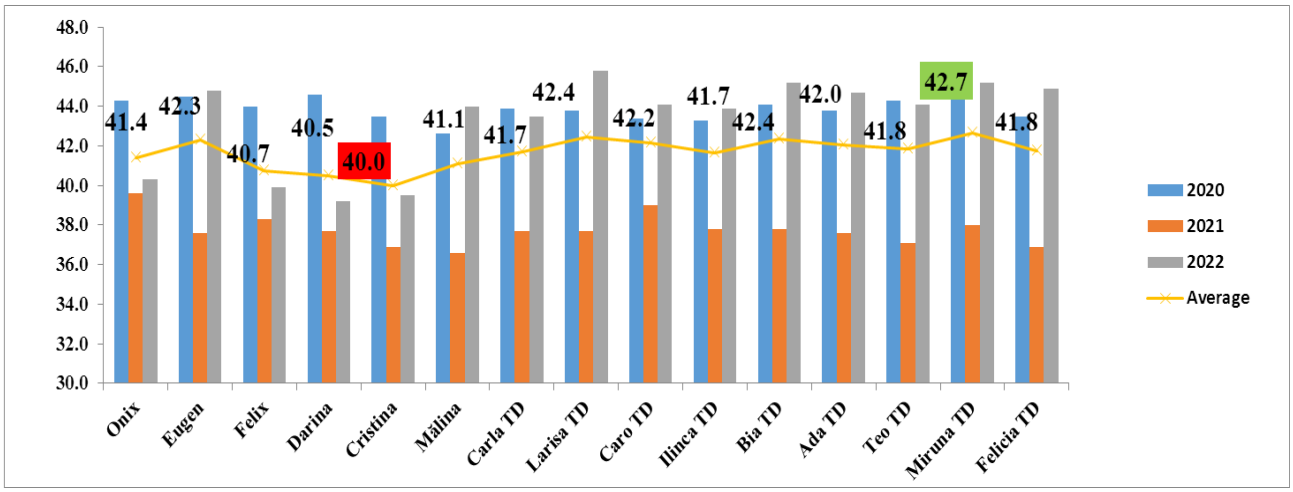

Figure 7 – Protein content of soybeans (%), 2020-2022// Conținutul de proteine din boabele de soia (%), 2020-2022

With the highest oil content, over 22%, the varieties Onix (22,3%) and Felix (22,4%) stand out, at the opposite pole are the varieties Ada TD (20,3%), Ilinca TD (20,4%), Teo TD and Felicia TD (20,5%) and Darina (20,9%), the other varieties had an average oil content between 21,1% and 21,9% (fig 8).

The fiber content of the grains had average values that oscillated within very narrow limits, namely 5,3% (Bia TD and Miruna TD varieties) and 5,6% (Darina and Cristina varieties) (fig. 9).

CONCLUSIONS

1. Regarding the climatic conditions, the experimental period was characterized as hot and dry.
2. Temperatures registered an increase of 1,4 °C, and precipitation an average deficit of 145,7 mm, compared to multi-year averages. During this period, there were also extreme weather phenomena that directly influenced the production of soybeans.

3. During the 5 years, the varieties recorded average yields of over 2000 kg/ha, with the exception of the varieties Felicia TD (1952 kg/ha), Darina (1982,2 kg/ha) and Carla TD (1991,8 kg /ha), the average yield being thus between 1952 kg/ha (Felicia TD variety) and 2380 kg/ha (Eugen variety).

4. During the experimental period, the highest value of yield was recorded for the Ada TD variety (3758 kg/ha - year 2018) and the lowest value was recorded for the Teo TD and Felicia TD varieties (293 kg/ha - year 2022).

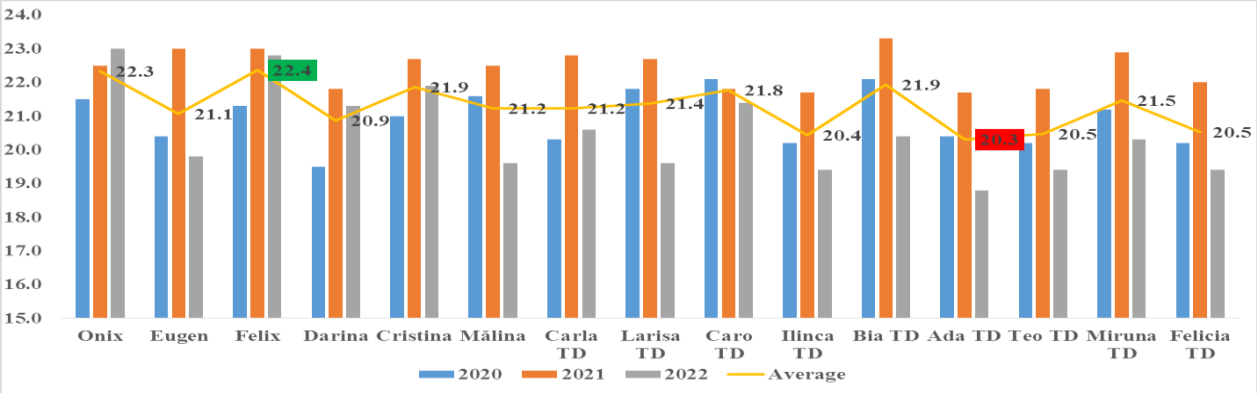

Figure 8 – Soybean oil content (%), 2020-2022// Conținut de ulei de soia (%), 2020-2022

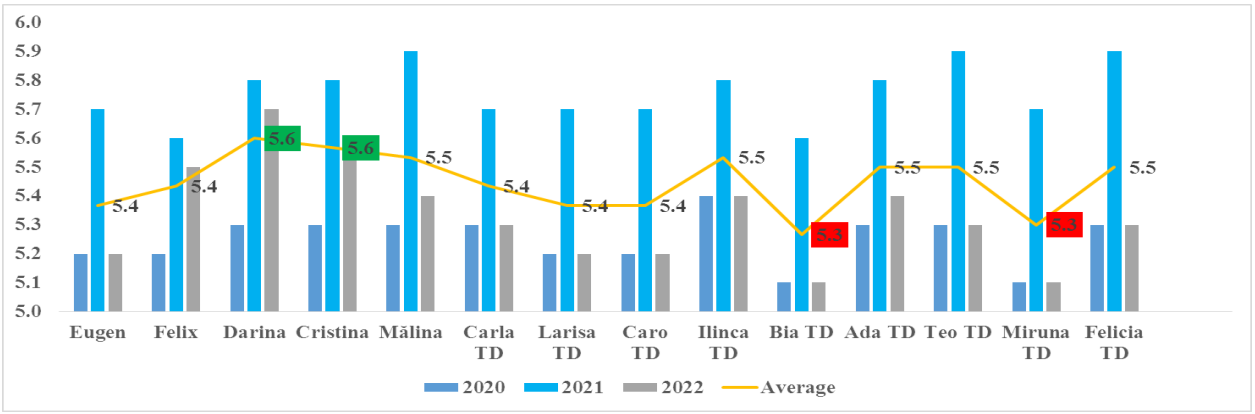

Figure 9 – Fiber content of soybean (%), 2020-2022 // Fiber content of soybean (%), 2020-2022

5. The most pronounced stability of yield was registered with the Cristina variety whose amplitude was 2428 kg/ha.

6. Following the determinations made on the productivity elements, the Felix variety stands out with the highest values.

7. From the point of view of quality elements, all cultivated varieties are high in protein (over 40%) and oil (over 20%).

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THE INFLUENCE OF APPLIED MANAGEMENT ON THE PRODUCTION AND VEGETATION STRUCTURE OF A *Dichanthium ischaemum* (L.) Roberty MEADOW

INFLUENȚA MANAGEMENTULUI APLICAT ASUPRA PRODUCȚIEI ȘI STRUCTURII COVORULUI VEGETAL PE O PAJIȘTE DE *Dichanthium ischaemum* (L.) Roberty

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Abstract:

The researches carried out in the 2021-2022 agricultural year, within the Research and Development Station for Meadows, Vaslui, on a Dichanthium ischaemum (L.) Roberty *meadow, were represented by the analysis of the applied management on the production of dry matter and the vegetation structure changes. The amount of green mass per hectare, the dry matter content and the amount of dry matter per hectare were determined. The study of vegetation was carried out using the geobotanical method. The agricultural year 2021-2022 was a very dry year, affecting the growth and development of permanent grasslands species. The studied meadow had a vegetation structure dominated by species with very poor fodder value and an animal load of 0.55 UVM per hectare. Following some of the measures applied, the grassland potential increased by 10-47%. In the case of the abandoned and mulch variants, the yields obtained were very close to those of the control variant, with no statistically assured differences, and in the case of the* $N_{50}P_{50}K_{50}$ *and* $N_{100}P_{100}K_{100}$ *fertilization variants the highest yields were obtained, with very significant increases ranging from 75.2 to 90.3 %. Because of the lack of precipitation the manure has not completely decomposed, remaining at the surface of the soil, the effect of its apiculation being less than that of the applied complex mineral fertilizers.*

Key words: abandonment, mulch, complex mineral fertilizer, manure

Rezumat.

*Cercetările efectuate în anul agricol 2021-2022, în cadrul Staţiunii de Cercetare-Dezvoltare pentru Pajişti Vaslui, pe o pajişte de Dichanthium ischaemum (*L.) Roberty*, a fost reprezentat de analiza managementului aplicat asupra producţiei de substanţă uscată şi a schimbărilor din structura covorului vegetal. Au fost determinate cantitatea de masă verde la hectar, conţinutul în substanţă uscată, cantitatea de substanţă uscată la hectar. Studiul asupra vegetaţiei s-a realizat prin metoda geobotanică. Anul agricol 2021-2022 a fost un an foarte secetos, fiind afectate creşterea şi dezvoltarea plantelor de pe pajiştile permanente. Pajiştea studiată a avut un covor vegetal dominat de specii cu valoare furajeră foarte slabă şi o încărcătură de animale de 0,55 UVM/ha. Din acest punct de vedere, în urma unora dintre măsurile aplicate, potenţialul pajiştii a crescut cu 10-47 %. În cazul variantelor abandonate şi mulcite producţiile obţinute au fost foarte apropiate de cele ale variantei martor, neexistând diferenţe asigurate statistic, iar în cazul variantelor de fertilizare* $N_{50}P_{50}K_{50}$ *şi* $N_{100}P_{100}K_{100}$ *au fost obţinute producţiile cele mai mari, cu sporuri foarte seminificative cuprinse între 75,2-90,3 %. Gunoiul de grajd nu s-a decompus complet, rămânând la suprafaţa solului, efectul aplicării acestuia fiind mai mic decât cel al îngrăşămintelor minerale complexe aplicate.*

Cuvinte cheie: abandon, mulci, îngrăşământ mineral complex, gunoi de grajd

INTRODUCTION

Meadows have played and are playing an important role in providing people with livelihoods for millennia as animal feed producing areas. Grassland areas described as green oceans are important for the ecosystem services they provide, with a key role in the balance of the global ecosystem. Grassland ecosystem services are the subject of numerous publications, being classified and abstracted in various ways. Currently, four ecosystem services are distinguished that meadows provide, such as: Support, supply, regulation and culture. In addition to the production of animal feed (supply service), the current focus is the relation of grasslands to climate and erosion control (regulation services), cultural services (tourism), etc. (Bărbulescu C. et al, 1991; Dragomir N., 2005; Ma W.G. et al, 2010; O'Mara F.P., 2012; Luescher A. et al, 2014; Shen H.H. et al, 2016).

Meadows should be given a higher priority in the future, as they play important roles and provide many benefits to society. Their importance is evident from the new concept of multifunctionality of the meadows, which includes the following functions: biological, social, economic, ecological, aesthetic and recreation. Thus, according to research, worldwide grasslands are essential for about 800 million people, a population that is directly connected to grassland grass for their livelihood and virtually everyone consumes or uses products obtained from grassland grass (e.g.: milk, meat and wool, fiber, fuel etc.) for their daily existence (White R. et al, 2000).

MATERIAL AND METHOD

The experience that is the subject of this paper research was organized in the Research and Development Station for Meadows, Vaslui area, on a *Dichanthium ischaemum* (L.) Roberty meadow. In the studied area there are large areas of permanent meadows, at different stages of degradation, due to the positioning on surfaces with different degrees of inclination, eroded or subject to erosion process, due to abandonment or non-rational use, with an inappropriate load of animals and failure to apply maintenance or improvement measures. Due to these aspects, the production was small and the floral composition was dominated by species with medium and low fodder value. In order to increase the production of permanent grassland in the area and the quality of the feed obtained, it was considered necessary to apply organic or mineral fertilizers, and their effect would be compared to that of abandoned and mulching or simple use, without any variants further improvement measures.

The purpose of the research carried on in the first year of implementation of management measures was the analysis of the management applied on the production of dry matter and the vegetation structure changes.

The objectives and activities of the research were represented by: 1. analysis of management applied on dry matter production (a. determination of green mass production; b. determination of dry matter content; c. calculation of dry matter production) and 2. analysis of management applied on the vegetation structure changes (a. analysis of changes in the floral composition;
b. calculation of pastoral value and grazing capacity for each variant).

To achieve the proposed goal and objectives, in the experimental field of Solesti location (Solesti commune) of Meadows Research and Development Station, Vaslui an experience was placed, according to the method of randomized blocks, with 11 variants, in 3 repetitions (Jităreanu G. and Onisie T., 1998). The area of each variant was 12 m^2 (3 m × 4 m) and the harvested area was 8.75 m^2 (2.5 m × 3.5 m). The total area of the experience was 396 m^2 (33 m × 12 m).

