

RESEARCH ON THE CONTROL OF THE SPECIES *AMBROSIA
ARTEMISIIFOLIA* IN THE SUNFLOWER CULTURE
IN THE NORTH-WEST AREA OF ROMANIA

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Keywords: *sunflower, Ambrosia artemisiifolia, herbicid efficacy, herbicid selectivity, production*

ABSTRACT

The primary objective of this research was to determine the most suitable herbicides, the most effective doses, and the optimal timing for the control of ragweed in sunflower crops. In 2024, an experiment was conducted at the Livada Agricultural Development Research Station, using the randomized block method with 10 variants in 3 repetitions, on an albic Luvisol soil with a pH of 5.1, a clay content of 20.9%, and a humus content of 1.8%.

INTRODUCTION

Ambrosia, known in Greek mythology as the "food of the gods" and described as "sweet earth and honey," is far from being a friendly plant in reality. Scientifically named *Ambrosia artemisiifolia*, this species of North American origin and has been present in Europe since 1860. It is primarily known for causing allergies, commonly referred to as "hay fever" by many residents.

This plant is an invasive species that has spread across many areas, and its harmful effects, particularly through the large amounts of pollen it releases, have led to a significant increase in the number of people experiencing asthmatic reactions or severe allergic symptoms.

Ambrosia artemisiifolia is an annual plant, 50–150 cm tall, with a strongly branched stem covered in soft hairs, and reddish or brownish-green in color. The leaves are deeply divided into linear segments and are covered with fine hairs, especially on the lower side. The flowers are unisexual, and the inflorescences bear only one type of flower, either male or female. The fruit is ovoid, hard, dark-colored, and has 5–7 spiny teeth, containing a single seed.

It is commonly found on railway embankments, road sides, and unkempt land in both urban and rural environments. Currently, this species is increasing by invading agricultural crops such as sunflower, soybean, and corn, as well as vineyards and semi-natural habitats.

It easily adapts and can form communities that compete with native species.

MATERIAL AND METHODS

The research was conducted under the pedoclimatic conditions at SCDA Livada, Satu Mare County, in 2024, on an albic luvisol with a pH of 5.1, a clay content of 20.9%, and a humus content of 1.8%. The primary focus of this experiment was the use of the herbicides Challenge 600 SC and Viballa, and their tolerance on three sunflower hybrids.

To achieve this objective, the herbicide Challenge 600 SC was applied to each type of cultivar (conventional, Clearfield, and Express) at a dose of 4 L/ha, in combination with the herbicide Dual Gold at 1.5 L/ha, applied pre-emergence.

The herbicide Viballa was applied to the same hybrids at a dose of 1 L/ha, in combination with Leopard at 1.5 L/ha, applied post-emergence. In addition to the Challenge 600 SC and Viballa, well-known herbicides were also applied to the three sunflower hybrids (Racer, Pulsar 40, and Helmstar) in the experiment to compare their effectiveness against Challenge 600 SC and Viballa (Table 1).

The herbicide application schedule is presented in table 1

Table 1.

Herbicides applied to the sunflower crop 2024

No	Hybrid	Herbicides	Quantity, kg/ha	The active substance
1	Expres	Control	-	-
2	Conventionally	Challenge 600 SC+ Dual Gold	4+1,5	aclonifen 600g/l + S-metolaclo 960g/l
3	Clearfield	Challenge 600 SC+ Dual Gold	4+1,5	aclonifen 600g/l + S-metolaclo 960g/l
4	Expres	Challenge 600 SC+ Dual Gold	4+1,5	aclonifen 600g/l + S-metolaclo 960g/l
5	Conventionally	Viballa+ Leopard 5EC	1+1,5	halauxifen-metil + quizalofop-P-etil 50 g/l
6	Clearfield	Viballa+ Leopard 5EC	1+1,5	halauxifen-metil + quizalofop-P-etil 50 g/l
7	Expres	Viballa+ Leopard 5EC	1+1,5	halauxifen-metil + quizalofop-P-etil 50 g/l
8	Conventionally	Dual Gold + Racer	1,5+2	S-metolaclo 960g/l + flurocloridon 250 g/l
9	Clearfield	Dual Gold + Pulsar 40	1,5+1,2	S-metolaclo 960g/l + imazamox 40 g/l
10	Expres	Dual Gold + Helmstar	1,5+0,020	S-metolaclo 960g/l + tribenuron metil 75 %

Climatic elements of the area:

The average multiannual temperature recorded at the Livada weather station over the last 60 years is 9.9°C.

