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BROMUS SECALINUS L. (RYE BROME) – AN UNWANTED WEED IN THE WINTER WHEAT CROPS

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Abstract. *The species Bromus secalinus L. (rye broom) is a dangerous, hibernating annual grass weed that infests rye (Secale cereale), winter wheat (Triticum aestivum) and other cereal crops. The present study aims to identify chemical variants for controlling the species Bromus secalinus L. in winter wheat crops, by using a diversified range of post-emergent herbicides, approved for this crop. Research on the chemical control of the species Bromus secalinus (rye broom) was carried out during 2022 and 2023, in an experimental field located in the locality of Peciu Nou, Timiș County. The variants (5 + 1 untreated control variant), each in 4 repetitions, were represented by 5 herbicides approved in Romania for the control of monocotyledonous weeds in wheat crops, at the time of the research. The experimental variants were the following: V1 - control (non-herbicide); V2-Atlantis Flex WG (mesosulfuron-methyl 45 g/kg + propoxycarbazone - sodium 67.5 g/kg + mefenpyr-diethyl (safener) 90 g/kg) - 0.3 kg/ha; V3-Axial One EC (pinoxaden 45 g/l + florasulam 5 g/l + cloquintocet-mexil 11.25 g/l) - 1 l/ha; V4-Herbos 110 EC (fenoxaprop-P-ethyl 110 g/l) - 0.7 l/ha; V5-Hussar Activ Plus OD (iodosulfuron-methyl-Na 10 g/l + 2.4 D (2-ethylhexyl ester) 300 g/l + thiencarbazone-methyl 7.5 g/l, mefenpyr diethyl (safener) 30 g/l) - 1 l/ha; V6-Senior (piroxsulam 7.5 % + cloquintocet-methyl (adjuvant) 7.5 %) 250 g/ha + 1 l/ha Dasoil (adjuvant) – 0.25 kg/ha. We detected 15 segetal species in the field, of which, the species addressed in the study - Bromus secalinus L. (popularly called rye brome), had a share of 24.3 % (i.e. 33.8 plants/m2). The Senior herbicide (piroxsulam 7.5% + cloquintocet-methyl (adjuvant) 7.5%) 250 g/ha + 1 l/ha Dasoil), at a dose of 0.25 kg/ha, almost completely controlled grass weeds, including Bromus secalinus (98.1%), but also the other weeds present (85.9%). The maximum production (6628 kg/ha) was also obtained in this variant.*

Key words: *rye brome, weeds, herbicides, winter wheat crops*

INTRODUCTION

The high share of cereal crops in the current structure of agriculture in Romania, but also the frequent use of the same types of herbicides (especially anti-dicotyledonous), have led to a change in the proportions between the segetal species, monocotyledons often becoming predominant; of these, the most dangerous are: *Apera spica-venti* (windgrass), *Avena fatua* (odusul) and *Bromus secalinus* (rye brome). Of these, the species *Bromus secalinus* has begun, in recent years, to become one of the grass species considered problematic in straw cereal crops, i.e. it causes direct and large damage to production, has a high resistance to agrotechnical and chemical control measures, and through its number or rapacity reduces the positive effect of some technological production factors [2,4,7].

The origin, characterization and spread of the species. *Bromus secalinus* L. is a dangerous, hibernating annual grass weed that infests rye (*Secale cereale*), winter wheat (*Triticum aestivum*) and other cereal crops. Since its life cycle coincides closely with that of the cereal crop it infests, it can become a major contaminant of cereal seeds for sowing at harvest. Originally from Eurasia, it was most likely spread through contaminated grain shipments to North America, Australia and elsewhere (figure 1.) [17,18].