The experience had the following experimental variants: v_1 - unfertilized (control); v_2 - abandonment; v_3 - mulch; v_4 - $N_{50}P_{50}K_{50}$; v_5 - $N_{100}P_{100}K_{100}$; v_6 - 10 Mg·ha^{-1} cattle manure, applied annually; v_7 - 10 Mg·ha^{-1} cattle manure, applied every 2 years; v_8 - 20 Mg·ha^{-1} cattle manure, applied annually; v_9 - 20 Mg·ha^{-1} cattle manure, applied every 2 years; v_{10} - 30 Mg·ha^{-1} cattle manure, applied annually; v_{11} - 30 Mg·ha^{-1} cattle manure, applied every 2 years.

Established doses of mineral and organic fertilizers were applied early in the spring, at the beginning of vegetation growth. The manure used came from cattle and had the following composition: N-0.458 %, P_2O_5-0.237 % şi K_2O-0.674 %.

In the 2021-2022 agricultural year, only one harvest was obtained at the studied meadow. The harvest was carried out on 28.06.2022, it was done manually, at the full flowering of the dominant grasses.

The amount of green mass per hectare (Q_{GM} - Mg·ha^{-1}) was determined by weighing the yield of green mass obtained on the 8.75 m^2 harvested area of an experimental plot and then reported per hectare. Dry matter content (DM - %) was determined by drying at 103^0 C according to SR ISO 6496/2001 standard. The amount of dry matter per hectare (Q_{DM} - Mg·ha^{-1}) - was calculated with the relationship: $Q_{DM} = Q_{GM} \times DM$.

The study on vegetation was carried on by geobotanic method, recording the degree of vegetation coverage on, the presence and classification of existing species by economic groups, as well as geobotanic indices (abundance and dominance). For the vegetation structure determination was used the geobotanical method, expeditious method for determining the floristic composition of the meadows based on the floral description (floristic or phytocenological) and the stational description of representative surfaces for each phytocenosis.

The floral survey highlights the list of the component species of phytocenosis studied, to which are added a series of data on relief (altitude, exposure, slope) and general data on vegetation (general soil coverage, in percentage).

The plant species on each variant were classified, according to their importance as fodder plants, into the following groups: *Gramineae*, *Leguminosae* and species from other botanical families (various).

The pastoral value (VP) was calculated with the relationship (Motcă G. et al, 1994):

$$Vp = \frac{\sum A \times Is}{100}$$, where: A - the average coverage of each species in the floral structure; is it specific index on fodder value, with values between 0 and 5.

With the help of pastoral value, grazing capacity was determined (Cp):

$Cp = Vp \times c$ (UVM·ha^{-1}), where: Vp - pastoral value; c (coefficient) = 0.4-0.6 (the coefficient is minimum for grasslands with poor management and maximum for those with a correct mode of exploitation); UVM - one standard 500 kg cow. Depending on the pastoral value and the grazing capacity, the production and quality of permanent grassland is assessed according to the data from tabele 1..

Tabele 1. Appreciation of the productivity and quality of permanent grasslands with the pastoral value help (Motcă G. et al, 1994)// Aprecierea productivității și calității pajiștilor permanente cu ajutorul valorii pastorale (Motcă G. et al, 1994)

Pastoral value determined by specific coverage	Grazing capacity (UVM/ha)	Meadow characterization
3.75-5.00	> 2-3	Very good
2.50-3.75	1-2	Good
1.25-2.50	0.5-1	Medium
0.25-1.25	0.2-0.5	Weak
< 0.25	< 0.2	Degraded

The validation of the results obtained in the experience was carried out according to the methodology of using the experiences executed in one place in several years (Jităreanu G. and Onisie T., 1998). The results were statistically interpreted by analyzing the variance and calculating the least significant differences.

The studied area is characterized by climatic conditions specific to the silvosteppe area. The weather data was taken from the meteorological station of Research and Development Station for Meadows, Vaslui (figure 1.).

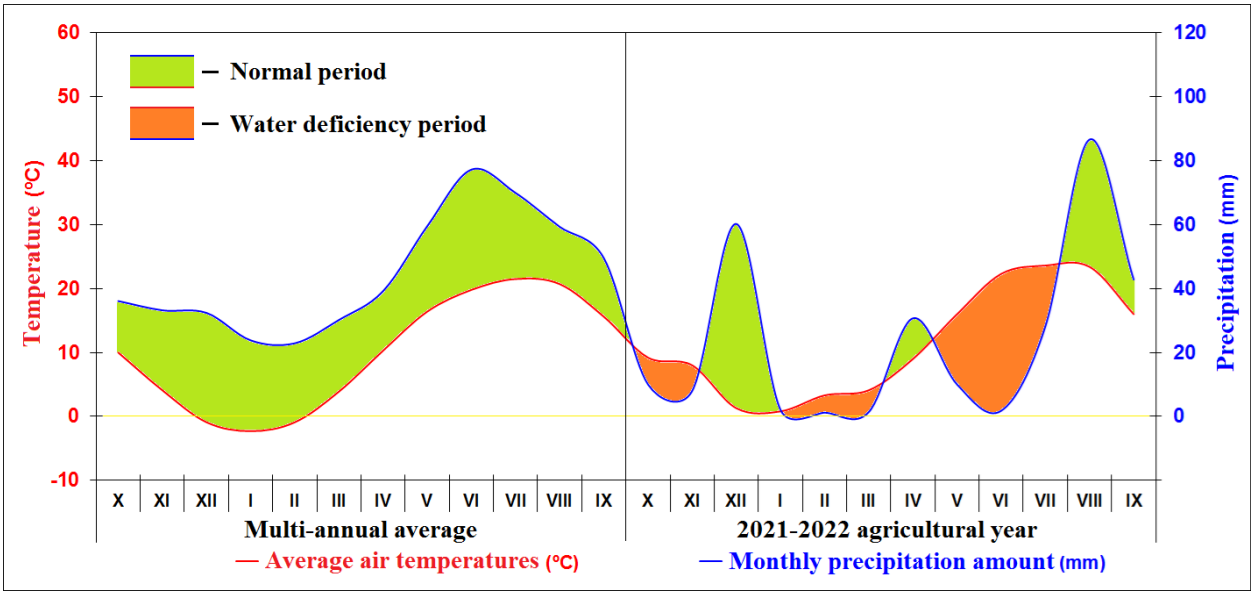

Figure 1. Climate chart of the 2021-2022 agricultural year // Diagrama climatică al anului agricol 2021-2022

In 2021-2022 the air temperature was higher than the multiannual average showing a deviation of 1.5 ºC, and in April-September, during the vegetation period, the deviation was 1.0 ºC. July and August were the warmest months, with average temperatures of 22.8-23.0°C, compared to the multi-year average, with deviations of 1.7-

2.2°C. The lowest temperatures were recorded in December and January (with average temperatures of 0.7-0.8°C).

The amount of precipitation was 250.2 mm lower than the annual average (154.5 mm lower than the multiannual average during the growing season). With the exception of December 2021 and August 2022, negative deviations from the multiannual average were recorded in each of the other months. Between May and July, the negative deviations from the multiannual average were 41.7-75.4 mm. The agricultural year 2021-2022 was a very dry year, affecting the growth and development of permanent meadows.

RESULTS AND DISCUSSION

At the Solesti location (figure 2.), in the area where the experience was located (coordinates: 46º44´59′ N 27º47´34′ E; average altitude: 189 m), the type of meadow identified was *Dichanthium ischaemum* (L.) Roberty (yellow bluestem), a type of secondary meadow, derived from a *Festuca valesiaca* Schleich. Ex Gaudin meadow, irrationally exploited for a long time (Vîntu V. et al, 2004).

The vegetation structure of this type of meadow, with a degree of vegetation coverage of 80%, is represented by *Gramineae* species - 75%, *Leguminosae* species - <1% and species from other botanical families (various group) - 5%. From the point of view of the floristic composition, the dominant species is *Dichanthium ischaemum* (L.) Roberty, with an average coverage of 60 % and the co-dominant species being (depending on the micro-conditions of each zone/grassland plot) *Festuca valesiaca* Schleich. ex Gaudin, *Poa pratensis* L. *Elymus repens* (L.) Gould (synonym: *Agropyron repens* (L.) P. Beauv.) or *Bromus inermis* Leyss. The pastoral value and the grazing capacity was 1.09, respectively 0.55 UVM·ha^{-1}, the meadow being part of the group of the weak meadows.

Figure 3. Location of experience (earth.google.com, 2022)// Locația experienței (earth.google.com, 2022)

In the Solesti location, in the area where the experience was located, on most surfaces occupied with permanent meadows, is the mixed one (the first regeneration of the vegetation season is mowed, and the following regenerations, if any, are grazed). Also, due to the low number of animals, there are also abandoned permanent meadows.

The exposure of the area on which the experience was placed is North-East, and the land has an average inclination of 15% (13.5 °). In the studied area there are slopes of more than 30% (27 °), which are subject to surface erosion (being present stryrations and rigoli) and depth (being present ravines created by rainstorm accumulations from periods with more consistent rainfall). There are also landslides at different stages.

Eroded soil, on which most grassland surfaces are located, is an important element of degradation! The presence of gaps in a large percentage, as well as the large share of the species *Dichanthium ischaemum* (L.) Roberty (with very low fodder value) in the vegetation structure, are very important elements of degradation!

In Table 2 the fodder value of each species is presented, with notes from 2 to 5, according to the scale of Csüros Ş., 1970 (Vîntu V. et al, 2004) and the changes in vegetation structure at each of the 10 working variants, compared to the initial variant (control variant).

Compared to the pastoral value and grazing capacity of the control variant, respectively 1.09 and 0.55 UVM·ha^{-1}, in all the variants where fertilizers, minerals or organic have been applied, the values have increased to 1.21-1.62 and 0.61-0.81 UVM·ha^{-1} (10-47 %) respectively.

The sustainable management of grassland ecosystems can be done only by knowing and linking the vegetation present on them and the stational conditions with the measures of improvement and the way of use (Elsaesser M. et al, 2008; Tonn B. and Briemle G., 2010). The differentiated application of measures to improve permanent grasslands, while maintaining the structural and functional balances established at the level of the pratical ecosystems, cannot be done without a prior study on the influence of fertilization on biomass production, but also their biodiversity (Cŏp T. et al, 2001; Jankowski K. et al, 2003; Samuil C. et al, 2010).

Table 2.Analysis of changes in vegetation structure in 2022, in the studied variants// Analiza modificărilor structurii vegetației în anul 2022, în variantele studiate

Experimental variants	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}	V_{11}
Vegetation coverage degree (%)	*70.0*	*67.1*	*68.6*	*75.6*	*70.8*	*66.2*	*68.5*	*66.7*	*71.8*	*74.0*	*72.0*
Gramineae (%)	64.7	61.3	62.3	64.9	59.1	55.3	60.2	58.5	62	59	57.6
Agropyron pectiniforme Roem. & Schult. (3)										0.2	
Bromus inermis Leyss. (4)	1	1	1	3.3	4	2.3	2	2	2	2.7	2
Dichanthium ischaemum (L.) Roberty (1)	56.7	54.7	54.3	51.7	45	41.7	52.3	46.7	52.7	45.7	43.3
Festuca valesiaca Schleich. ex Gaudin (3)	5.7	4	5.7	3.7	4	5.7	3.3	3.3	3	3	4
Elymus repens (L.) Gould (2)	1.3	1.3	1.3	5	4.7	4.3	2.3	5.7	3	4	7
Dactylis glomerata L. (5)				0.3	0.7	0.3	0.3	0.3	0.3	1	
Koeleria gracilis Pers. (0)								0.3		0.7	0
Poa pratensis L. (5)				0.7	0.7	0.7			0.7	0.7	1
Festuca arundinacea Schreb. (4)		0.3		0.2		0.3		0.2	0.3	1	0.3
Leguminosae (%)	0.6	0.3	1.4	2.8	3.1	2.4	1.7	1.4	1.8	4.1	4.5
Coronilla varia L. (-2)					0.3						
Lathyrus tuberosus L. (3)				0.3		0.7		0.2		0.7	0.7
Lotus corniculatus L. (4)	0.2	0.3		1				0.2		1	
Medicago falcata L. (5)						1	1.3	0		0.5	1
Medicago lupulina L. (5)	0.2	0	0.7	1	1.7		0.2	0	0.2	0.2	0.7
Ononis arvensis L. (1)						0.3					
Trifolium pratense L. (5)					0.3			0.3	0.3		0.3
Vicia cracca L. (3)						0.2		0.7	0.3		
Vicia hirsuta (L.) Gray (3)	0.2		0.7				0.2		1	1	0.8
Vicia sativa L. (1)				0.5	0.8	0.2				0.7	1
Various (%)	4.7	5.5	4.9	7.9	8.6	8.5	6.6	6.8	8	10.9	9.9
Achillea millefolium L. (3)	1.2	1.7	1	1	2.5	2.7	1	1.7	1.3	2	1.3
Achillea setacea Waldst. & Kit. (2)	0.5	0.5		1	1	1	0.2	0.2	0.2	0.3	
Artemisia austriaca Jacq. (-1)						0.2			0.2	0	0.2
Asperula cynanchica L. (0)				0.3							
Carduus acanthoides L. (-1)								0.5		0.5	0.3
Convolvulus arvensis L. (3)		0.2							0.2	1.7	
Centaurea scabiosa L. (0)			0.2					0.3	0.3		0.3
Chenopodium album L. (2)										0.2	
Cichorium intybus L. (3)	0.3	0.3		0.7	0.5	0.7	0.2	0.2	0.3	1	0.3
Cirsium arvense (L.) Scop. (1)			0.2							0.7	1
Echium vulgare L. (0)				0.2							
Eryngium campestre L. (-1)	0.2	0.2	0.7		0.5	0.5	0.2	0.2	0.7	0.7	0.5
Galium humifusum M. Bieb. (0)							0.2		0.2		
Galium verum L. (0)					0.3						
Knautia arvensis (L.) Coult (1)							0.2				
Lappula squarrossa (Retz.) Dumort. (0)			0.3	0.3			0.3	0.3		0.2	
Plantago lanceolata L. (3)	0.3	0.2		1.3	0.5	0.7			0.2		0.3
Plantago media L. (3)							0.3	0.3	0.7		0
Plantago major L. (3)			0.2								0.3
Potentilla cinerea Chaix ex Vill. (0)	1	1.3	1	1	1.3	1.7	1.7	1.7	1	1	1.3
Sambucus ebulus L. (-2)							0.3	0.2			
Salvia nemorosa L. (3)	0.2	0.3	0.3		0.3		1		0.7		0.8
Sonchus arvensis L. (2)				0.3				0.2		0.3	0.3
Thymus glabrescens Willd. (3)	1	0.8	1	1.8	1.7	1	1	1	2	2.3	3
Gaps (%)	30.0	32.9	31.4	24.4	29.2	33.8	31.5	33.3	28.2	26.0	28.0
Number of species	15	16	15	21	19	20	20	25	24	28	27
Vp	1.09	1.18	1.12	1.61	1.62	1.21	1.27	1.21	1.28	1.36	1.35
Cp (UVM·ha^{-1})	0.55	0.59	0.56	0.81	0.81	0.61	0.64	0.61	0.64	0.68	0.68