At Livada, the multiannual average rain fall over 60 years is 751.4 mm, with an un even and unpredictable distribution during the growing season.

An analysis of the climate data reveals a significant precipitation deficit throughout the 2024 growing season, with notable differences from the multiannual average, particularly in February, March, April, May, July, and August. This deficit primarily affected production, leading to decreased yields, especially in spring crops (Figure 2).

In parallel with the rainfall deficit during the mentioned period, temperatures increased in each month compared to the multiannual average, with positive deviations ranging from 1.6°C in May to 7.4°C in February (Figure 1).

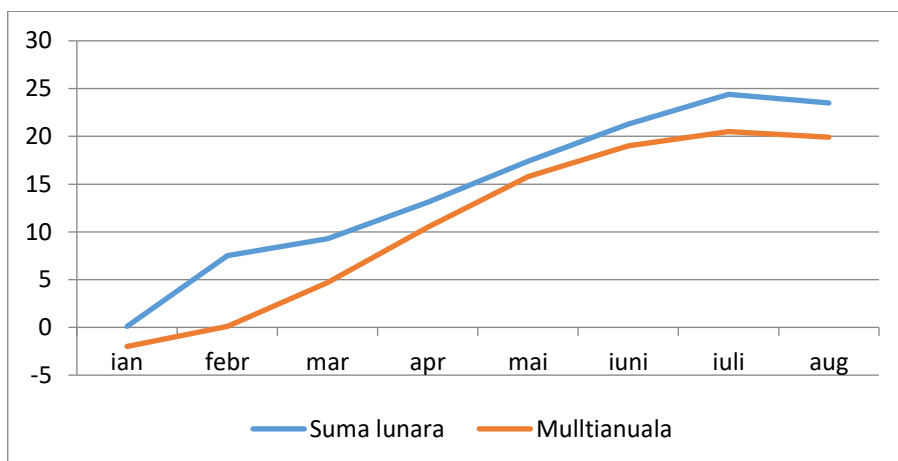


Figure 1. Monthly temperatures (°C) recorded at ARDS Livada 2024

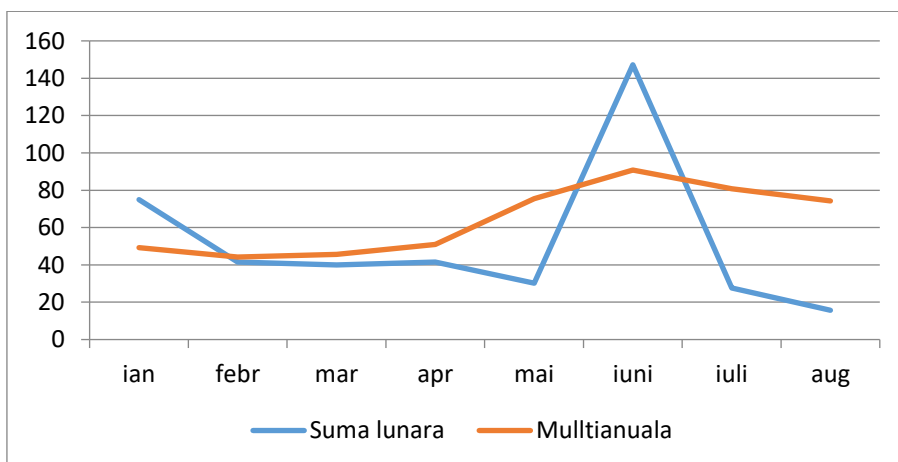


Figure 2 Monthly precipitation (mm) recorded at SCDA Livada 2024

RESULTS AND DISCUSSION

During the growing season, observations were made following treatment regarding the selectivity and effectiveness of the herbicides on weeds in the sunflower crop. The selectivity of the tested herbicides against the sunflower was assessed through visual observations using the EWRS scale (grades 1 to 9; where 1 indicates selective and 9 indicates phytotoxicity) (Table 3).

The effectiveness of the herbicides was evaluated by counting the number of weeds by species per square meter (1 m²) in each variant.

The effectiveness of the herbicides was then calculated using the following formula:

$$\text{Effectiveness} = \frac{\text{Untreated weeding degree} - \text{Treated weeding degree}}{\text{Degree of untreated weeding}} \times 100$$

In the sunflower crop within the monocotyledonous group, the species *Eriochloavillosa* exhibited a significantly higher biomass compared to other

monocotyledonous species, accounting for 51% of the total weight. In the dicotyledonous group, the dominant species was *Ambrosia artemisiifolia*, which comprised 25% of the total weight (Figure 3).

