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RESEARCH ON WEED CONTROL ON ALBIC LUVISOL OF NORTHWESTERN ROMANIA IN AUTUMN WHEAT CROP

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Abstract

The research was carried out in the 2022-2023 agricultural year, the experience being located on an albic luvosol with a pH of 5.1, a clay content of 20.9% and a humus content of 1.8, the Glosa wheat variety being sown. The present work presents the effectiveness and efficiency of herbicide treatments on wheat production on an albic luvisol in Livada township, Satu Mare county, and implicitly the weed control strategies. The dominant species in the wheat culture on the albic luvosol are: Matricaria inodora, Raphanus raphanistrum, Sinapis arvensis, Cirsium arvense, Viola arvensis, Apera spica-venti, Gypsofila muralis, Sclerantus anuus, Elymus repens, Convolvulus, Galeopsis tetrahit. The effectiveness of the treatments was different depending on the herbicide used and the degree of weeding. The effective fight against weeds in the field requires a good knowledge of the pedoclimatic conditions that influence the effectiveness of herbicide treatments applied pre-emergence or post-emergence due to the different floristic composition depending on these conditions. It is noted that the fight against weeds in the wheat crop and beyond is an important link without which a profitable crop cannot be achieved. Herbicides remain one of the most effective means of combating weeds in the wheat crop.

***Key words:** wheat, weeds, herbicides, effectiveness, production*

INTRODUCTION

Wheat holds a significant share in field crops structure in Romania. With all the progress made in agriculture in the last century, weeds are still present in cultivated fields (Mondici et. all 2019, Şugar et. all 2021). It is true that in countries with advanced agriculture, they are relatively low in number, and the weed seed bank is continuously decreasing. The technical and financial effort to reduce weed infestation is high, but it is justified by the higher level and quality of production (Brejea et. all).

Numerous researches conducted in other countries and in our country have led to the conclusion that the fight against weeds cannot be achieved through singular measures, as it was once considered (Şugar et. all 2019). Chemical weed control represented a significant step forward and still remains an effective measure, but by no means the exclusive one (Brejea et. all).

Chemical weed control in wheat cultivation is a matter of national interest due to the damages inflicted on Romanian agriculture. In recent years, the Romanian pesticide market has seen the introduction of several herbicides with promising results in combating weeds in wheat cultivation (Ciobanu 2016, Mondici 2019)

The essential aspect of combating and controlling weeds (two distinct concepts that do not exclude each other but complement each other) is a part of plant population control. Its objective is not merely the crop (or not only the crop) or the vegetation of the weeds but rather maximizing the production of the cultivated plant in the presence of plants from other species (Brejea et. all).

MATERIALS AND METHODS

The research was conducted in an experimental field located on a albic luvisol with a pH of 5.1, clay content of 20.9%, and humus content of 1.8%. The wheat variety sown for the experiment was Glosa.

The wheat variety Glosa was obtained at the National Research-Development Institute for Plant Breeding in Fundulea, Romania. It is an early-maturing variety with good lodging resistance, winter hardiness, drought, and heat resistance. Additionally, it shows good resistance to ear emergence sprouting and moderate resistance to brown rust, while exhibiting strong resistance to loose smut (Brejea et. al). The experimental design followed the randomized block method with 12 variants in three replications, each having a plot area of 21m². The solution rate was 500 l/ha, and treatments were applied during autumn (BBCH 10-13) and spring (BBCH 30-32).

During the administration of herbicides, the equipment used was the Plot Sprayer PSGF 4.3, with TeeJet nozzles, nozzle size 0.2, and a traveling speed of 6 km/h.

The harvesting of the experimental plots was conducted on 06.07.2023 using a combine harvester specifically designed for harvesting experimental plots (Figure 1).