Research carried on during the first year of use revealed that the application of mineral or organic fertilizers caused important changes in the level of green mass production. Thus, the following aspects have emerged regarding the quantities of feed harvested by variants (table 3.):

- in the case of the V_2 - abandonment and V_3 - mulch variants the obtained productions were very close to those of the control variant, with no statistically assured differences. This is due to the fact that the management measures are in the first year of application;
- the highest yields were obtained in the case of V_4 - $N_{50}P_{50}K_{50}$ and V_5 - $N_{100}P_{100}K_{100}$ variants, with very significant positive differences ranging from 75.2-90.3%. This is due to the fact that nutrients in mineral fertilizers are easier to access by plants, but in the case of higher doses of fertilizers and a lack of precipitation, their effect on production is less;
- in the case of the V_6 - 10 Mg·ha^{-1} cattle manure, applied annually and V_7 - 10 Mg·ha^{-1} cattle manure, applied every 2 years variants productions were obtained with insignificant increases between 7.3-10.8%. This is due to the fact that the nutrients in organic fertilizers are more difficult to access by plants, especially when there is a lack of precipitation, their effect on production being less significant;
- in the case of the V_8 - 20 Mg·ha^{-1} cattle manure, applied annually and V_9 - 20 Mg·ha^{-1} cattle manure, applied every 2 years variants production with distinctly significant differences of between 42.5 and 43.1 % were obtained. This is due to the fact that at higher doses of manure applied, their effect on production is greater;
- in the case of the V_{10} - 30 Mg·ha^{-1} cattle manure, applied annually and V_{11} - 30 Mg·ha^{-1} cattle manure, applied every 2 years variants productions with very significant increases ranging from 56.6-74.4% were obtained. This is due to the fact that, at higher doses of manure applied, their effect on production being higher, but due to the lack of precipitation, the use of nutrients in them by plants was diminished. Manure has not completely decomposed, remaining on the surface of the soil, the effect of its application, even at doses of 30 t·ha^{-1}, being less than that of complex mineral fertilizers applied.

Table 3. The influence of applied management on biomass production obtained on the *Dichanthium ischaemum* (L.) Roberty meadow, in 2022// Influența managementului aplicat asupra producției de biomasă obținută pe lunca Dichanthium ischaemum (L.) Roberty, în 2022

Experimental variants	Q_{GM} (Mg·ha^{-1})	Difference		Signi-cance	DM (%)	Q_{DM} (Mg·ha^{-1})	Difference		Signi-cance
		Mg·ha^{-1}	%				Mg·ha^{-1}	%	
v_1 (control)	2.20	control	100	control	35.11	0.77	control	100	control
v_2	2.13[i]	-0.08	96.5		35.11	0.74	-0.03	96.1	
v_3	2.21	0.01	100.4		34.98	0.77	0.00	99.6	
v_4	3.86	1.66	175.2	***	34.83	1.22	0.44	157.4	***
v_5	4.19	1.99	190.3	***	31.56	1.32	0.55	171.3	***
v_6	2.36	0.16	107.3		31.61	0.83	0.06	107.9	
v_7	2.44	0.24	110.8		35.31	0.87	0.09	112.0	
v_8	3.14	0.94	142.5	**	35.49	1.06	0.29	137.1	**
v_9	3.15	0.95	143.1	**	33.79	1.08	0.30	139.3	**
v_{10}	3.84	1.64	174.4	***	34.18	1.29	0.52	167.0	***
v_{11}	3.45	1.25	156.6	***	33.61	1.16	0.38	149.7	**
	LSD 0.5	*0.64*				LSD 0.5	*0.22*		
	LSD 0.1	*0.87*				LSD 0.1	*0.29*		
	LSD 0.01	*1.18*				LSD 0.01	*0.40*		

[i] - for the determination of the production from the abandoned variant, the area of 1 m^2 of each repetition was harvested, and this will no longer be taken into account in the following years.

The research carried on, in terms of dry matter content and the level of dry matter production, highlighted the following aspects (table 3.):

- biomass from harvested plants had an average humidity of 66 %, lower than the normal range of 70-75 %. This was due to the lack of rainfall and high temperatures recorded, which led to the drying of the foliage from the lower floors of the plants;
- the dry matter content was between 34.83-35.11% in unfertilized variants, between 31.56-31.61% in mineral fertilized variants and between 34.83-35.11% in non-fetilized variants, between 33.56-35.49% in manure fertilized variants. Fertilization with complex mineral fertilizers and with 20-30 Mg·ha^{-1} cattle manure resulted in the obtaining of green mass with a higher humidity.

Dry matter yields followed the same trend as green mass yields and ranged from 0.77 to 1.32 Mg·ha^{-1}.

CONCLUSIONS

1. In the area where the experience was located (coordinates: 46º44´59´ N 27º47´34´ E; average altitude: 189 m), the type of meadow identified was *Dichanthium ischaemum* (L.) Roberty (yellow bluestem), a type of secondary meadow, derived from a *Festuca valesiaca* Schleich. Ex Gaudin meadow.
2. The main elements of degradation identified on the meadows in the area where the experience was located are represented by the non-rational use, the presence of erosion (associated with a soil with fertility problems), the presence of gaps in a large percentage, as well as the large share of species with very low fodder value in the vegetation structure.
3. The agricultural year 2021-2022 was a very dry one. The amount of precipitation was 250.2 mm lower than the annual average (by 154.5 mm lower than the multiannual average during the growing season) and the growth and development of the permanent meadows plants was affected.
4. Research conducted during the first year of meadow use revealed that the application of mineral or organic fertilizers caused important changes in the level of green mass production.
5. In the case of the abandonment and mulch variants, the productions was very close to those of the control variant, with no statistically assured differences, which is due to the fact that the management measures are in the first year of application.
6. In the case of variants fertilized with $N_{50}P_{50}K_{50}$ and $N_{100}P_{100}K_{100}$ were obtained the highest yields, of 3.86-4.19 $Mg \cdot ha^{-1}$ green mass, with very significant positive differences between 75.2-90.3% compared to the non-fertilized control variant, due to the fact that the nutrients in mineral fertilizers are easier to access by plants, but in case of higher doses of fertilizers and a lack of precipitation, their effect on production is less.
7. In the case of variants fertilized with 10 $Mg \cdot ha^{-1}$ cattle manure, yields with insignificant increases between 7.3 and 10.8 % have been obtained, and in the case of variants fertilized with 20-30 $Mg \cdot ha^{-1}$ cattle manure, green mass production with distinct and very significant positive differences has been obtained, due to the fact that, at higher doses of manure applied, their effect on production is greater, but due to the lack of precipitation, the use of nutrients in them by plants has been diminished.
8. Manure has not completely decomposed, remaining on the surface of the soil, the effect of their application, even at doses of 30 $Mg \cdot ha^{-1}$, being less than that of complex mineral fertilizers applied.
9. Dry matter yields followed the same trend as green mass yields and ranged from 0.77 to 1.32 $Mg \cdot ha^{-1}$.
10. Compared to the pastoral value and the grazing capacity of the control variant, of 1.09 and 0.55 $UVM \cdot ha^{-1}$ respectively, for all the variants where fertilizers, minerals or organic have been applied, the values have increased to 1.21-1.62 and 0.61-0.81 $UVM \cdot ha^{-1}$ respectively.

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RESULTS OF THE MAIZE BREEDING PROGRAM FROM A.R.D.S. TURDA IN THE CREATION OF SEMI EARLY MAIZE HYBRIDS

REZULTATE ALE PROGRAMULUI DE AMELIORAREA PORUMBULUI DE LA S.C.D.A. TURDA ÎN CREAREA HIBRIZILOR SEMITIMPURII DE PORUMB

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Abstract : *Maize (Zea mays) represents one of the most important agricultural crops, both worldwide and in Romania, where it is the plant cultivated on the largest areas. Agricultural research must respond to market demand with productive hybrids, adapted to the cultivation area, so at the Agricultural Research and Development Station Turda the creation of such hybrids is a priority objective. In the last decade, 5 semi-early maize hybrids with high yields were registered and introduced into production: Turda 332, Turda 344, Turda 335, Turda 2020 and Turda 380. These maize hybrids were tested both at Agricultural Research and Development Station Turda, as well as in the network of research stations belonging to Academy of Agricultural and Forestry Sciences. Their testing was also carried out in the State Institute for Variety Testing and Registration Network, in order to be registered in the Official Catalogue of cultivated plant varieties in Romania. All five hybrids outperformed the controls used in the experiment, having superior yields. At A.R.D.S. Turda, the average yield in 3 years of experimentation exceeded 12.7 t/ha for all 5 hybrids tested, but Turda 344, Turda 335 and Turda 2020 stand out. In the case of experimentation in the A.A.F.S. network the hybrids Turda 335, Turda 2020 and Turda 380 stood out, with the highest yields, but it should be noted that for all 5 hybrids yield of over 9.3 t/ha were recorded. In the S.I.V.T.R. network the hybrids Turda 335 and Turda 2020 stood out, with average productions of approximately 13 t/ha obtained in three and two years of testing, respectively.*

Keywords: maize, hybrids, yield, moisture dynamics

Rezumat:

Porumbul (Zea mays) reprezintă una dintre cele mai importante culturi agricole, atât la nivel mondial, cât și în România, unde este planta cultivată pe cele mai mari suprafețe. Cercetarea agricolă trebuie să răspundă cererii pieței cu hibrizi productivi, adaptați zonei de cultură, așa că, la Stația de Cercetare Dezvoltare Agricolă Turda crearea unor astfel de hibrizi este un obiectiv prioritar. În ultimul deceniu au fost înregistrați și introduși în producție 5 hibrizi semitimpurii de porumb cu randamente mari: Turda 332, Turda 344, Turda 335, Turda 2020 și Turda 380. Acești hibrizi de porumb au fost testați atât la Stația de Cercetare-Dezvoltare Agricolă Turda, precum şi în reţeaua de staţii de cercetare aparţinând Academiei de Ştiinţe Agricole şi Silvice. Testarea acestora a fost efectuată și în rețeaua Institutului de Stat pentru Testarea și Înregistrarea Soiurilor, pentru a fi înregistrate în Catalogul Oficial al soiurilor de plante cultivate din România. Toți cei cinci hibrizi au depășit martorii utilizați în experiment, având randamente superioare. La A.R.D.S. Turda, randamentul mediu în 3 ani de experimentare a depășit 12,7 t/ha pentru toți cei 5 hibrizi testați, dar se remarcă Turda 344, Turda 335 și Turda 2020. În cazul experimentării în cadrul A.A.F.S. rețeaua s-au remarcat hibrizii Turda 335, Turda 2020 și Turda 380, cu cele mai mari producții, dar de remarcat că pentru toți cei 5 hibrizi s-au înregistrat randamente de peste 9,3 t/ha. În cadrul S.I.V.T.R. rețeaua s-au remarcat hibrizii Turda 335 și Turda 2020, cu producții medii de aproximativ 13 t/ha obținute în trei, respectiv doi ani de testare.

Cuvinte cheie: porumb, hibrizi, randament, dinamica umidității

INTRODUCTION

Maize (*Zea mays*) is one of the main crops in the world. The areas cultivated with this plant are impressive; worldwide there are around 202 million hectares cultivated in recent years, thus occupying the second place from this point of view. Maize is overtaken in areas cultivated only by wheat and is followed by rice. From the point of view of the total productions obtained, however, maize is ahead of wheat. It can also be seen from figure 1 the impressive growth of the areas cultivated with maize in the last 60 years, they have doubled.