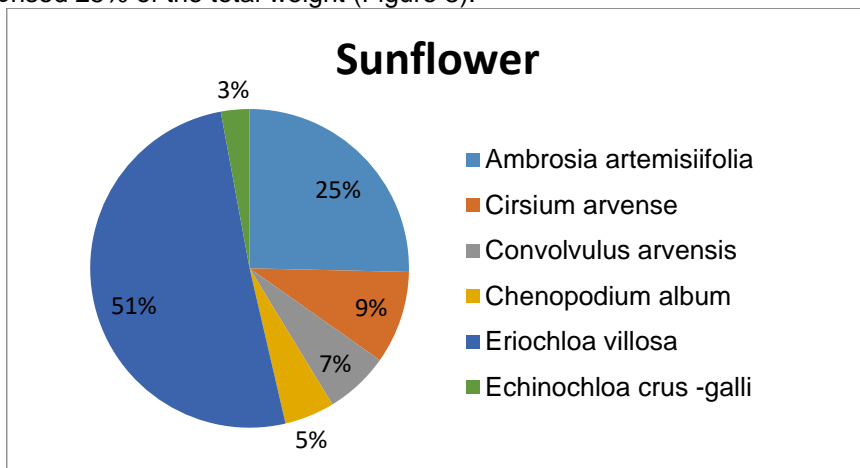


Figure 3. Dominant weed species existing in the non-herbicated variant in the 2024 sunflower crop

Observations were made at 3, 7, and 14 days post-application of the herbicides to assess the tolerance of sunflower hybrids. It is noteworthy that after the application of the Viballa herbicide, sunflower plants—regardless of their type—exhibited umbrella-like appearance, which returned to normal after 7 days (Table 2).

Table 2

Observations on the behavior of sunflower plants 3,7,14 days after treatment

Nr crt.	Herbicides	Quantity, kg/ha	Time of application	Crop condition after treatment		
				3 days	7 days	14 days
1	Control	-	-	-	-	Normal
2	Challenge 600 SC+ Dual Gold	4+1,5	preem	-	-	Normal
3	Challenge 600 SC+ Dual Gold	4+1,5	preem	-	-	Normal
4	Challenge 600 SC+ Dual Gold	4+1,5	preem	-	-	Normal
5	Viballa+ Leopard 5EC	1+1,5	post	Umbrella effect	Normal	Normal
6	Viballa+ Leopard 5EC	1+1,5	post	Umbrella effect	Normal	Normal
7	Viballa+ Leopard 5EC	1+1,5	post	Umbrella effect	Normal	Normal
8	Dual Gold + Racer	1,5+2	preem	Normal	Normal	Normal
9	Dual Gold +Pulsar 40	1,5+1,2	preem+post	Normal	Normal	Normal
10	Dual Gold + Helmstar	1,5+0,020	preem+post	Normal	Normal	Normal

The development stage of the crop plants at the time of the post-emergence treatment was at BBCH 14-16 (4-6 leaves), while *Ambrosia* plants were 10-15 cm in height.

Regarding the effectiveness of the herbicides applied in the experiment, it was noted that the variants treated with the herbicides Viballa at 1 L/ha and Leopard 5EC at 1.5 L/ha, applied post-emergence, achieved very high effectiveness in combating *Ambrosia*, regardless of the hybrid sown, with efficacy ranging from 93% to 98%.

In contrast, less satisfactory efficacy was observed in the variants treated pre-emergence with the herbicides Challenge 600 SC at 4 L/ha and Dual Gold at 1.5 L/ha, primarily due to the performance of Dual Gold. Observations indicate that Challenge herbicide controls ragweed less effectively.

Good efficacy was achieved in variants 8, 9, and 10, attributed to the herbicide Dual Gold, which was further enhanced by the application of Racer at 2 L/ha, Pulsar 40 at 1.2 L/ha, and Helmstar—herbicides that effectively control dicotyledons.