Figure 1. Harvesting wheat with the combine harvester for experimental plots, Wintersteiger. - 2023

Table1. The herbicides applied in the wheat crop during the 2022-2023 period

Variant Number	Herbicides	Dosage L,kg/ha	Application timing	Active substance
1	Untreated (Control)	-	-	-
2	Sekator Progres OD	0,15	Post S.**	iodosulfuron methyl25g/l+amidosulfuron100g/l+safener
3	Bizon	1	Post e. A.*	diflufenican100g/l+penoxulam15g/l+ florasulam 3,75g/l
4	Bizon	1	Post S.	diflufenican100g/l+penoxulam15g/l+ florasulam 3,75g/l
5	Trinity SC	2	Post e. A.	pendimetalin300g/l+diflufenican40g/l+ clortoluron250g/l
6	Trinity SC	2	Post S.	pendimetalin300g/l+diflufenican40g/l+ clortoluron250g/l
7	Joystick	0,2	Post e. A.	iodosulfuron50g/kg+florasulam20g/kg+ diflufenican400g/kg
8	Joystick	0,2	Post S.	iodosulfuron50g/kg+florasulam20g/kg+ diflufenican400g/kg
9	Stomp Aqua+Rival Super Star	2,9+0,015	Preem***+Post S	pendimetalin455g/l+Tribenuron-methyl37,5%+clorsulfuron 37,5%
10	Stomp Aqua+Helm star	2,9+0,015	Preem+Post S	pendimetalin455g/l+ Tribenuron-methyl 75%
11	Rival 75GD	0,020	Post S.	Clorsulfuron 75%
12	Attribut+ Helmstar	0,060+0,015	**Post S.**	Propoxycarbazone-sodium 700g/kg+ Tribenuron-methyl 75%

Postemergent early in autumn.
***Postemergent spring*
****Preemergent*

The experiment aimed to assess the selectivity of wheat plants and the effectiveness of herbicide treatments in controlling annual and perennial

monocotyledonous and dicotyledonous weeds. (Table 1)

Climate Data.

According to Köppen's classification, the north-western region of Transylvania falls under the Cfbx climatic province, characterized by a moderately temperate-continental climate with a slight subatlantic influence. The average annual temperatures vary between 8°C and 11.6°C. The sum of the useful temperatures, (>10°C) in the plain area ranges from 1200 to 1450°C. The multiannual average temperature recorded at the Livada station over the last 60 years is 9.9°C. The evolution of multiannual average monthly temperatures shows that January is the coldest month -2.1˚C, while July is the warmest 20.5˚C.

In Livada, the multiannual average precipitation over 60 years reaches 751.4 mm, with non-uniform and capricious distribution during the vegetation period.

The phenomenon of climate warming is manifesting in a continuous process, reaching an average value of 11.6°C in the years of experience, compared to the multiannual average of 9.9°C. The most significant temperature increases are recorded in the winter months, with positive differences compared to the multiannual averages of 3.0°C in December, 2.7°C in January, and 1.4°C in February.

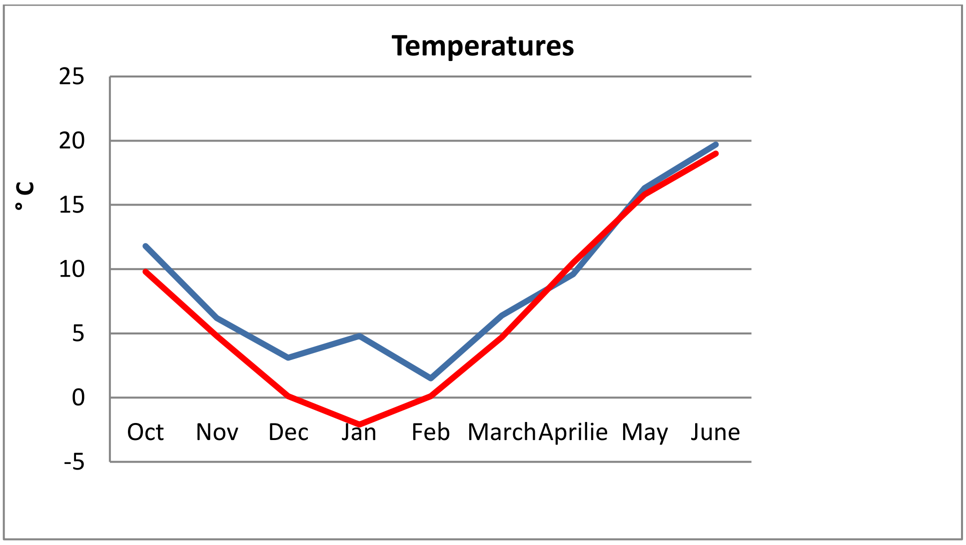

Figure 2. Annual and multiannual temperatures (ºC) recorded at the Livada Agricultural Research and Development Station