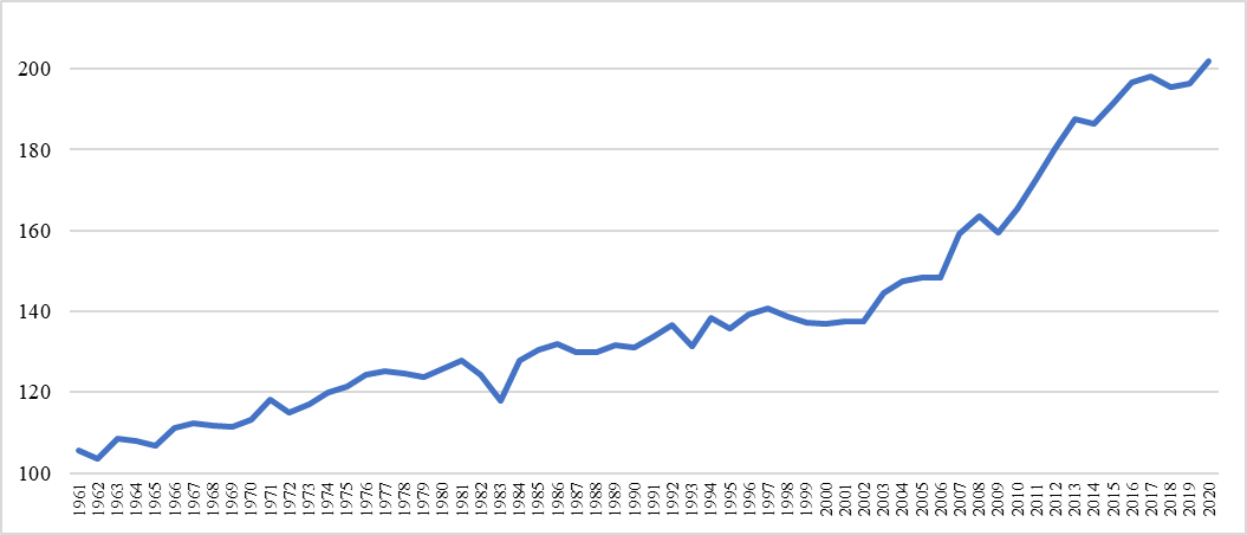

Figure 1. Areas cultivated with maize, worldwide, between 1961-2020 (FAOSTAT, 2023)// Suprafețe cultivate cu porumb, la nivel mondial, între 1961-2020

The introduction of maize hybrids into culture (initially between varieties, and later as inbred lines) led to higher yields, thus increasing the interest in this plant. The increases in production are not exclusively due to the introduction of hybrids, the improvement of culture technology, the ability of hybrids to respond better to higher densities and high amounts of fertilizers also contribute to these high productions (Haș, 2004).

Maize is one of the most important crops in Romania, occupying the largest cultivated area in the country, approximately 2.5 million hectares annually. Also, at the level of the European Union, Romania is ranked first having the largest area cultivated with maize (FAOSTAT, 2023).

Maize breeding in Turda began with the establishment of the Turda Maize Cultivation Experimental Station in 1957 and was initially oriented towards the promotion of hybrid maize in the Transylvania area, then towards the creation of extra-early and early genotypes adapted to the climatic conditions of the area. In the last decades, due to the climate changes that are also felt in the Transylvania maize growing areas, it has become possible to successfully cultivate semi-early hybrids, genotypes that are characterized by superior yield. The maize breeding activity at the Agricultural Research and Development Station Turda was therefore reoriented towards another type of hybrids: with a slightly longer vegetation period, higher production capacity, better adaptability to crop areas, increased tolerance to stress factors.

From the beginning of the maize breeding activity until now, at A.R.D.S. Turda, 45 maize hybrids were registered. Among them, 17 hybrids are simple, 20 trilinear and 8 double, and if we refer to the vegetation period, we can say that 5 are extra early, 21 early, and 19 semi-early. Among the creations of the last decade, the hybrids Turda 332, Turda 344, Turda 335, Turda 2020 and Turda 380 stand out, hybrids also found in the Official Catalogue of Cultivated Plant Varieties in Romania. All the 5 mentioned hybrids stood out due to their superior yields compared to the controls, superior quality and superior ability to capitalize on technological factors (Haș et al., 2014; Haș et al., 2018; Haș et al., 2021; Varga et al., 2022).

In this paper, we proposed to present of the five maize hybrids registered in the last decade, for a better knowledge of their agro-biological characteristics.

MATERIAL AND METHODS

All five hybrids are achievements of the A.R.D.S. Turda Maize Breeding Laboratory, their parental forms being own creations. The sources used as starting material for the creation of inbred lines were synthetics obtained in the reciprocal selection programs or commercial hybrids. In order to obtain the specific heterosis of maize hybrids, it was considered the inclusion of the parental forms different from germplasm groups.

The hybrids were tested in the Academy of Agricultural and Forestry Sciences (A.A.F.S.) network, under the specific conditions of the research stations: A.R.D.S. Turda, A.R.D.S. Secuieni, A.R.D.S. Livada, A.R.D.S. Lovrin and R.D.S.C.B. Târgu Mureș.

Experimental data also come from nine test centres within the ecological network of the State Institute for Variety Testing and Registration (S.I.V.T.R.), under non-irrigated conditions, at different times, as follows:

Turda 332 – 2011-2013 (registered in 2014)

1. Turda 344 – 2014-2016 (registered in 2017)
2. Turda 335 – 2018-2020 (registered in 2021)
3. Turda 2020 – 2019-2020 (registered in 2021)
4. Turda 380 – 2019-2021 (registered in 2022)

The experiments were carried out in comparative cultures, according to the experimental protocols of A.A.F.S. and S.I.V.T.R., in three repetitions and two rows/plot. Each variant was sown at a plot of 70,000 plants/ha, in two rows of 8.7 m length and 0.7 m between rows, respectively, 12.2 m^2 harvestable area.

Characterization of the new creations

Turda 332 (FAO 380) is a simple hybrid tested in the ecological network of S.I.V.T.R. in the period 2011-2013 and registered in 2014. The characteristics of this hybrid are: plant height of 241±20 cm, insertion of the main ear at a height of 90±5 cm, erect leaves, cylindrical ears, with a weight of 216±10 g, 18-22 kernel rows and red cob. The kernels are semi-dent, dark yellow, and the thousand kernel weight (TKW) has average values of 270-300 g and a shelling percentage of 80-82%. This hybrid stands out for its good resistance to low temperatures in the first part of the vegetation period, as well as a very good resistance to plant falling, drought and heat, as well as to the attack of *Ostrinia nubilalis*. Among the specific characteristics, it is possible to produce seeds completely without castration, based on cytoplasmic male-sterility.

Turda 344 (FAO 380) is a trilinear maize hybrid registered by A.R.D.S. Turda in 2017. The pronounced degree of diversification of parental genotypes gives it possibilities of adaptation to a wide the range of ecological conditions. This hybrid is characterized by the following features: plant height of 270±20 cm, the insertion of the main ear is at 107±10 cm, semi-erect leaves, cylindrical ear, 18-20 kernel rows, red cob, dent, light yellow kernels, with a TKW of 280-300 g and a shelling percentage of 82-88%. The hybrid shows very good resistance to low temperatures in the first part of the vegetation period, good resistance to plant falling, drought and heat, as well as good to medium resistance to diseases and pests. The Turda 344 hybrid also has the advantage of a hybridization formula with male sterile and completely pollen fertility restoring parental genotypes, as well as a good coincidence between the flowering of the male flowers and the appearance of the stigmas.

The hybrid **Turda 335** (FAO 380) was registered in 2021, after being experimented for three years (2018-2020) in the S.I.V.T.R. network. The plants of this hybrid are tall (293±7 cm), the insertion of the main ear at a height of 101±9 cm, semi-erect leaves. The ears of this hybrid have a cylindrical shape, 16-20 kernel rows and white cob. The dent, yellow-orange kernels have a TKW of 350-370g and a shelling percentage of 84-86%. The Turda 335 hybrid has a very good resistance to low temperatures in the first part of the growing season, good resistance to plant falling, and good tolerance to drought and heat. The hybrid is characterized by an increased rate of water loss from the grain, at maturity.

The hybrid **Turda 2020** (FAO 380) was tested in the ecological network of S.I.V.T.R. in 2019-2020, being registered in 2021 after only 2 years of testing, as it outperformed the controls in both years. The height of this hybrid is 300±10 cm, the insertion of the main ear is at 139±4 cm, and the leaves are semi-erect. The ears of this hybrid have a cylindrical-conical shape, 18-22 kernel rows and dark red cob. The kernels, dent and dark yellow coloured, have a TKW of 260-280 g and a shelling percentage of 82-84%. The Turda 2020 hybrid has very good resistance to low temperatures in the first part of the growing season, good resistance to plant falling, and good tolerance to drought and heat. An advantage of this hybrid is the possibility of being produced based on a hybridization formula with male-sterile and completely pollen fertility restoring parental forms.

Turda 380 (FAO 380) is the newest creation of A.R.D.S. Turda, being registered in the Official Catalogue of Cultivated Plant Varieties in Romania in 2022. The plant is vigorous, tall (310±10 cm), high and uniform ear insertion, erect leaves. The ear is cylindrical, having medium length (18-20 cm), 14-16 kernel rows, dent, and

yellow-normal kernels. The hybrid stands out for: very good resistance to low temperatures in the first part of the growing season, good resistance to plant falling, good tolerance to drought, heat and an increased rate of water loss from the grain, at maturity.

RESULTS AND DISCUSSIONS

1. The testing of the hybrids at A.R.D.S. Turda - 2019-2021

The 5 hybrids created at A.R.D.S. Turda were tested according to the prevision protocol. The experimental field was placed in a three-year rotation: soybean, wheat, maize. The soil works consisted of autumn plowing and two works of preparing the seed bed, the first being carried out already in the autumn. The experimental field was fertilized by applying 400 kg/ha of complex fertilizer of type NPK 27:13.5:0, together with the preparation of the germination bed. Herbicide was applied at pre-emergence with 1.2 l/ha, using dimetanamid-p as the active substance (720 g/l) and post-emergence with 2 l/ha using tembotrione (44 g/l) and isoxadiphen-ethyl (22 g/l) as active substances.

From a climatic point of view, these years can be characterized as follows: the year 2019 was normal in terms of precipitation, while the year 2020 was very rainy; the two experimental years were warm, thus being favourable for maize cultivation. In 2021, a normal year from the point of view of precipitation, there are an excessively dry June, followed by a rainy July, while temperatures were excessively above the multi-year average, the year being characterized as one of heat, offering favourable conditions for maize.

The hybrids Turda 335 and Turda 380 were noted with average yield of over 13 t/ha, and Turda 332, Turda 344 and Turda 2020 exceeded 12.5 t/ha. The superior yield of the hybrids registered in the last decade at Turda is also correlated with a slight increase in the vegetation period. Higher yield can be observed in 2021, when the new Turda 380 hybrid achieved a production of 16.3 t/ha, and the yield of the Turda 332, Turda 335 and Turda 2020 hybrids exceeded 15 t/ha, while for the trilinear hybrid Turda 344, it was 14.7 t/ha. The average yields in the three experimental years exceeded 12.7 t/ha in all 5 analysed hybrids (figure 2).

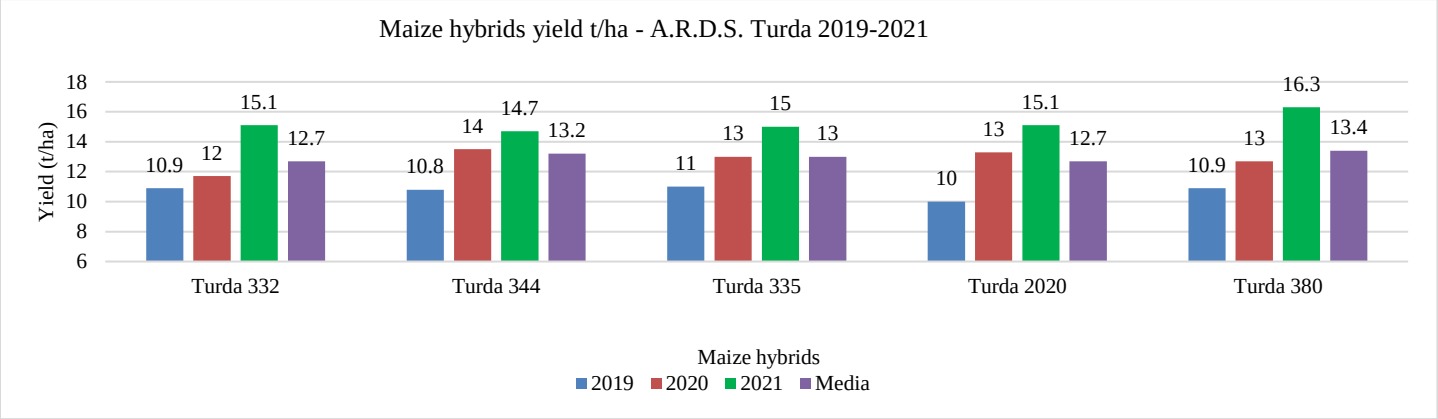

Figure 2. The yield (t/ha) obtained at A.R.D.S. Turda – 2019-2021// Producția (t/ha) obtinută la SCDA Turda – 2019-2021

The rate of grain water loss is a characteristic of hybrids that is highly dependent on environmental conditions, particularly on rainfall after the maturity period. Some of the hybrids produced at Turda were also studied from the perspective of grain moisture loss from physiological maturity to harvest. When climatic conditions are favourable (sun and wind), as they were in 2019 and 2020, maize hybrids tend to have a superior rate of grain water loss. When these conditions become unfavourable (rains and low temperatures), as it was in 2021, the characteristic of hybrids to have a good rate of moisture loss from the grains becomes very important. The hybrid Turda 335 stands out, with the best loss of moisture from the grains, in all three experimental years. A good rate of grain moisture loss was also observed at the other hybrids (table 1).