Table 3

Selectivity and efficacy of herbicides for control of *Ambrosia artemisiifolia* species in sunflower crop 2024

Nr. crt.	Hybrid	Herbicides	Quantity, kg/ha	Time of application	Selectivity EWRS notes	Fighting the species <i>Ambrosia artemisiifolia</i> %
1	Expres	Not herbicided	-	-	-	-
2	Convențional	Challenge 600 SC+ Dual Gold	4+1,5	preem	1	71
3	Clearfield	Challenge 600 SC+ Dual Gold	4+1,5	preem	1	78
4	Expres	Challenge 600 SC+ Dual Gold	4+1,5	preem	1	75
5	Convențional	Viballa+ Leopard 5EC	1+1,5	post	1	93
6	Clearfield	Viballa+ Leopard 5EC	1+1,5	post	1	98
7	Expres	Viballa+ Leopard 5EC	1+1,5	post	1	98
8	Convențional	Dual Gold + Racer	1,5+2	preem	1	80
9	Clearfield	Dual Gold +Pulsar 40	1,5+1,2	preem+post	1	83
10	Expres	Dual Gold + Helmstar	1,5+0,020	preem+post	1	80

Based on the data obtained in the agricultural year 2024, the best results against ragweed were recorded with the application of Viballa at 1 L/ha and Leopard 5EC at 1.5 L/ha, regardless of the hybrid. This treatment was applied when the sunflower plants were at the 3-4 leaf stage, achieving an effectiveness of 93% to 98% in combating this species, without reinfestation of the sunflower crop until harvest.

The results regarding the selectivity and effectiveness of the products under investigation are presented in Table 3.

Through the analysis of variance in production, the differing behaviours of the sunflower hybrids in interaction with the tested herbicides were assessed for significance. The Express hybrid achieved the highest production, recording 31.83 q/ha, with a very significant difference from the control when interacting with the herbicide Challenge 600 SC at 4 L/ha + Dual Gold at 1.5 L/ha. Conversely, the same hybrid exhibited lower productions with insignificant differences compared to the control, producing 19.55 q/ha with Viballa at 1 L/ha + Leopard 5EC at 1.5 L/ha and 13.26 q/ha with Dual Gold at 1.5 L/ha + Helmstar at 0.020 kg/ha.

The Clearfield hybrid achieved the highest production of 20.06 q/ha in interaction with the herbicides Challenge 600 SC at 4 L/ha and Dual Gold at 1.5 L/ha. It also produced a similar yield, although not statistically significant, in the variant treated with Viballa at 1 L/ha and Leopard 5EC at 1.5 L/ha. However, this hybrid exhibited significantly reduced production when herbicided with Dual Gold at 1.5 L/ha applied pre-emergence and Pulsar 40 at 1.2 L/ha applied post-emergence, showing a distinctly significant difference compared to the control.

The Conventional Hybrid produces yields ranging from 21.42 q/ha in the variant treated with Viballa at 1 L/ha and Leopard 5EC at 1.5 L/ha applied post-emergence, to 15.3 q/ha in the variant treated with Challenge 600 SC at 4 L/ha and Dual Gold at 1.5 L/ha, and 13.77 q/ha in the variant treated with Dual Gold at 1.5 L/ha and Racer at 2 L/ha. Additionally, there is a distinctly significant difference of -10.01 q/ha between the non-herbicided variant and the average yield from the experiment (Table 4).

The comparison of production between the variants and the control is not significant; therefore, it is essential to assess the significance of the differences among the variants in the experiment. To achieve this, the method of multiple comparisons was employed (Table 5).

From this table, it is evident that the Express hybrid treated with Challenge 600 SC at 4 L/ha and Dual Gold at 1.5 L/ha ranks first, with a production of 31.83 q/ha, showing a significant difference compared to all other variants. The second-ranked variant, the Conventional hybrid treated with Viballa at 1 L/ha and Leopard 5EC at 1.5 L/ha, exhibits significant differences only with the variants ranked below sixth position, specifically those ranked 7th, 8th, 9th, and 10th (the Conventional hybrid treated with Dual Gold at 1.5 L/ha, the Express hybrid treated with Dual Gold at 0.020 kg/ha, and the Clearfield hybrid treated with Dual Gold at 1.5 L/ha + Pulsar 40 at 1.2 L/ha).

Table 4

The Influence of Herbicide Treatments on Production in Sunflower Cultivation 2024

No.	Hybrid	Herbicides	Quantity, kg/ha	Time of application	Production q/ha	+/- Compared to the average	Significance
1	Expres	Not herbicided	-	-	6,80	-10,01	00
2	Convențional	Challenge 600 SC+ Dual Gold	4+1,5	preem	15,30	-1,51	
3	Clearfield	Challenge 600 SC+ Dual Gold	4+1,5	preem	20,06	3,25	
4	Expres	Challenge 600 SC+ Dual Gold	4+1,5	preem	31,83	15,02	xxx
5	Convențional	Viballa+ Leopard 5EC	1+1,5	post	21,42	4,61	
6	Clearfield	Viballa+ Leopard 5EC	1+1,5	post	19,72	2,91	
7	Expres	Viballa+ Leopard 5EC	1+1,5	post	19,55	2,74	
8	Convențional	Dual Gold + Racer	1,5+2	preem	13,77	-3,04	
9	Clearfield	Dual Gold +Pulsar 40	1,5+1,2	preem+post	6,46	-10,35	00
10	Expres	Dual Gold + Helmstar	1,5+0,02	preem+post	13,26	-3,55	
		Average	-	-	16,81	Mt.	