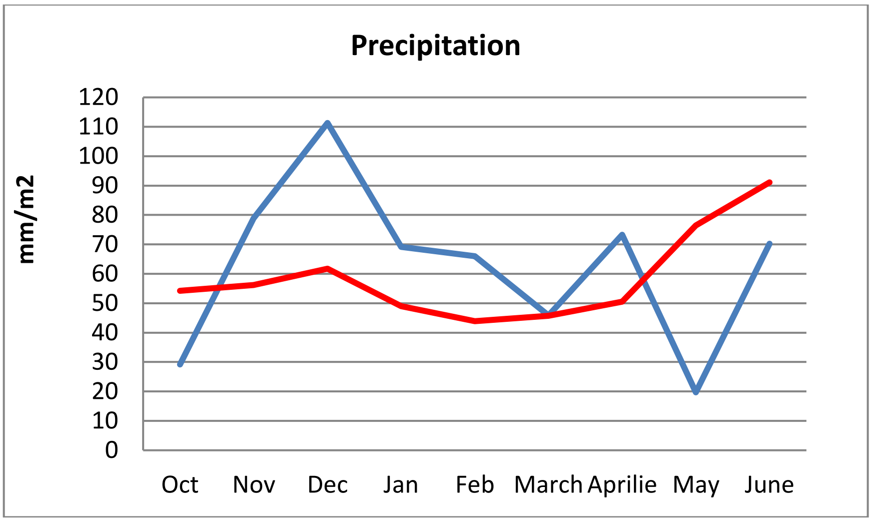

Figure 3. Annual and multiannual precipitation (mm) recorded at the Livada Agricultural Research and Development Station

Regarding precipitation, there is an increase in monthly irregularity with extreme manifestations of drought (May-August 2022) or excessive rainfall (September 2023). Over the period from September 2022 to June 2023, the total precipitation was 743.6 mm, compared to the multiannual average of 595.2 mm for the same period, with positive differences of +113.8 mm (September 2022) and +49.5 mm (December 2022).
The climate conditions during the years 2022-2023 recorded at the Livada

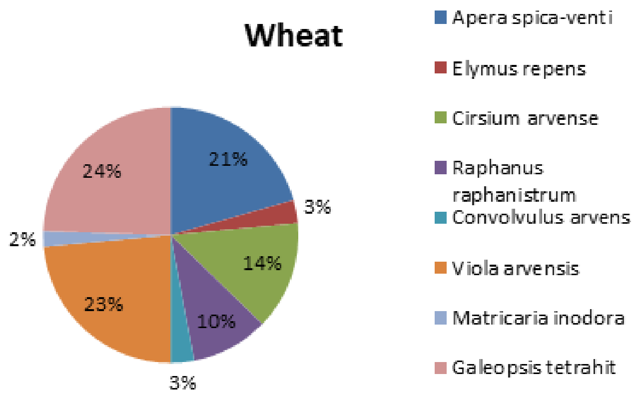

Figure 4. Frequency of dominant weed species present in the wheat crop -2023

RESULTS AND DISCUSSIONS

The selectivity of the tested herbicides towards wheat cultivation was assessed based on visual observations using the EWRS scale (scores ranging from 1 to 9; 1 = selective, 9 = phytotoxic) as shown in Table 2. The effectiveness of the herbicides was evaluated by counting the number of weeds per species per 1m² in each variant. Figure 3 presents the dominant weeds in the wheat crop.