Table 1. Grain moisture loss between physiological maturity and harvest// Pierderea de umiditate a boabelor între maturitatea fiziologică și recoltare

No.	Hybrid	2019		2020		2021	
		U% at harvest	Moisture loss U%/day	U% at harvest	Moisture loss U%/day	U% at harvest	Moisture loss U%/day
1.	**Turda 332**	23.0	-0.53	21.4	-0.61	27.1	-0.21
2.	**Turda 344**	22.2	-0.63	22.2	-0.64	24.3	-0.41
3.	**Turda 335**	25.5	-0.65	20.2	-0.92	25.8	-0.48
4.	**Turda 2020**	24.5	-0.52	24.6	-0.59	24.7	-0.35
5.	**Turda 380**	27.9	-0.43	23.4	-0.84	26.1	-0.42

The trait of faster grain water loss was sometimes associated with the expression of several characters influencing it (table 2). In the case of the research carried out on the hybrids created at Turda, the relationships that stood out were between the higher rate of water loss from the grains and the some traits: the large number of rows of dent kernels, the reduced rate of the husk on the ears, found in hybrids Turda 344 and Turda 2020, the reduced thickness of the cob (Turda 344), the nutant position of the ear at maturity (Turda 332, Turda 344), the high insertion of the ear (Turda 380, Turda 344, Turda 335).

Table 2. Ear traits that influence the grain and cob moisture loss// Caracteristicile știuletelui care influențează pierderea de umiditate a boabelor și a știuleților

No	Trait / Hybrid	Ear height insertion (cm)	Kernel rows (no)	Cob thickness (cm)	Husk rate (%)	Ear position at maturity
1.	**Turda 332**	132	18-20	2.6	8	Nutant
2.	**Turda 344**	145	18-20	2.4	6	Nutant
3.	**Turda 2020**	141	18-20	2.5	6	Semi-erect
4.	**Turda 335**	140	14-16	2.6	8	Erect
5.	**Turda 380**	150	14-16	2.5	7	Erect

2. The testing of the hybrids on the A.A.F.S. network – 2020-2021

In 2020 and 2021, all 5 hybrids were tested in the A.A.F.S. network, in 5 locations. The productions obtained showed some oscillations depending on the experimental year and the location, but the average productions in both years and the five research stations exceeded 9.2 t/ha for all hybrids, two of them, Turda 335 and Turda 2020, even exceeding 10.5 t/ha. In both years, at A.R.D.S. Turda, all five hybrids had yields above 10 t/ha. High yields were also obtained at R.D.S.C.B. Târgu Mureș, especially for Turda 335, Turda 2020 and Turda 380. The hybrids studied stood out for their high yields in 2021 at A.R.D.S. Secuieni, and in 2020 at A.R.D.S. Livada (table 3). It can therefore be stated that hybrids can be cultivated with good results both in Transylvania and in Moldova.

Table 3. The yield (t/ha) of the newest 5 maize hybrids, A.A.F.S. ecological network, 2020-2021// Producția (t/ha) al celor mai noi 5 hibrizi de porumb, in reteaua ecologică a SCDA, 2020-2021

Nr. crt.	Hibrizi testați	Ani	Yield (t/ha) at (U=14%)					
			Turda	Târgu Mureș	Secuieni	Livada	Lovrin	Media
1.	**Turda 332**	2020	10,7	9,5	6,6	11,8	7,8	9,3
		2021	10,7	9,3	12,1	9,6	4,8	
2.	**Turda 344**	2020	12,2	10,1	6,7	14,4	8,5	9,7
		2021	10,7	8,5	10,0	9,4	6,8	
3.	**Turda 335**	2020	11,6	8,9	7,7	14,7	10,9	11,1
		2021	11,1	13,8	12,6	9,4	10,7	
4.	**Turda 2020**	2020	11,7	10,3	6,0	12,6	10,3	10,5
		2021	10,5	15,0	11,4	8,9	8,5	
5.	**Turda 380**	2020	11,7	11,0	6,4	13,1	8,1	9,9
		2021	11,1	10,8	10,7	8,8	7,8	

3. The testing of the hybrids in the S.I.V.T.R. network

The Turda 332 hybrid was tested for registration in the period 2011-2013, in 9 localities in the country (table 4). The hybrid was distinguished by superior yields as compared to the controls, in all test years and at all

locations, with an average yield of over 9.4 t/ha. The year 2012 was very unfavourable for maize crop due to the drought, productions being generally low, but in 2011 and 2013, the average productions in the 9 localities exceeded 10.8 t/ha (table 4). The maximum yield obtained in the S.I.V.T.R. network was 16.1 t/ha at Rădăuţi (2011) and of 15.9 t/ha at Dej (2013). The highest average yield in the three years of experimentation were obtained in Dej (12 t/ha), Satu Mare (11.7 t/ha) and Rădăuți (11.3 t/ha).

Table 4. The yield (t/ha) of Turda 332 from S.I.V.T.R. network/ Producția (t/ha) hibridului Turda 332 in rețeaua ISTIS

Locality / Year	Yield (t/ha) – Turda 332									
	Târgoviște	**Șimleul Silvaniei**	**Sibiu**	**Satu Mare**	**Rădăuți**	**Negrești**	**Inand**	**Dej**	**Bacău**	**Average of localities**
2011	6,9	9,5	12,6	15,4	16,1	9,6	8,3	13,3	12,3	11,6
2012	5,3	7,2	5,0	7,3	5,5	3,9	7,2	6,8	5,7	6,0
2013	6,9	10,7	11,5	12,5	12,5	7,5	6,1	15,9	13,3	10,8
3 years average	6,4	9,1	9,7	11,7	11,3	7,0	7,2	12,0	10,5	9,4
Average of controls	**6,1**	**8,3**	**7,8**	**9,2**	**9,3**	**6,5**	**6,9**	**10,2**	**8,7**	**8,1**

The Turda 344 hybrid was tested in 6 localities, between 2014-2016, being approved in 2017 and then patented in 2018. The maximum production during the testing period at S.I.V.T.R. (table 5) exceeded 13 t/ha at Luduș (2016) and over 12 t/ha at Dej (2014). The average yield in the three years, over 9.6 t/ha, exceeded the controls with 1.5 t/ha. Average yield of over 10 t/ha were obtained in Tecuci, Satu Mare, Luduș and Dej.

Table 5. The yield (t/ha) of Turda 344 from S.I.V.T.R. network// Producția (t/ha) hibridului Turda 344 în rețeaua ISTIS

Locality / Year	Yield (t/ha)– Turda 344						
	Tecuci	**Satu Mare**	**Negrești**	**Luduș**	**Inand**	**Dej**	**Average of localities**
2014	9,1	11,5	10,7	11,3	5,9	12,3	10,1
2015	11,9	9,4	7,2	6,9	5,9	10,6	8,7
2016	10,7	9,5	7,1	13,0	8,8	10,5	9,3
3 years average	10,6	10,1	8,3	10,4	6,9	11,1	9,6
Average of controls	**8,6**	**8,5**	**7,4**	**8,9**	**6,0**	**9,3**	**8,1**

Turda 335 was tested in the period 2018-2020, being registered in the official catalogue of varieties in 2021 and patented in 2022. The average production of the hybrid Turda 335 in the three experimental years, in the nine localities (table 6) was approximately 13 t/ha, exceeding 12.6 t/ha every year. Some high production values are noted in the three years in Dej (17.4 t/ha), Rădăuți (15.3 t/ha), Sibiu (14.1 t/ha) and Luduș (13.6 t/ha). Highest yields were noted in Dej, in 2019 (21.8 t/ha) and in Rădăuți in 2020 (17.3 t/ha).

Table 6. The yield (t/ha) of Turda 335 from S.I.V.T.R. network// Producția (t/ha) hibridului Turda 335 în rețeaua ISTIS

Locality / Years	Yield (t/ha) – Turda 335									
	Târgoviște	Șimleul Silvaniei	Sibiu	Satu Mare	Rădăuți	Negrești	Luduș	Inand	Dej	Average of localities
2018	11,3	11,0	13,8	11,4	13,8	14,2	14,2	9,5	13,8	12,6
2019	13,6	8,6	13,9	11,8	14,9	15,3	13,5	9,2	21,8	13,6
2020	9,4	12,4	14,5	16,5	17,3	8,8	13,1	6,7	16,5	12,8
3 years average	11,4	10,7	14,1	13,2	15,3	12,7	13,6	8,4	17,4	13,0
Average of controls	10,7	10,5	12,6	11,9	14,2	11,1	11,9	7,7	13,4	11,6

Turda 2020 stood out during the testing period by yield superior to all witnesses, in all testing centres, being proposed for registration after only two years, 2019 and 2020, so that in 2021 it was registered and in 2022 patented. The average yield in the two years of experimentation in nine localities exceeded 13 t/ha (table 7). Some localities were noted where the average yield over the two years was: 18.6 t/ha in Dej, 17.0 t/ha in Rădăuți, 14.3 t/ha in Satu Mare and 14.0 t/ha ha in Sibiu. The highest productions were obtained in 2019 at Dej (21.1 t/ha) and Rădăuți (17.1 t/ha), as well as in 2020 in the same test centres, when yield had values of 16, 1 t/ha, respectively 16.9 t/ha.

Table 7. The yield (t/ha) of Turda 2020 from S.I.V.T.R. network// Producția (t/ha) hibridului Turda 2020 în rețeaua ISTIS

Locality / Years	Yield (t/ha)– Turda 2020									
	Târgoviște	Șimleul Silvaniei	Sibiu	Satu Mare	Rădăuți	Negrești	Luduș	Inand	Dej	Average of localities
2019	15,4	8,5	13,3	12,4	17,1	12,2	11,9	9,2	21,1	13,5
2020	8,9	13,3	14,7	16,2	16,9	8,2	12,2	6,7	16,1	12,6
2 years average	12,1	10,9	14,0	14,3	17,0	10,2	12,1	8,0	18,6	13,0
Average of controls	11,1	10,2	12,4	12,4	14,5	9,9	11,0	7,1	16,6	11,7

The newest creation of A.R.D.S. Turda, the semi-early hybrid Turda 380 was registered in 2022 after 3 years of testing (2019-2021) and is patent pending. The average yield in the three years of experimentation, in nine localities, was 11.6 t/ha. Maximum yield was achieved at Dej in 2019, 18.8 t/ha, and 16.6 t/ha were obtained in Rădăuți in 2019 and 2020. The highest average yield obtained in the three years of testing were noted in Rădăuți, Satu Mare and Dej.

Table 8. The yield (t/ha) of Turda 380 from S.I.V.T.R. network// Producția (t/ha) hibridului Turda 380 în rețeaua ISTIS

Locality / Years	Yield (t/ha) – Turda 380									
	Târgoviște	Șimleul Silvaniei	Sibiu	Satu Mare	Rădăuți	Negrești	Luduș	Inand	Dej	Average of localities
2019	14,0	8,4	14,0	12,8	16,6	13,3	12,5	8,1	18,8	13,2
2020	8,8	12,9	14,7	15,1	16,6	9,2	12,6	6,5	13,9	12,3
2021	5,4	11,7	11,7	10,0	12,6	6,8	11,2	3,8	11,0	9,4
3 years average	9,4	11,0	13,5	12,6	15,3	9,8	12,1	6,1	12,6	11,6
Average of controls	9,1	10,0	12,1	11,6	13,8	9,1	10,1	5,9	15,1	10,8

CONCLUSIONS

1. Climate change, the competition with hybrids on the market, as well as the demand from farmers have determined the change in the orientations of breeding programs towards the creation of maize hybrids with a slightly longer vegetation period, but with higher productivity, the creations of the last decade standing out in this regard.
2. The yields obtained by the maize hybrids Turda 332, Turda 344, Turda 335, Turda 2020 and Turda 380, in the ecological network of the research stations within A.A.F.S., as well as from the testing at S.I.V.T.R. determines the recommendation to cultivate these hybrids with good results in various regions of the country, especially in favourability zones I and II in Transylvania and Moldova, as well as in the hilly areas in the west of the country.

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BEHAVIOR OF SOME WINTER TRITICALE VARIETIES UNDER PEDOCLIMATIC CONDITIONS OF ARDS TELEORMAN, DURING 2020-2022

COMPORTAREA UNOR VARIETĂȚI DE TRITICALE DE TOAMNĂ IN CONDITILE PEDOCLIMATICE DE LA SCDA TELEORMAN ÎN PERIOADA 2020-2022

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Abstract

The paper presents yield performances of 16 triticale cultivars (Zori, Zvelt, Zaraza, Tulnic, Utrifun, FDL Ascendent, Haiduc, Negoiu, Oda, Pisc, FDL Cordial, 14225T2-1, 16026T4-1, Vultur, 14187T1 și TF2), under pedoclimatic conditions of ARDS TELEORMAN, during 2020-2022, under two technologies; optimum nitrogen and phosphorus (N96:P40) and optimum phosphorus reduced dose of nitrogen(N40:P40) fertilization. The tested cultivars differently reacted to environment during research. There were identified cultivars well adapted to unfavorable environmental conditions, such as Vifor, FDL Cordial, 14225T1-02, 16026T4-1 și 14187T1, and cultivars rather more adapted to favorable environmental conditions, Oda, Pisc, Utrifun, Zvelt, Zaraza și FDL Ascendent. The new cultivars Utrifun și FDL Ascendent expressed a high yield potential in quite contrasting environmental conditions.