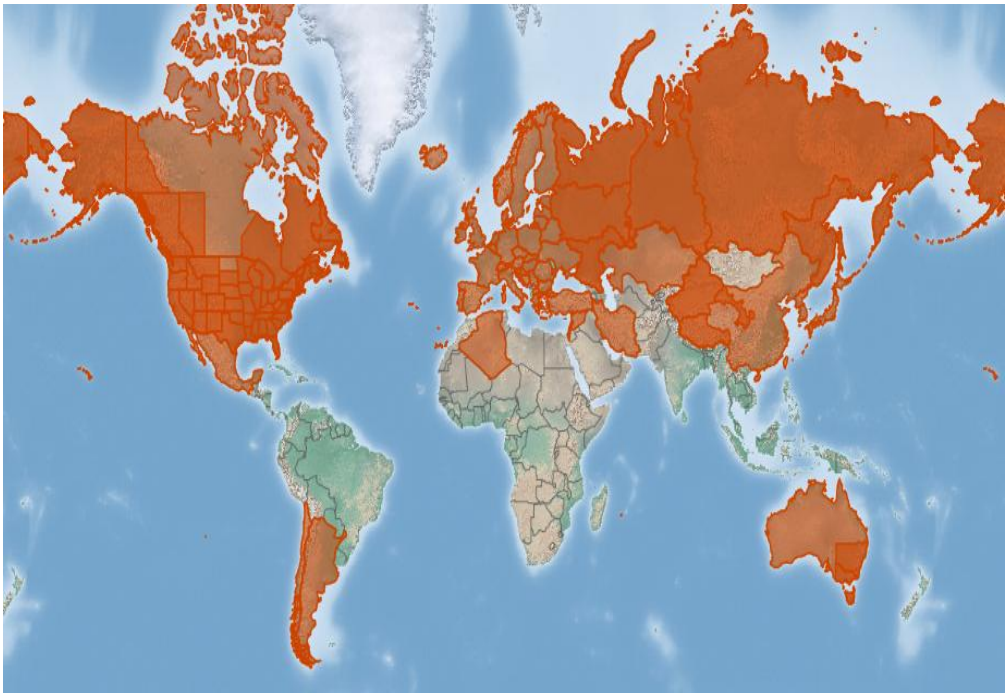

Figure 1. Distribution of the species *Bromus secalinus* L. around the world (https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.10034)

The mature plant of *Bromus secalinus* L. has a fasciculate root and a stem of 40-90-110 cm, yellow-green, smooth. The leaves have glabrous sheaths with the opening in the shape of the letter V. The blade is glabrous or hairy, on the edges always short hairy. The ligule is shortly cut and fringed. The inflorescence is the panicle, at first erect, then slightly pendulous. The spikelets are ovoid, or oblong-ovoid, compressed, 2-2.5 cm long, yellowish-green or brown. The glumes are unequal, hairy, the lower one lanceolate, sharp, 5-8 mm long and with 5-7 veins. The spikelets contain 5-11-17 flowers, with unequal blades, the lower one longer, 8-11 mm, lanceolate-ovate, serrate, with the edges twisted after flowering, with aristes 0.5-8 mm long. The caryopsis is ovate-elongate, 6-7 mm, brown, provided with a tuft of bristles at the base, enclosed in hard, twisted palae (figure 2) [2,5].

One plant produces up to 1,400 caryopses. The seeds germinate in autumn, staggered in the soil, up to a depth of 12 cm. [2.5]. Flour obtained from wheat mixed with rye bran becomes blackish, with a specific taste, practically unusable. Consumed bread causes gastric disturbances, is difficult to digest and produces dizziness in humans and animals [19].

Prevention of the spread and control of the segetal species *Bromus secalinus* L. The techniques for controlling the weed *Bromus secalinus* are limited, with the emphasis being on its control in cereal crops, especially wheat. With its panicles, rye brome outgrows the strawy cereals it infests, so that weed hotspots can be easily located and the degree of infestation of crops with this weed can be easily assessed. The biological cycle of the species *Bromus secalinus* is based on the seed as the basic unit of the species, the objective of control being to reduce the number of seeds that reach the soil, by destroying the weed before fruiting,

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limiting the competitive effect of the weed with crop plants, while reducing its seed reserve in the soil, reducing the possibility of infesting wheat fields in future years [11,12,15].