The dominant weed species in wheat cultivation were: Apera spica-venti, Elymus repens, Cirsium arvense, Raphanus raphanistrum, Convolvulus arvensis, Viola arvensis, Matricaria inodora, and Galeopsis tetrahit (Figure 4) The effectiveness of the herbicides was calculated using the formula: Effectiveness = (Untreated weed density - Treated weed density) / Untreated weed density x 100.

The herbicide Bizon 1l/ha, applied both in autumn and spring, provided weed control ranging between 75-84%.

Good effectiveness was achieved in variants V5 and V6, treated with Trinity SC 2l/ha at different application timings (Post e. A. and Post S.).

Satisfactory results, with effectiveness between 75-79%, were obtained in variants V7 (Joystick, applied in autumn); V9 and V10 (Stomp Aqua + Rival Super Star, and Stomp Aqua + Helmstar, respectively, applied in pre-emergence and post-emergence in spring).

Less effective herbicides, with values ranging from 40 to 64%, were observed in variants V11 Rival 75 GD, V12 Attribut+Helmstar, and V8 Joystick, applied only in spring.

Table 2. Selectivity and effectiveness of herbicide treatments in the wheat crop - 2023.

No	Herbicides	Dosage l,kg/ha	Application timig	Selectivity EWRS scores	Effectiveness (%).
1	Untreated (Control)	-	-	-	-
2	Sekator Progres OD	0,15	Post S.**	1	69
3	Bizon	1	Post e. A.*	1	84
4	Bizon	1	Post S.	1	75
5	Trinity SC	2	Post e. A.	1	80
6	Trinity SC	2	Post S.	1	79
7	Joystick	0,2	Post e. A.	1	79
8	Joystick	0,2	Post S.	1	64
9	Stomp Aqua+Rival Super Star	2,9+0,015	Preem***+Post S	1	75
10	Stomp Aqua+Helmstar	2,9+0,015	Preem+Post S	1	75
11	Rival 75GD	0,020	Post S.	1	40
12	**Attribut+ Helmstar**	**0,060+0,015**	**Post S.**	**1**	51

Under the aspect of production, through variance analysis, a very significant positive influence is observed in the variants treated with the herbicides: Bizon 1l/ha, regardless of the application timing, Trinity SC 2l/ha applied at BBCH 10-13 in autumn, and the variant treated with Stomp Aqua 2.9l/ha + Helmstar 0.015kg/ha.

Noticeable significantly positive differences compared to the untreated control are observed in the variants treated with the following herbicides: Sekator Progres OD 0.150 kg/ha, Trinity SC 2l/ha applied in spring, Joystick 0.200 kg/ha applied in autumn at BBCH 10-13, and Stomp Aqua 2.9 l/ha + Rival Super Star 0.015 kg/ha.

Table 3. The influence of herbicide treatments on the production in the wheat crop – 2023

No	Herbicides	Dosage l,kg/ha	Application timig	Yield q/ha	The difference +/- compared to the untreated control	Semnification
1	Untreated (Control)	-	-	84,38	-	-
2	Sekator Progres OD	0,15	Post S.	92,76	8,38	XX
3	Bizon	1	Post e. A.	94,09	9,71	XXX
4	Bizon	1	Post S.	98,28	13,90	XXX
5	Trinity SC	2	Post e. A.	95,99	11,61	XXX
6	Trinity SC	2	Post S.	93,71	9,33	XX
7	Joystick	0,2	Post e. A.	92,00	7,62	XX
8	Joystick	0,2	Post S.	88,57	4,19	-
9	Stomp Aqua +Rival Super Star	2,9+ 0,015	Preem +Post P	91,62	7,24	XX
10	Stomp Aqua +Helmstar	2,9+ 0,015	Preem +Post P	94,09	9,71	XXX
11	Rival 75GD	0,020	Post S.	88,38	4,00	-
12	Attribut+ Helmstar	0,060+0,015	Post S.	89,52	5,14	-