Introduction of cultivars with large adaptability to contrasting environmental conditions, could contribute to the yield stability in triticale, irrespective the availability of favorable crop conditions in some years. The superior yield capacity of the both, the new triticale genotypes under registration and the perspective lines as compared to the former ones proved in different environmental conditions recommend them to be cultivated in the area in order to obtain sustainable yields.

***Key words: triticale, environmental conditions, cultivar reaction, yield potential*.**

Rezumat

Lucrarea prezintă rezultatele de producție obținute la 16 soiuri de triticale (Zori, Zvelt, Zaraza, Tulnic, Utrifun, FDL Ascendent, Haiduc, Negoiu, Oda, Pisc, FDL Cordial, 14225T2-1, 16026T4-1, Vultur, 14187T1 și TF2), în condițiile pedoclimatice de la SCDA TELEORMAN, în perioada 2020-2022, cultivate în două condiţii de fertilizare cu azot şi fosfor în optim (96 kg azot s.a./ha şi 40 kg fosfor s.a./ha) și în condiţii de fertilizare cu doza optimă de fosfor şi redusă cu azot, (40 kg azot s.a /ha şi 40 kg fosfor s.a./ha). Soiurile testate au reacţionat diferit la mediu și la tehnologia de fertilizare. Au fost identificate soiuri bine adaptate atât la condiţii nefavorabile de mediu, cum ar fi: Vifor, FDL Cordial, 14225T1-02, 16026T4-1 și 14187T1, cât și la condiţii favorabile de mediu, Oda, Pisc, Utrifun, Zvelt, Zaraza și FDL Ascendent. Noile soiuri Utrifun și FDL Ascendent sunt bine adaptate la condiţiile de mediu din zona de sud a ţării, având un potenţial mare de producţie. Prin cultivarea soiurilor cu adaptabilitate mare la condiţiile de mediu contrastante, reducerea randamentului de producţie înregistrată în anii nefavorabili ar putea fi redusă. Noile genotipuri în curs de omologare și de perspectivă sunt bine adaptate la condiţiile de mediu din zonă, având un potenţial de producţie superior, comparativ cu soiurile mai vechi și recent omologate, ceea ce le recomandă pentru cultivarea cu succes (asigurarea unui nivel optim de producţie) în anii nefavorabili de cultură.

Cuvinte cheie: triticale, condiţii de mediu, reacţie soiuri, nivel de producţie. Cuvinte cheie: triticale, condiţii de mediu, reacţie soiuri, producţie.

INTRODUCTION

Among cereal crops, triticale is one of the great achievements of the man in the field of theoretical and applied genetics and which has wide potential possibilities for increasing the yield per surface unit (Ittu et al., 1986, 1990, 2001; Ittu and Săulescu , 1988, 2000).

The major contribution to the improvement of grain production was made by the genetic advances obtained to increase the number of grains per ear, grain weight and hectoliter mass. Also, an important contribution was the reduction of the plant's height with favorable effects on the improvement of resistance to falling (Ittu et al., 2007). Of particular importance was the transfer from wheat of the semi-dominant gene RhtB1b for reducing plant

height. This gene played a major role in the creation of intensive triticale genotypes with high resistance to fall and at the same time with a greater efficiency of use of assimilates in increasing grain production. A new important step in genetic diversification was the introduction into the Romanian triticale germplasm of the dominant height reduction gene, Hl, transferred from rye, the mutant EM 1, obtained by K o b i l i a n s k i, in the former U.S.S.R. (Ittu et al. , 2007)

The genetic recombinations carried out further in the breeding program carried out at I.N.C.D.A. Fundulea, for improving the resistance to sprouting in the ear, allowed the creation (I t t u et al., 2006 b) (a) of a new germplasm with very low amylolytic activity in the grain (fall index 250-325 sec.) and with a duration of significantly higher dormancy than the best varieties for this characteristic. This germplasm is the basis for the future creation of new triticale varieties with improved resistance to sprouting in the ear.

Considering that the triticale species is mainly intended for use as fodder, silage or especially as grains, the increase in production potential was achieved without decreasing the protein content. The nutritional value of products obtained from triticale is mostly given by the increased content of protein substances that exceeds that of wheat, as well as by the amino acid structure of the protein complex and especially by the richer content in lysine. The nutritional value, the high digestibility of carbohydrates and protein substances give priority to triticale especially in feeding non-ruminant animals, pigs and birds.

The research carried out in this regard demonstrated that the protein-energy ratio is generally higher in the case of fodder obtained from triticale, than that of traditional concentrated fodder (BROUWER; 1977). The strong growth rate in the first phases of growth and the rich vegetative mass of the plants compete with the growth of weeds, which it can practically eliminate. (GAŞPAR; BUTNARU; 1985). Appreciating the essential properties of the triticale species compared to the basic cereals, corn and wheat ZILLINSKI and BORLAUG (1971), NASCIMENTO et al. (2004). , as well as in human nutrition in bakery, pastry, spirits industry, and in the perspective of being used on a large scale in the production of biofuels (bioethanol, biogas) (HILLS et al., 2007).

The genetic diversification of the autochthonous triticale germplasm was achieved, mainly, through the intensive use of Romanian wheat and (Romanian) triticale germplasm in hybridizations, which allowed important progress to be made in improving grain filling, increasing hectoliter mass and, as a result, of production potential. In order to continue to maintain in the breeding program an upward genetic progress in triticale, it is necessary to achieve the improvement and sustained genetic diversification of the germplasm, by carrying out exchanges with other breeding programs in the world and especially by introducing new genetic variability of to wheat and rye for the main agronomic characters (I t t u et al., 2007).

The extremely large variation, both in the total amount of precipitation from one year to another, and in their distribution throughout the year, causes, in some years, important water deficits during the vegetation of grassy cereals, while in other years there are an excess of moisture. The climate changes of the last period of time have accentuated these extreme variations, with serious consequences on agricultural production, triticale genotypes reacting differently depending on the adaptation capacity (V o i c a , 2009). The use of genetic diversity at the territorial level, by cultivating several different species in each area, represents the simplest and most accessible way of reducing crop fluctuations. In this paper, we aimed to analyze the influence of environmental conditions on the production of some triticale varieties, cultivated and some lines of perspective, at SCDA Teleorman, considering the fact that in this area, an element of stress frequently encountered, it is constituted by, both atmospheric and ground drought. The aim of the current work is to analyze the behavior of some triticale genotypes under approval alongside the newest approved varieties, based on multi-year tests in comparative crops, in order to identify, approve and recommend for the expansion of the crop, the best adapted from each other.

MATERIALS AND METHODS

The data presented in this paper refer to the behavior of 16 genotypes of autumn triticale, of which 10 are varieties approved in the period 2012-2022 (Zori, Zvelt, Zaraza, Tulnic, Utrifun, FDL Ascendent, Haiduc, Negoiu, Oda, Pisc, varieties that can be found in the Official Catalog for the year 2022, 5 perspective lines: FDL Cordial, 14225T2-1, 16026T4-1, Vultur, 14187T1 and TF2, the first variety created in Romania in 1984. The experimentation period was three years (2019-2022), characterized by different climatic conditions in terms of

precipitation and temperature regimes, under optimal nitrogen and phosphorus fertilization conditions (96 kg nitrogen s.a./ha and 40 kg phosphorus s.a./ha), and in conditions of fertilization with the optimal dose of phosphorus and reduced with nitrogen, (40 kg nitrogen s.a./ha and 40 kg phosphorus s.a./ha)

The experiment was carried out at S.C.D.A. Teleorman, on a cambic/vertic pseudogleyed chernozem soil, with the following characteristics: humus content: 3.0-3.6%; clay content (in the 0-45 cm soil layer): 45-48%; total nitrogen: 224 ppm; phosphorus: 684 ppm; potassium: 388 ppm; pH (in water): 6.3.The main hydro-physical indices of the soil on the 0-80 cm horizon have the following average values: apparent density 1.43 t/m3, field capacity 27.3% (310.4 mm), wilting coefficient 15.0% (171 .0 mm), minimum ceiling 21.1% (240.7 mm).

The preceding plants was in the years 2019-2020 and 2020-2021were peas and chickpeas, and in the year 2021-2022, sunflower, and the sowing rate was 500 germinable grains/m2. The harvestable plot was 5 m2. The following scheme was used for weed control: Mustang (florasulam 6.25% + Acid 2,4D EHE (2-ethylhexyl-ester) 30%) – 0.5 l/ha + Nuance 10 g/ha.

The varieties studied were characterized, in each of the three years, both from the point of view of production capacity and some morphological characters.

The obtained experimental results were processed by analysis of variance (Ce a p o i u, 1968). Also, the production data were processed statistically, as an experience with 16 varieties in three years in the same locality, and the analysis of the links between the characters was estimated by the method of simple correlations. The reaction of each variety to the environmental conditions was determined by analyzing the regression of each variety, in the three environmental conditions, against the production of all the varieties in the three environmental conditions (Brukner and Frohberg , 1987).

The stability of the production was assessed based on the coefficients of variation. Keim and Kronstand (1979), using the regression analysis method, suggested that a variety is adapted to unfavorable environmental conditions when b<1 (subunit regression slope) and a" (regression constant, intercept) has positive values; adapted to favorable environmental conditions when b>1 (slope of the above-unit regression); widely adapted to different environmental conditions when b>1 and "a" has large values.

The determination of the resistance to sprouting in the ear was done on 10 ears of each variant, harvested at full maturity, which were then submerged in water for three hours to soak well with water. The spikes of each variety were tied into a bouquet, with an identification tag, then these bouquets were placed in a stand in a vertical position with the base in a tray of water. In order to ensure and maintain high humidity, the bunches of ears thus prepared were then covered with a bell made of plastic foil attached to a metal frame. To maintain humidity, the ears were sprayed daily with water by using a hand pump. The resistance of the varieties was assessed after 10 days, by visually assessing the degree of sprouting and scoring on a scale from 1 to 9, where 1 = very resistant to sprouting in the ear (very little sprouted), and 9 = very sensitive to sprouting in the ear (very sprouted). The scoring was done on each ear, and the recorded score represents the average of 10 ears.

Characterization of the behavior of the main pathogens*: Septoria*, *Helminthosporium*, *Puccinia striiformis* and *Puccinia recondite* was done in the field, during natural infection, by grades from 1 to 9 for *Septoria and Helminthosporium* and by the frequency and degree of rust attack on a scale from 0 to 100, and to establish the behavior of triticale genotypes to *Fusarium graminearum*, artificial infections were made. The method of artificial infection consisted of applying the inoculum by injecting directly into the herringbone or sprinkling the plants at the anthesis. The inoculum was produced according to the method described by Ittu et al., 1997.The reaction of genotypes to this pathogen was expressed according to the severity of the attack (% spicules attacked at 20 post-inoculation days) and the spread of infection in the ear, based on the calculation of the AUDPC index (area under the disease progress curve (Wilcoxson RD, Skovmand B, Atif AA (1975)

RESULTS AND DISCUSSION

The rainfall regime of the three years of experimentation was very different (table no. 1), the year 2019-2020 with drought in autumn, the year 2020-2021 with excess water in autumn and winter, and the year 2021-2022 with excess of water in autumn and drought in winter and at grain filling. These very diverse rainfall regime conditions allowed a good assessment, under field conditions, of the behavior of the tested triticale genotypes.

Table 1 Rainfall (mm) registered under different vegetation stages at ARDS Teleorman during 2019-2022
Precipitaţiile (mm) înregistrate la S.C.D.A. Teleorman în diferite fenofaze de creştere şi dezvoltare în perioada 2019-2022

Years	Sowing and sprouting of plants X-XI	Winther reserve XII-III	Intense growth-blooming - IV-V	Grain filing VI
2019-2020	30.9º	216.1	99	84
2020-2021	129*	313.5*	119	99
2021-2022	115.9*	135.5º	95	36.5ºº
Multi-year-average	82.67	185.77	103.03	72.43

o drought; o very dry; *rainy; **very rainy

During the entire vegetation period of autumn triticale, the average monthly temperatures exceeded the multiannual average. High temperatures in winter had a negative influence on the phenomenon of vernalization. In the winter months there was no snow cover.

In April, the autumn grassy cereals were affected by the differences between the average daytime and nighttime temperatures, with an effect on the number of grains in the ear. There was a lack of grain along the length of the ear, and the base and tip of the ear had sterile spikelets. Due to high temperatures and insufficient water in the 2019-2020 crop year, fall triticale had a weaker twinning based on the genotypic expression of each cultivated variety.

The productions obtained by the grassy cereal genotypes during the experimental period generally reflect the amount of precipitation that fell during the sowing-emergence period, the winter reserve and intense growth at flowering, (tables 2 and 3), while the number of ears and the number of grains in the spike generally reflects the amount of precipitation that fell during the period of sowing - emergence and intense growth - flowering. The weight of the grains is influenced by the amount of precipitation that fell during the period of grain filling, intense growth-flowering, but also the winter reserve, and the height of the plants (reflected) by the amount of precipitation that fell during the period of winter and intense growth-flowering.