Figure 2. *Bromus secalinus L.*- rye brome
(https://www.knowyourweeds.com/uz/weeds/Bromus_secalinus#&gid=1&pid=)

Rye brome has been a very common and dominant weed of cereal crops in the past, even since prehistoric times; for example, an archaeological discovery of a 17th-century batch of rye grain in Europe consisted of 12% *B. secalinus* seed [16]. Controlling rye brome plants growing on fallow land before they produce seed can prevent spread to grain fields. All agricultural equipment to be used in wheat fields should be thoroughly cleaned to prevent seed transfer. Delaying the sowing of wheat until after the germination of rye brome allows the destruction of the seedlings with tillage or herbicides. Deep ploughing can effectively bury *Bromus* seeds [11, 12].

However, chemical control of weeds, including *B. secalinus*, remains the most widely used method in intensive agriculture. The use of herbicides with different modes of action is important to prevent the development of herbicide resistance in weed species. Resistance of *B. secalinus* biotypes in wheat crops to several group 2 herbicides (imazamox, propoxycarbazone-sodium, pyroxsulam, and sulfosulfuron) has already been reported in Kansas and Oklahoma [6].

Synowiec and Kalemba (2015) reported that the essential oil distilled from the seeds of *Heracleum sosnowskyi* has the potential to be used as a natural herbicide against maize weeds; even a relatively low dose of 0.2 g/liter caused a significant reduction in germination

and plant growth of *B. secalinus* [13].

MATERIAL AND METHOD

Research on the chemical control of the species *Bromus secalinus* (rye broom) was carried out during 2023 and 2024, in an experimental field located in the locality of Peciu Nou, Timiş County. The variants (5 + 1 untreated control variant), each in 4 repetitions, were represented by 5 herbicides approved in Romania for the control of monocotyledonous weeds in wheat crops, at the time of the research. The doses of herbicides applied in the experimental variants were those recommended by the producing companies. The precursor plant was corn.

The experimental variants were the following:

V_1 - control (unherbicided); V_2-Atlantis Flex WG (mesosulfuron-methyl 45 g/kg + propoxycarbazone - sodium 67.5 g/kg + mefenpyr-diethyl (safener) 90 g/kg) – 0.3 kg/ha; V_3-Axial One EC (pinoxaden 45 g/l + florasulam 5g/l + cloquintocet-mexil 11.25 g/l) - 1 l/ha; V_4-Herbos 110 EC (fenoxaprop-P-ethyl 110 g/l) – 0.7 l/ha; V_5-Hussar Activ Plus OD (iodosulfuron-methyl-Na 10 g/l + 2.4 D (2-ethylhexyl ester) 300 g/l + thiencarbazone-methyl 7.5 g/l, mefenpyr diethyl (safener) 30 g/l) - 1 l/ha; V_6-Senior (piroxsulam 7.5% + cloquintocet-methyl (adjuvant) 7.5%) 250 g/ha + 1 l/ha Dasoil (adjuvant) – 0.25 kg/ha.

Post-emergent herbicides were applied in the spring, when the wheat plants were in the twinning phase, until the first internode was formed. During this period, the rye brome plants were in the 2-4 leaf stage, before twinning, and the dicotyledonous weeds were in the "rosette" stage (2-4 leaves). Before the herbicide treatments, the initial weediness degree of the winter wheat was assessed by numerical mapping, and after approximately 15 days, the effectiveness of the different herbicides in reducing the total weediness and with *Bromus secalinus* L. was assessed, also by numerical mapping of the weeds. In each experimental variant, 5 determinations were made using the metric frame with a side of 0.5 x 0.5 m (area of 0.25 m2).

For each plot/experimental variant, a "Weed Sheet" was prepared based on data from the 5 primary weed mapping sheets (one for each survey). The plot weed sheet included the following columns: current number, weed species, phenophase and size of the weed species, number of individuals/m^2, sum (of all individuals from the 5 determinations), average (of individuals of the same species), participation (p%), constancy (k%), class and lifespan [4].