CL 5% = 6,55q/ha; CL 1% = 8,99q/ha; CL 0,1% = 12,24q/ha;

Table 5

Multiple comparisons Duncan – Sunflower 2024

Nr	Hybrid	Herbicides	Production q/ha	The difference from the version on the spot								
				10	9	8	7	6	5	4	3	2
				6,46	6,80	13,26	13,77	15,30	19,55	19,72	20,06	21,42
1	Expres	Challenge 600 SC+ Dual Gold	31,83	25,37 7,55 x	25,03 7,53 x	18,57 7,46 x	18,06 7,42 x	16,53 7,33 x	12,28 7,22 x	12,11 7,09 x	11,77 6,89 x	10,41 6,55 x
2	Convențional	Viballa+ Leopard 5EC	21,42	14,96 7,53 x	14,62 7,46 x	8,16 7,42 x	7,65 7,33 x	6,12 7,22	2,0 7,09	1,7 6,89	1,36 6,55	
3	Clearfield	Challenge 600 SC+ Dual Gold	20,06	13,6 7,46 x	13,26 7,42 x	6,8 7,33	6,29 7,22	4,76 7,09	0,51 6,89	0,34 6,55		
4	Clearfield	Viballa+ Leopard 5EC	19,72	13,26 7,42 x	12,92 7,33 x	6,46 7,22	5,95 7,09	4,42 6,89	0,17 6,55			
5	Expres	Viballa+ Leopard 5EC	19,55	13,09 7,33 x	12,75 7,22 x	6,29 7,09	5,78 6,89	4,25 6,55				
6	Convențional	Challenge 600 SC+ Dual Gold	15,30	8,84 7,22 x	8,50 7,09 x	2,04 6,89	1,53 6,55					
7	Convențional	Dual Gold + Racer	13,77	7,31 7,09 x	6,97 6,89 x	0,51 6,55						
8	Expres	Dual Gold + Helmstar	13,26	6,80 6,89	6,46 6,55							
9	Expres	Not herbiced	6,80	0,34 6,55								
10	Clearfield	Dual Gold +Pulsar 40	6,46									

Between the variants ranked second, the Conventional hybrid treated with Viballa at 1 L/ha and Leopard 5EC at 1.5 L/ha shows no significant differences compared to the variants ranked 3rd to 6th. Specifically, these include the Clearfield hybrid treated with Challenge 600 SC at 4 L/ha and Dual Gold at 1.5 L/ha, the Express hybrid treated with Viballa at 1 L/ha and Leopard 5EC at 1.5 L/ha, and the Conventional hybrid treated with Challenge 600 SC and Dual Gold (Table 5).

CONCLUSIONS

The aim of the research conducted at SCDA Livada in 2024 and beyond was to identify the most effective herbicide within sunflower cultivation for combating *Ambrosia*, an invasive species that is spreading in many areas. The herbicides Challenge 600 SC, applied pre-emergence, and Viballa, applied post-emergence, demonstrated very good selectivity for the cultivated sunflower hybrids (Conventional, Clearfield, and Express). The results and observations from the field indicate that the herbicide Viballa, applied at a dose of 1 L/ha, is very effective in combating *Ambrosia artemisiifolia*, provided that the weeds are sprouted and no

taller than 10–15 cm at the time of application. The Express hybrid achieved the highest production of 31.83 q/ha, showing a very significant difference from the control when interacting with the herbicide Challenge 600 SC at 4 L/ha combined with Dual Gold at 1.5 L/ha. By employing the method of multiple comparisons, it is determined that the Express hybrid treated with Challenge 600 SC at 4 L/ha and Dual Gold at 1.5 L/ha ranks first, achieving a production of 31.83 q/ha, with a significant difference compared to all other variants. Based on these results, farmers can establish the most effective and efficient methods for weed control (especially against ragweed) in sunflower crops, regardless of the cultivated hybrid (Conventional, Clearfield, or Express).

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