Table 2 Correlation coefficients between yield and some productivity traits and rainfall registered under different vegetation stages (N 96:P40)
Coeficienţii de corelaţie dintre producţie şi alte caractere de productivitate şi precipitaţiile din diferite faze de vegetaţie (N 96:P40)

Specification	Sowing and sprouting of plants X-XI	Winther reserve XII-III	Intense growth-blooming - IV-V	Grain filing VI
yield	0.70*	0.81**	0.96**	0.60*
Number of plants/m2	0.99***	0.4	0.45	0.2
Number of ears/m2	0.93**	0.49	0.74*	0.17
Number of grains/ear	0.83**	0.67*	0.88**	0.40
Greutatea boabelor /spic	0.49	0.92***	0.99***	0.77*
height	0.57	0.92	0.96***	0.69*

Table 3 Correlation coefficients between yield and some productivity traits and rainfall registered under different vegetation stages (N40:P40)
Coeficienţii de corelaţie dintre producţie şi alte caractere de productivitate şi precipitaţiile din diferite faze de vegetaţie (N 40:P40)

Specification	Sowing and sprouting of plants X-XI	Winther reserve XII-III	Intense growth-blooming - IV-V	Grain filing VI
yield	**0.88****	0.59	**0.82****	0.30
Number of plants/m2	**0.99*****	0.14	0.45	0.20
Number of ears/m2	**0.93*****	0.17	0.14	0.49
Number of grains/ear	**0.79***	**0.71***	**0.90****	0.46
Greutatea boabelor /spic	0.22	**0.97*****	**0.96*****	**0.93****
height	0.36	**0.94*****	**0.99*****	0.85**

Table 4 Yield of winter triticale cultivars tested at ARDS Teleorman, during 2019-2022(N96:P40) . // Producția de boabe obținută la genotipurile de triticale testate la SCDA Teleorman, in perioada 2019-2022, (N96:P40)

No crt	GENOTYPES	Yield Kg/ha 2020	Diff. witness face	yield Kg/ha 2021	Diff. witness face	yield Kg/ha 2022	Diff. witness face	average
1	HAIDUC(martor)	4839	0	7329	0	4810	0	5659
2	NEGOIU	5315	476	7570	241	5205	395*	6030
3	ODA FD	3983	-856	7753	424	5032	222	5589
4	PISC	4388	-451	8034	705**	5164	354	5862
5	TULNIC	3670	-1169^{o}	6610	-719^{oo}	5397	587**	5226
6	UTRIFUN	4963	124	8085	756**	5651	841***	6233
7	VIFOR	6370	1531**	8224	895***	5995	1185***	6863
8	ZORI	4808	-31	7670	341	5695	885***	6058
9	ZVELT	3508	-1331^{oo}	7910	581*	6022	1212***	5813
10	ZARAZA	4483	-356	7679	350	5501	691**	5888
11	FDL ASCENDENT	4996	157	8169	840***	5946	1136***	6370
12	FDL CORDIAL	6625	1786***	7906	577*	5421	611**	6651
13	14225T1-02	7055	2216***	8666	1337***	5781	971***	7167
14	16026T4-1	6110	1271**	8500	1171***	6126	1316***	6912
15	14187T1-1	6598	1759***	8664	1335***	5883	1073***	7048
16	TF2	5546	707	6355	-974^{ooo}	5016	206	5639
average		5204	365	7820	7820	5540	730	6188
	5%		877		415		383	
	1%		1224		597		555	
DL	0.1%		1573		834		777	

Table 5 Yield of winter triticale cultivars tested at ARDS Teleorman, during 2019-2022 (N 40:P40)
Producția de boabe obținută la genotipurile de triticale testate la SCDA Teleorman, in perioada 2019-2022 (N40:P40)

No crt	GENOTYPES	yield Kg/ha 2020	Diff. witness face	yield Kg/ha 2021	Diff. witness face	yield Kg/ha 2022	Diff. witness face	average
1	HAIDUC(martor)	5486	0	7067	0	5666	0	6073
2	NEGOIU	6035	549	7252	185	6025	359	6437
3	ODA FD	4926	-560	6736	-331	6037	371	5900
4	PISC	4378	-1108$^{oo.}$	7012	-55	6228	562*	5873
5	TULNIC	3078	-2408^{ooo}	6363	-704^{o}	6230	564*	5224
6	UTRIFUN	5001	-485	7872	805**	6354	688**	6409
7	VIFOR	6490	1004*	7611	544*	6790	1124	6964
8	ZORI	4472	-1014^{o}	7324	257	6250	584*	6015
9	ZVELT	4373	-1113^{oo}	7215	148	6691	1025***	6093
10	ZARAZA	5235	-251	7100	33	6393	727**	6243
11	FDL ASCENDENT	4953	-533	7391	324	6685	1019***	6343
12	FDL CORDIAL	6780	1294**	7742	675*	6655	989***	7059
13	14225T1-02	7140	1654***	7920	853**	6384	718**	7148
14	16026T4-1	6320	834*	7810	743**	6794	1128***	6975
15	14187T1-1	7793	2307***	7895	828**	5976	310	7221
16	TF2	5993	507	6251	0	5372	-294	5872
average		5528		7285		6283		6366
	5%		763.96		494.86		460.92	
	1%		1070.80		706.11		660.12	
DL	0.1%		1467.62		979.33		917.75	

As a result of the fluctuations of the environmental factors, there was a great variability of the production from one year to another (Table 4). In the fertilization variant N96: P40, the average productions varied from 3508 kg/ha (Zvelt, 2020) to 8666 kg/ha. (14225T2-1, in 2021). The lowest productions were obtained in 2020, a year characterized by drought during the sowing-emergence period and low temperatures in April. The highest average production, respectively 7820 kg/ha, was obtained in 2021, a normal year in terms of the amount of precipitation, which in each vegetation phase was above the multiannual average. Among the varieties studied, the genotypes: Utrifun, Vifor, FDL Cordial, 14225T1-02, 16026T4-1, 14187T1-1 performed very well, exceeding the production of the control variety Haiduc with distinctly significant and very significant increases. Distinctly significant and very significant production losses compared to the control were recorded in the genotypes: Zvelt (2020), Tulnic and TF2 (2021).

In the version fertilized with N40:P40, the average productions varied from 3078 kg/ha (Tulnic, 2020) to 7920 kg/ha (14225T2-1, 2021). The lowest productions were obtained in 2020. The highest average production was obtained in 2021 (7285 kg/ha). In the period 2019-2020 and 2021-2022, in which the drought phenomenon manifested itself during the vegetation period, a higher production was recorded in the triticale crop in the N40:P40 fertilization variant, compared to that of N96:P40. The genotypes: Utrifun, FDL Cordial, 14225T1-02, 16026T4-1, 14187T1-1 were distinguished by distinctly significant and very significant increases in production, compared to the control variety Haiduc. Distinctly significant and very significant production losses compared to the control, were recorded in the genotypes: Pisc, Tulnic and Zvelt (2020) (Table 5).

Table 6 Maximum, minimum and average yields and its amplitude at 16 triticale cultivars and their response parameters to the variation of environmental conditions, at Teleorman, during 2019-2022 (N 96:P40)// Producţiile medii, minime şi maxime şi amplitudinea producţiei la genotipurile de triticale şi parametrii de răspuns ai acestora la variaţia condiţiilor de mediu din perioada 2019-2022 (N 96:P40)

No crt	Genotypes	Yield kg/ha			Amplitude	a	b	R	CV %
		average	minimum	maximum					
1	HAIDUC	5659	**4810**	**7329**	2519	-576	1.01	0.99	25.55
2	NEGOIU	6030	**5205**	**7570**	2365	-222	0.99	0.96	22.14
3	ODA FD	5589	**3983**	**7753**	**3770**	-2769	1.35	0.99	34.82
4	PISC	5862	**4388**	**8034**	**3646**	-2458	1.34	1	32.76
5	TULNIC	5226	**3670**	**6610**	2940	-393	0.91	0.87	28.27
6	UTRIFUN	6233	**4963**	**8085**	**3122**	-868	1.14	1	26.32
7	VIFOR	6863	**5995**	**8224**	2229	**1871**	**0.81**	**0.96**	**17.39**
8	ZORI	6058	**4808**	**7670**	2862	-198	1.01	0.98	24.18
9	ZVELT	5813	**3508**	**7910**	**4402**	-2670	1.37	0.88	37.99
10	ZARAZA	5888	**4483**	**7679**	**3196**	-1071	1.12	0.98	27.73
11	FDL ASCENDENT	6370	**4996**	**8169**	**3173**	-598	1.12	0.98	25.57
12	**FDL CORDIAL**	6651	**5421**	**7906**	2485	**2266**	**0.71**	**0.81**	**18.68**
13	**14225T1-02**	7167	**5781**	**8666**	2885	**1891**	**0.85**	**0.84**	**20.17**
14	**16026T4-1**	6912	**6110**	**8500**	2390	**971**	**0.96**	**0.99**	**19.90**
15	**14187T1**	7048	**5883**	**8664**	2781	**1191**	**0.94**	**0.93**	**20.49**
16	TF2	5639	**5016**	**6355**	1339	3098	0.41	0.87	**11.96**
	average	6188		**7820**	2616				

In the three years of experimentation, the biggest difference between the minimum and maximum production of the same variety, was registered with the Zvelt variety (4402 kg/ha). in the version fertilized with N96:P40 (Table 6). Differences in production of over 3000 kg/ha were recorded in contrasting environmental conditions and in the varieties: Oda FD, Pisc, Zaraza and FDL Ascendent, while minimal values regarding the differences in production were recorded, in the same conditions of medium in the genotypes: TF2, Negoiu, 16026T4-1 and Vifor.

The evaluation of the coefficient of variation (CV%) of the triticale genotypes studied, highlights minimum values of the TF2 variety, in the N96:P40 fertilized version, which attests to the high level of production stability of this variety (11.96). The higher values of the coefficients of variation (> 30%) recorded for the genotypes: Vifor, FDL Cordial, 14225T1-02, 16026T4-1, 14187T1-1, Negoiu. The Oda, Pisc and Zvelt suggesting their lower level of stability. . Depending on the regression coefficient values, the analyzed genotypes can be classified as adapted to unfavorable environmental conditions (b<1): Negoiu, Tulnic, Vifor, FDL Cordial, 14225T1-02, 16026T4-1, 14187T1 and/or adapted to favorable environment (b>1), such as: Oda, Pisc, Utrifun, Zvelt, Zaraza and FDL Ascendent. It should be noted that a characterization of varieties based exclusively on the value of the regression coefficient does not lead to the identification of varieties with wide adaptability to varied environmental conditions. An optimal characterization can be obtained by analyzing both the value of the regression coefficient and the regression constant. According to the two parameters of the regression, the triticale genotypes can be classified into the following categories:

- good adaptability to unfavorable environmental conditions (b<1, a positive values): Vifor, FDL Cordial, 14225T1-02, 16026T4-1, 14187T1 and TF2;
- good adaptability to favorable environmental conditions (b>1, a negative values): such as) Oda, Pisc, Utrifun, Zvelt, Zaraza and FDL Ascendent.

Table 7 Maximum, minimum and average yields and its amplitude at 16 triticale cultivars and their response parameters to the variation of environmental conditions, at Teleorman, during 2019-2022 (N 40:P40)// Producţiile medii, minime şi maxime şi amplitudinea producţiei la genotipurile de triticale şi parametrii de răspuns ai acestora la variaţia condiţiilor de mediu din perioada 2019-2022 (N 40:P40)

No. crt	Genotypes	Yield kg/ha			Amplit.	a	b	R	CV %
		average	Minim.	maxim.					
1	HAIDUC	6073	5486	7067	1581	177	0.92	0.94	14.25
2	NEGOIU	6437	6035	7252	1217	1848	0.72	0.90	10.96
3	ODA FD	5900	4926	6736	1810	-545	1.01	0.98	15.47
4	PISC	5873	4378	7012	2634	-3427	1.46	0.95	23.03
5	TULNIC	5224	3078	6363	3285	-6090	1.77	0.84	35.59
6	UTRIFUN	6409	5001	7872	2871	-3951	1.63	1	22.41
7	VIFOR	6964	6490	7611	1121	2841	0.65	0.98	8.33
8	ZORI	6015	4472	7324	2852	-4131	1.59	0.98	23.95
9	ZVELT	6093	4373	7215	2842	-3833	1.56	0.91	24.82
10	ZARAZA	6243	5235	7100	1865	-394	1.04	0.98	15.08
11	FDL ASCENDENT	6343	4953	7391	2438	-2259	1.35	0.95	21.36
12	FDL CORDIAL	7059	6655	7742	1087	3392	0.57	0.85	15.01
13	14225T1-02	7148	6384	7920	1536	3954	0.50	0.58	28.99
14	16026T4-1	6975	6320	7810	1490	1521	0.86	0.99	26.38
15	14187T1	7221	5976	7895	1919	6224	0.15	0.13	51.18
16	TF2	5872	5372	6251	879	4690	0.18	0.36	12.45
	average	6366							

In the N40:P40 fertilized variant (Table 7), the biggest difference between the minimum and maximum production of the same variety, in the three experiments, was registered with the Tulnic variety (3285 kg/ha). Large differences in production (>2800 kg/ha) were also recorded in the Utrifun and Zvelt varieties. The smallest differences in production in different environmental conditions were recorded in the varieties TF2, FDL Cordial, Vifor and Negoiu.

The lowest coefficient of variation was registered with the genotype Vifor (CV%=8.33), which suggests a higher level of production stability, followed by the genotypes: Negoiu, TF2, Haiduc, Oda, Zaraza and FDL Cordial. The high values of the coefficient of variation recorded in the genotypes 14187T1-1 (CV%=51.18) and Tulnic (CV% =35.59), indicate their lower stability.