RESULTS AND DISCUSSIONS

Primary assessment of weed presence in the winter wheat crop

The climatic peculiarities observed in 2023 and 2024 led to a very diverse and abundant weeding of the winter wheat crop, namely 139 weeds/m^2. We detected 15 segetal species in the field, of which, the species addressed in the study - *Bromus secalinus* L. (popularly called rye brome), had a share of 24.3% (i.e. 33.8 plants/m^2), spread relatively evenly throughout the entire area of the experiment. By far, the most common were the annual dicotyledonous weed species, numbering 9 out of the 15 identified, i.e. 87.2 weed plants/m^2, out of a total of 139, i.e. 62.7%. These were as follows: *Fallopia convolvulus* (black-bindweed or wild buckwheat), *Stellaria media* (common chickweed), *Veronica arvensis* (common speedwell), *Galiopsis tetrahit* (common hemp-nettle), *Galium aparine* (stickywilly), *Polygonum aviculare* (common knotgrass or birdweed), *Fumaria officinalis* (fumitory, drug fumitory or earth smoke), *Papaver dubium* (long head poppy) and *Consolida regalis* (branching larkspur) (table 1 and figure 3.).

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A much less consistent presence was seen in perennial dicotyledons, both in terms of number of species (3) and cumulative weight (only 4.3 %): *Cirsium arvense* (Canadian thistle, creeping thistle) – 2.2 plants/m^2, *Rubus caesius* (European dewberry) – 1.2 plants/m^2 and *Convolvulus arvensis* (field bindweed) -2.4 plants/m^2, (table 1 and 2).

Table 1

Initial weed mapping in winter wheat crop (average values 2023/2024)

Nr. Crt.	Species	Phenophase/ Waist	Amount 5/survey (S)	Average (bur./m^2)	P (%)	k (%)	Class/ Lifetime
1	*Bromus secalinus*	A 8	169	33.8	24.3	100	M.a.
2	*Fallopia convolvulus*	A 3	82	16.4	11.7	100	D.a.
3	*Stellaria media*	B 4	73	14.6	10.5	100	D.a.
4	*Veronica arvensis*	B 5	59	11.8	8.6	100	D.a.
5	*Galeopsis tetrahit*	A 9	55	11.2	8.1	100	D.a.
6	*Galium aparine*	A 8	48	9.6	6.9	100	D.a.
7	*Avena fatua*	A 9	43	8.6	6.2	80	M.a.
8	*Polygonum aviculare*	A 4	41	8.2	6.0	100	D.a.
9	*Fumaria officinalis*	A 3	36	7.2	5.1	60	D.a.
10	*Papaver dubium*	A/B 11	31	6.2	4.3	80	D.a.
11	*Elymus repens*	A8	23	4.6	2.5	40	M.p.
12	*Convolvulus arvensis*	A 4	12	2.4	1.8	80	D.p.
13	*Cirsium arvense*	A 11	8	2.2	1.7	60	D.p.
14	*Consolida regalis*	A 4	12	2.0	1.5	40	D.a.
15	*Rubus caesius*	A 8	9	1.2	0.8	40	D.p.
	Total	-	695	139	100,0	-	-

Figure 3. The initial weeding of the winter wheat experience (average values 2023/2024)

Among the monocotyledons, the annual species *Avena fatua* L. (common wild oat) caught our attention, which, although not very numerous (8.6 plants/m^2), was relatively evenly spread over the field, with a constancy of 80% (in fact, it was present in 4 out of the 5 control points). It should be noted that from the same botanical category we sporadically encountered other species of *Bromus*: *Bromus tectorum* (downy brome, drooping brome or cheatgrass), *Bromus arvensis* (field brome) and *Bromus sterilis* (barren brome, poverty brome, and sterile brome), but these are confined, for now, to the areas at the edges of the plots cultivated with wheat. It is at least important to point out the relatively frequent presence (approximately 4.6 plants/m^2) in the wheat field of a perennial monocotyledonous species - couch grass or creeping wild rye (*Elymus repens* L.), difficult to remove from cereal crops (table 1 and 2).