CL 5% = 5,27 q/ha 1% = 7,18 q/ha 0,1% = 9,64 q/ha

Table 4 The influence of herbicide treatments on TGW

No	Herbicides	Dosage l,kg/ha	Application timig	TGW	The difference +/- compared to the untreated control	Semnification
1	Netratat	-	-	40,27	-	-
2	Sekator Progres OD	0,15	Post S.	40,40	0,13	-
3	Bizon	1	Post e. A.	40,07	-0,20	-
4	Bizon	1	Post S.	40,87	0,60	xxx
5	Trinity SC	2	Post e. A.	40,13	-0,14	-
6	Trinity SC	2	Post S.	41,00	0,73	xxx
7	Joystick	0,2	Post e. A.	40,40	0,13	-
8	Joystick	0,2	Post S.	40,53	0,26	-
9	Stomp Aqua+Rival Super Star	2,9+0,015	Preem+Post P	41,20	0,93	xxx
10	Stomp Aqua+Helmstar	2,9+0,015	Preem+Post P	40,20	0,07	-
11	Rival 75GD	0,020	Post S.	40,27	0,00	-
12	**Attribut+ Helmstar**	**0,060+0,015**	Post S.	**40,73**	**0,46**	**xx**

CL 5% = 0,27g; CL 1% = 0,36g; CL 0,1% = 0,49g;

The effectiveness of herbicides in early weed competition removal is also expressed through the quality characteristics of the main production, specifically in terms of MMB (main marketable bulk). From Table 4, it is evident that the treatments in the variants treated with the herbicides Bizon 1l/ha and Trinity SC 2l/ha applied in post-emergence in the spring, as well as Stomp Aqua 2,9l/ha + Rival Super Star 0,015 kg/ha

applied in pre-emergence + post-emergence in the spring, have a very significant positive influence. There were significantly positive distinct differences observed in the variant treated with the herbicides Attribut 0,060 kg/ha + Helmstar 0,015 kg/ha.

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herbicides Attribut 0,060 kg/ha + Helmstar 0,015 kg/ha.

CONCLUSIONS

The research was conducted during the agricultural year 2022-2023 at the Livada Agricultural Research and Development Station, Satu-Mare County, on autumn wheat crop. The experiment was carried out using the randomized block method, with herbicide application during autumn (BBCH 10-13) and spring (BBCH 30-32).

The dominant weed species in the wheat crop on stagnogleized preluvosol are: Apera spica-venti, Elymus repens, Cirsium arvense, Raphanus raphanistrum, Convolvulus arvensis, Viola arvensis, Matricaria inodora, and Galeopsis tetrahit.

The applied herbicides demonstrated excellent selectivity and effectiveness in the autumn wheat crop. The best effectiveness was achieved in variants treated with Bizon 1l/ha applied in both autumn and spring, Trinity SC 2l/ha at different application timings, and Joystick 200g/ha applied in autumn. Very significantly positive yield differences were obtained in variants treated with: Bizon 1l/ha, regardless of the application timing,

Trinity SC 2l/ha applied in autumn, and the variant treated with Stomp Aqua 2.9l/ha + Helmstar 0.015kg/ha. Distinctly significant positive differences compared to the untreated control were observed in variants treated with: Sekator Progres OD 0.150 kg/ha, Trinity SC 2l/ha applied in spring, Joystick 0.200 kg/ha applied in autumn, and Stomp Aqua 2.9 l/ha + Rival Super Star 0.015 kg/ha.

The analysis of MMB (Thousand Grain Weight) shows highly significant positive differences in the variants treated with the herbicides Bizon 1l/ha, Trinity SC 2l/ha, Stomp Aqua 2,9l/ha + Rival Super Star 0,015 kg/ha, and distinctly significant differences in the variants treated with the herbicides Attribut 0,060kg/ha + Helmstar 0,015 kg/ha compared to the control group in the experiment.

Regardless of the applied herbicides, each herbicide showed a positive difference compared to the untreated control, indicating that herbicide application in wheat cultivation is an important technological link.

Farmers have the possibility, based on these results, to establish the most effective and efficient methods for weed control in autumn wheat cultivation.

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