According to the value of the regression coefficient, the studied genotypes are divided into the following categories: adapted to unfavorable environmental conditions (b<1): Haiduc, Negoiu, Vifor, FDL Cordial, 14225T1-02, 16026T4-1, 14187T1 and TF2, adapted to favorable environmental conditions (b>1): Oda, Pisc,

Tulnic, Utrifun, Zori, Zvelt, Zaraza and FDL Ascendent. Taking into account the two parameters of the regression, the genotypes Haiduc, Negoiu, Vifor, FDL Cordial, 14225T1-02, 16026T4-1, 14187T1 and TF2, showed a higher level of adaptability to unfavorable environmental conditions (b<1, a positive values), compared to Oda, Pisc, Tulnic, Utrifun, Zori, Zvelt, Zaraza and FDL Ascendent, well adapted to favorable environmental conditions (b>1, a negative values)

Table 8 Correlation between some productivity traits and yield (N 96:P40)
Corelaţia dintre unele elemente de productivitate şi corelaţia dintre acestea şi producţie (N 96:P40)

Specification	Yield	Number of plants/m2	Number of ears/m2	Number of grains/ear	Grain weight/ear	height
Producţion	1					
Number of plants/m2	0.67	1				
Number of ears/m2	**0.90****	**0.93****	1			
Number of grains/ear	**0.97*****	**0.82****	**0.97*****	1		
Grain weight/ear	**0.97*****	0.47	0.76*	**0.83****	1	
height	**0.91****	0.52	0.77*	**0.88****	**0.95*****	1

From the study of the correlations between the analyzed characters, significant and/or distinctly significant values of the correlation coefficient between production and the number of ears were identified (r=0.90**); the number of grains in the ear (r=0.97***), the weight of the grains per ear (r=0.97***) and the height of the plants (r=0.91**); between the number of plants and the number of ears (r=0.93**); between the number of ears and the number of grains in the ear (r=0.97***); between the number of grains in the ear and the weight of the grains in the ear (r=0.83**) and the height of the plants (r=0.88**); between the weight of the grains in the ear and the height of the plants (r=0.95***) (variant fertilized with N96:P40) (Table 8).

Table 9 Correlation between some productivity traits and yield(N 40:P40)
Corelaţia dintre unele elemente de productivitate şi corelaţia dintre acestea şi producţie (N 40:P40)

Specification	Producţion	Number of plants/m2	Number of ears/m2	Number of grains/ear	Grain weight/ear	height
Producţion	1					
Number of plants/m2	**0.87****	1				
Number of ears/m2	0.68*	**0.95*****	1			
Number of grains/ear	**0.98*****	0.78*	**0.95*****	1		
Grain weight/ear	0.64	0.20	0.14	0.77*	1	
height	0.76*	0.35	0.015	**0.85****	0.98***	1

In the version fertilized with N40:P40 (table 9), the correlations between production and the number of plants/m2 (r=0.87**) and the number of grains in the ear (r=0.98***), between the number of plants/ m2 and the number of ears/m2 (r=0.95***), between the number of ears and the number of grains in the ear (r=0.95***), between the number of grains in the ear, the weight grains in the ear (r=0.77* and waist (r=0.85**) and between the weight of the grains in the ear and waist. (r=0.98***)

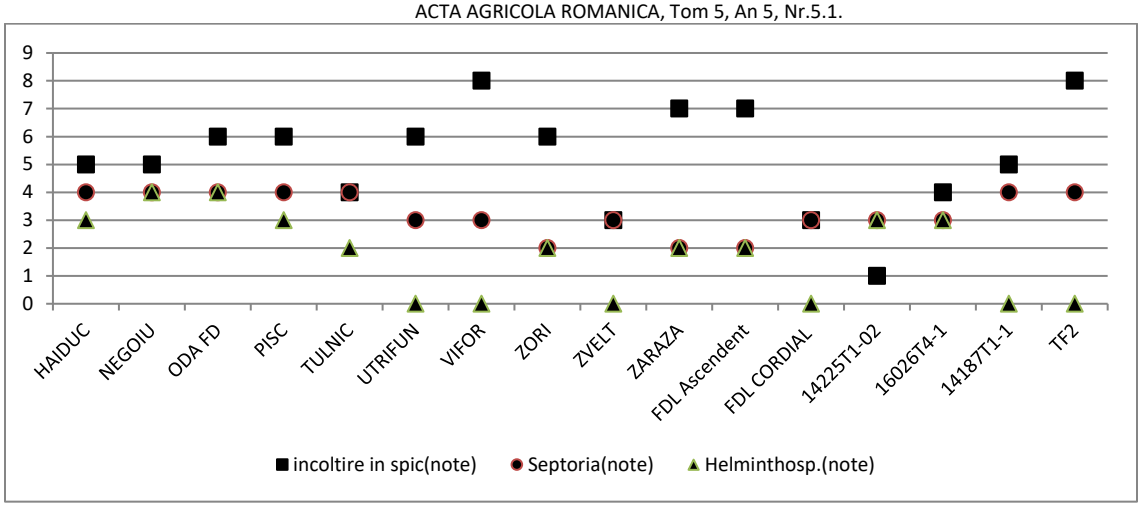

Fig. 1 Behavior of genotypes to Septoria triticii, Helminthosporium sp. (natural infection) and germination of grains in the ear (artificial conditions), (SCDA Teleorman, 2021 and 2022)
Reacția genotipurilor de triticale la *Septoria triticii*, *Helminthosporium* sp. (infecție naturală) și încoltirea boabelor în spic (condiții artificiale), (SCDA Teleorman, 2021 și 2022)

Regarding disease resistance, a level of variability was found (Fig. 1). The least affected by Helminthosporium were the genotypes: Utrifun, Vifor, Zvelt, FDL Cordial, and by septoriosis Zori, Zaraza and FDL Ascendent (grade 1-2).

The phenomenon of sprouting in the ear manifests itself when at the full maturity of the field of triticale, there is a period of rain accompanied by a drop in temperature. In such conditions, the water reaches the grain and the grain sprouts. Since we did not have the necessary conditions for the manifestation of this phenomenon, we resorted to testing under artificial conditions. The genotypes: 14225T1-02 (grade 1), Zvelt, FDL Cordial (grade 3) and 16026T4-01 (grade 1-4) had very good resistance.

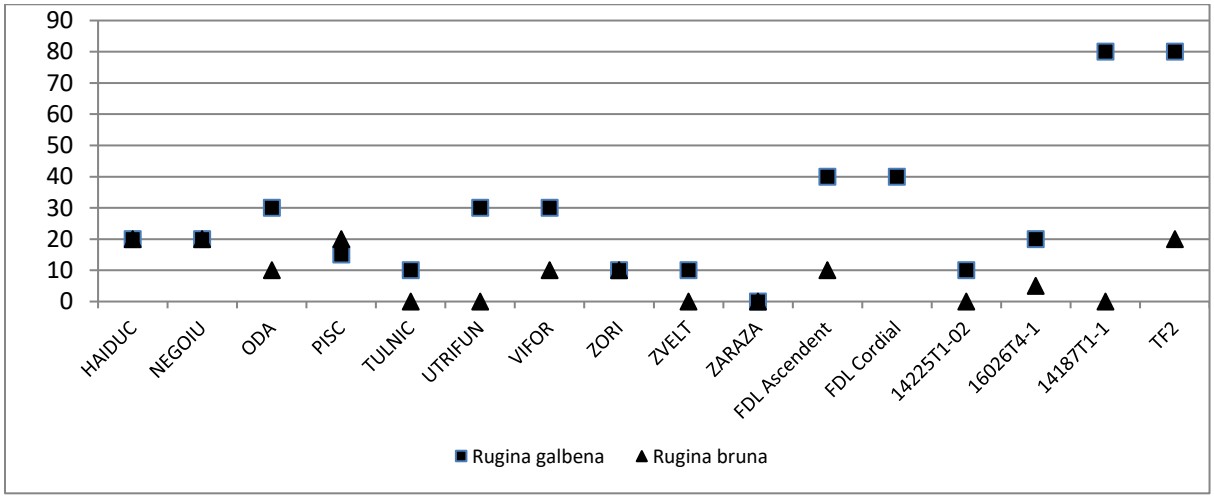

Fig. 2 The behavior of triticale genotypes to yellow rust and brown rust (SCDA Teleorman, natural infection, 2021)
Reacția genotipurilor de triticale la rugina galbenă și rugina brună (SCDA Teleorman, infecție naturală, 2021)

The yellow and brown rusts appeared only in the year 2021 (Fig. 2) and only in the first phase, because there followed a period with more abundant precipitation that washed away the uredia (pustules), so the attack could no longer be noted. Attack frequency was between 0-80% (RB) and between 0-20% (RY). The genotypes least affected by these diseases were: Zori, FDL Cordial, Tulnic, Utrifun, Zvelt, Zaraza, 14225T2-1, Vifor and Oda

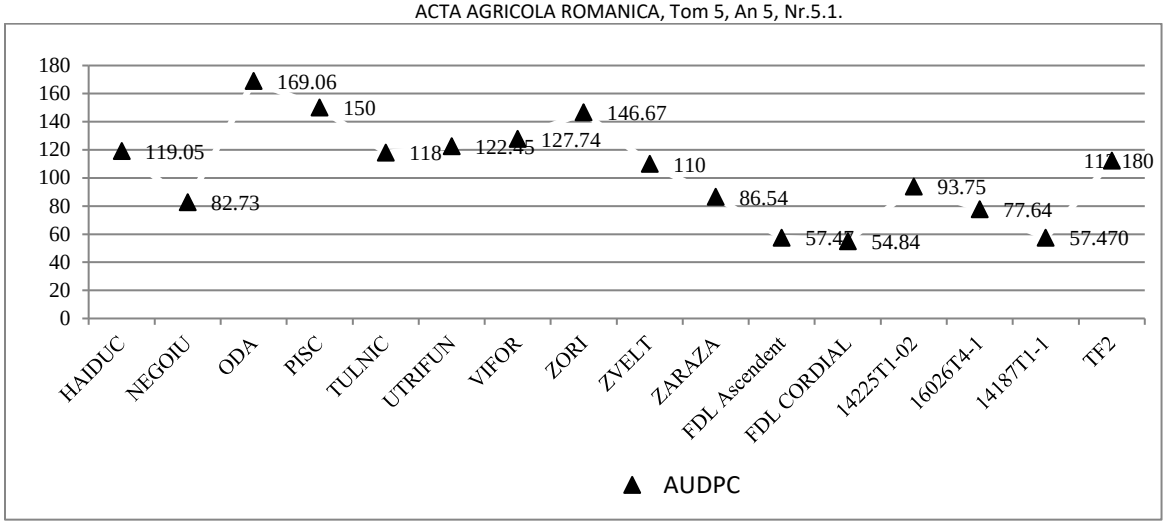

Fig. 3 The behavior of triticale genotypes to fusariosis of the ear (SCDA Teleorman, artificial infection, year 2022)
Reacția genotipurilor de triticale la fuzarioza spicului (SCDA Teleorman, infectie artificiala, 2022)

Fusarium head blight is a widespread damaging disease of cereals in all growing areas of the world. Besides the significant reduction in production, the accumulation of specific toxins (trichotecenes) in the seeds, associated with the attack of the Fusarium pathogen, irreversibly depreciates their quality. The genotypes: FDL Ascendent, 14187T1-1, FDL Cordial, 14225T2-1 and 16026T4-1 were distinguished by a slower evolution of the disease (AUDPC= 54.84-57.47)

The results obtained from the study of an assortment of triticale genotypes, carried out at SCDA Teleorman, in the period 2019-2022, highlighted the genetic variability for the analyzed characters and some lines were identified in the process of homologation and/or perspective, with production potential and resistance to diseases and sprouting in the ear, adapted to less favorable culture conditions. In a period marked by unpredictable climate changes in terms of intensity and evolution, ensuring the diversity of agricultural crops within new varieties adapted for cultivation and exploitation, in less favorable conditions, is a major desire.

CONCLUSIONS

Following this study, the following conclusions were drawn:

1. On average over three years, in the fertilization variant N96:P40, the genotypes: Vifor, FDL Ascendent, FDL Cordial, 14225T1-02, 16026T4-1 and Utrifun generated the highest yield 8000-8666 kg/ha, while the varieties Vifor, FDL Ascendent, FDL Cordial, 14225T1-02, 16026T4-1, Negoiu and Utrifun made the best use of the N40:P40 fertilization conditions, the recorded yields being between 7600-7900 kg/ha;
2. In an experimental cycle of three years, only the year 2021 was favorable for the triticale culture, when the average yield obtained were over 7800 kg/ha, compared to the yield between only 5200-5500 kg/ha, in the years 2020 and 2022. , characterized by long periods of drought
3. The highest yield was recorded in 2021 with the 14225T1-02 variety (8666 kg/ha), and the lowest with the Tulnic variety (3508 kg/ha) within the N96P:40 fertilization variant and 7920 kg/ha. (14225T2 -1 in 2021) and 3078 kg/ha (Tulnic 2020) in the N40:P40 fertilization variant.
4. Triticale genotypes well adapted to unfavorable environmental conditions were Vifor, FDL Cordial, 14225T1-02, 16026T4-1 and 14187T1 and to favorable environmental conditions Oda, Pisc, Utrifun, Zvelt, Zaraza and FDL Ascendent;
5. It should be noted that the new varieties introduced into culture (Utrifun and FDL Ascendent) make very good use of the soils in the southern part of the country.

6. The new genotypes under approval and of perspective are well adapted to the environmental conditions in the area, having a higher production potential, compared to the older and recently approved varieties, which can also ensure an optimal level of production in unfavorable crop years.

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