It is easily visible that of all the segetal species in the wheat field, 7 species (*Bromus secalinus*, *Fallopia convolvulus*, *Galium aparine*, *Galiopsis tetrahit*, *Polygonum aviculare*, *Stellaria media* and *Veronica arvensis*) had a constancy of 100 %, being found, more or less numerous, in all 5 evaluation points in each plot (table 2).

Table 2

Distribution by botanical class of weeds initially present in the wheat crop (average values 2023/2024)

Botanical class and life period	Number of species/class	Botanical class frequency (plants/m^2)	Botanical class constancy (%)	The share of the botanical class (%)
Dicotyledons (broad-leaved) annuals	9	87.2	84.4	62.7
Dicotyledonous (broad-leaved) perennials	3	5.8	60.0	4.3
Monocotyledons (narrow-leaved) annuals	2	42.4	90.0	30.5
Monocotyledonous (narrow-leaved) perennials	1	4.6	40.0	2.5

Weed control in winter wheat crops.

The herbicides tested in the experiment affected the degree of weeding in various ways, depending on the range of control of the active substances contained in the products. Thus, in the V_2- Atlantis Flex WG variant (mesosulfuron-methyl 45 g/kg + propoxycarbazone - sodium 67.5 g/kg + mefenpyr-diethyl (safener) 90 g/kg) - 0.3 kg/ha, plants belonging to the species of the *Poaceae* family, including *Bromus secalinus*, were almost completely eliminated (over 92.5 %). However, against the background of a rather limited control of the broad-leaved species, predominant in the crop, the overall efficacy was unsatisfactory (35.9 %) (table 3).

Some herbicides, such as Axial One 050 EC8 (pinoxaden 45 g/l + florasulam 5 g/l + cloquintocet-mexil 11.25 g/l) clearly affected the number of grass weeds, annual or perennial, but these being only 2 (*Avena fatua* and *Elymus repens*) and with a total weight of only 8.7%, the effects at a general level were modest, this also in the context in which the herbicide in this variant (V_3) had no visible effect on the plants of the target species - *Bromus secalinus*, very numerous (33.8 plants/m^2). On the other hand, it acted well on several dicotyledonous species, but overall, it reduced wheat weeding by only 61.2% (table 3).

The herbicide Herbos 110 EC (fenoxaprop-P-ethyl 110 g/l (0.7 l/ha) (V4), although a dedicated graminicide, did not affect rye brome (*Bromus secalinus*), but affected the other 2 graminaceous and several dicotyledonous weed species; therefore, the total percentage of weed elimination, in the variants treated with this product, had a total unsatisfactory level of only 21.6%. For this reason, we do not recommend opting for this product in wheat crops with a

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high risk of invasion by Bromus ssp. However, it is advisable to apply it in combination with an herbicide for the control of dicotyledonous weed species (table 3).

Hussar Activ Plus OD (iodosulfuron-methyl-Na 10 g/l + 2.4 D (2-ethylhexyl ester) 300 g/l + thiencarbazone-methyl 7.5 g/l, mefenpyr diethyl 30 g/l), 1 l/ha, was administered in variant V_5. Here, we could appreciate a very good control of narrow-leaved weeds, but also of numerous dicotyledonous species (overall, 81.7%). But, unfortunately, they did not affect in any way the species in question - (*Bromus secalinus* L.), which is why it does not constitute a viable technological solution for wheat crops with obsiga (table 3).

Finally, in the last variant (V_6) we tried the herbicide Senior (piroxsulam 7.5% + cloquintocet-methyl (adjuvant) 7.5%) 250 g/ha + 1 l/ha Dasoil), at a dose of 0.25 kg/ha. We noticed, by far, the cleanest plots, in all 4 repetitions. The explanation for this state is, on the one hand, the almost complete control of segetal weeds, including *Bromus secalinus* (98.1), and on the other hand, we could appreciate a very good control of numerous broadleaf weeds initially found in wheat. Therefore, in this variant of the experiment, the most effective overall weed control was achieved (85.9%) (table 3.).

As a conclusion of the study carried out, we find that of the 5 tested herbicides, (all, first of all, dedicated graminicides), only two: Atlantis Flex WG (mesosulfuron-methyl 45 g/kg + propoxycarbazone - sodium 67.5 g/kg + mefenpyr -diethyl (safener) 90 g/kg) - 0.3 kg/ha and Senior (piroxsulam 7.5% + cloquintocet-methyl (adjuvant) 7.5 %) 250 g/ha + 1 l/ha Dasoil (adjuvant) had the ability to almost completely eliminate the *Bromus secalinus* L. species (rye brome) (table 3).

Table 3

The efficiency of graminicidal herbicides used in winter wheat crop
(average values 2023/2024)

Herbicide variant/dose	Composition (a.s.)	Herbicide effectiveness (%)	
		General	*Bromus secalinus* L.
V_1 – control (unherbicided)	-	0.0	0.0
V_2- Atlantis Flex WG (0.3 kg/ha)	mesosulfuron-metil 45 g/k + propoxicarbazon-sodiu 67.5 g/kg + mefenpir-dietil 90 g/kg	35.9	92.5
V_3- Axial One 050 EC (1 l/ha)	pinoxaden 45 g/l + florasulam 5 g/l + cloquintocet-mexil 11.25 g/l	61.2	0
V_4- Herbos 110 EC (0.7 l/ha)	fenoxaprop-P-etil 110 g/l	21.6	0
V_5- Hussar Activ Plus OD (1 l/ha)	iodosulfuron-metil-Na 10 g/l + 2.4 D (2-etilhexil ester) 300 g/l + tiencarbazon-metil 7.5 g/l, mefenpir dietil 30 g/l	81.7	0
V_6- Senior (0.25 kg/ha)	piroxsulam 7.5 % + cloquintocet-metil (adjuvant) 7.5 %) 250 g/ha + 1 l/ha Dasoil (adjuvant)	85.9	98.1

The results obtained show that in straw cereal crops where problematic monocotyledonous segetal species are present, but also a large number of dicotyledonous species, the combined application (if compatible) of at least two active substances with mutually complementary control spectra is required.

In order to have a medium and long-term control of *Bromus* species, it is recommended the approach of a complex of integrated control measures, in which the use of

herbicides is supported by a rational crop rotation, the timely performance of soil work and harvesting, but also the use of only seeds free of caryopsis of obsiga.

Taking into consideration the effect of herbicides on wheat plants, repeated observations showed that all five tested herbicides were very well tolerated by the wheat crop cultivated in the experiment, without visible phytotoxic effects.

Achieved production results

The climatic conditions of the two years influenced the level of wheat production obtained in the experimental plots, the field average being 5287.8 kg/ha. Overall, a close positive correlation could be established between the efficacy of the herbicides tested in the field and the level of wheat production obtained (table 4).

The highest wheat production obtained, on average over the two years, was recorded in the V_6 variant, where we tried the Senior herbicide (piroxsulam 7.5% + cloquintocet-methyl (adjuvant) 7.5%) 250 g/ha + 1 l/ha Dasoil), in a dose of 0.25 kg/ha, moreover, the most weed-free version, in all 4 repetitions; specifically, the wheat production (STAS grains) was 6628 kg/ha, with a yield increase of 1340.2 kg/ha, estimated to be very significantly positive compared to the field average.

The herbicide product Hussar Activ Plus OD (iodosulfuron-methyl-Na 10 g/l + 2.4 D (2-ethylhexyl ester) 300 g/l + thiencarbazone-methyl 7.5 g/l, mefenpyr diethyl 30 g/l), at a dose of 1 l/ha, administered in variant V_5, led to a difference of + 1340.2 kg/ha, very significantly positive compared to the field average (table 4 and figure 6).

The herbicide in variant V_3 - Axial One 050 EC8 (pinoxaden 45 g/l + florasulam 5 g/l + cloquintocet-mexil 11.25 g/), although it clearly reduced the general weediness of wheat (by 61.2%), resulted in a production increase of only 548.2 kg/ha, considered, however, significant compared to the calculated field average (table 4).

Table 4

Production obtained from winter wheat crop
(average values 2023/2024)

Herbicide (variant)	Dose	Absolute production (kg/ha)	Relative production (%)	Production difference (kg/ha)	Signifi. dif.
V_6 - Senior	0.25 kg/ha	6628	125.4	+ 1340.2	XXX
V_5 - Hussar Activ Plus OD	1 l/ha	6349	120.1	+ 1340.2	XXX
V_3 - Axial One 050 EC	1 l/ha	5836	110.4	+ 548.2	X
Average	-	5287.8	100,0	0,00	Mt.
V_2 - Atlantis Flex WG	0.3 kg/ha	4607	87.1	- 680.8	00
V_4 - Herbos 110 EC	0.7 l/ha	4324	81.8	- 963.8	000
v_1- control (unherbicided)	-	3983	75.3	- 1304.8	000

$DL_{5\%}$ = 498 kg/ha $DL_{1\%}$ = 659 kg/ha $DL_{0.1\%}$ = 827 kg/ha

The herbicide product Hussar Activ Plus OD (iodosulfuron-methyl-Na 10 g/l + 2.4 D (2-ethylhexyl ester) 300 g/l + thiencarbazone-methyl 7.5 g/l, mefenpyr diethyl 30 g/l), at a dose of 1 l/ha, administered in variant V_5, led to a difference of +1340.2 kg/ha, very significantly positive compared to the field average (table 4 and figure 6.).

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61.2%), resulted in a production increase of only 548.2 kg/ha, considered, however, significant compared to the calculated field average (table 4 and figure 6.).

The lowest production (4324 kg/ha) among the herbicide variants (explainable against the background of a generally unsatisfactory level of weed removal, of only 21.6%), was recorded in variant V4, treated with Herbos 110 EC (fenoxaprop-P-ethyl 110 g/l (0.7 l/ha), with 963.8 kg/ha less compared to the variant considered as the control (field average).

The minimum production was recorded, as expected, in the non-herbicide variant (V_1), from which only 3983 kg/ha were harvested.

CONCLUSIONS

- ✓ *Bromus secalinus, L.* (rye broom) is an annual autumn grass species, which has relatively recently (in the last 5-6 years) passed from the status of ruderal weed to that of segetal weed, with the prospect of becoming, in a short time, a problem in straw cereals (accentuated also by the predominant use of herbicides to combat broadleaf weeds);
- ✓ At the initial assessment regarding the presence of different segetal species, 15 main weeds contributed (of which 9 were dicots, broad-leaved, annuals), which, in different proportions, led to an average weeding of 139 weeds/ m^2. The species taken for observation - *Bromus secalinus* L. (rye brome) had a consistent weight of 24.3%, specifically 33.8 plants/m^2;
- ✓ Taking into consideration the effect of herbicides on wheat plants, repeated observations showed that all five herbicides under study were very well tolerated by the wheat crop grown in the experiment, without quantifiable phytotoxic effects;
- ✓ Of the 5 monitored herbicides, (all primarily dedicated graminicides), only two: Atlantis Flex WG (mesosulfuron-methyl 45 g/kg + propoxycarbazone - sodium 67.5 g/kg + mefenpyr-diethyl (safener) 90 g /kg) - 0.3 kg/ha and Senior (piroxsulam 7.5% + cloquintocet-methyl (adjuvant) 7.5% 250 g/ha + 1 l/ha Dasoil (adjuvant) had the ability to almost completely eliminate the species Bromus secalinus L. (rye brome);
- ✓ The results obtained show that in grassy cereal crops where problematic monocotyledonous straw species are present, but also a large number of dicotyledonous species, the combined application (if compatible) of at least two active substances with mutually complementary control spectra is required;
- ✓ The weed mapping procedure (choosing one of the known methods) is, practically, an indispensable step in the inspired choice of herbicides or the combination of herbicides that we intend to apply;
- ✓ In order to have a medium and long-term control of *Bromus species*, it is recommended the approach of a complex of integrated control measures in which the use of herbicides is supported by a rational crop rotation, the timely performance of soil work and harvesting, but also the use when sowing only the free seeds of rye brome caryopsis.

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