NEW STRATEGIES OF CHEMICAL CONTROL OF *AMBROSIA ARTEMISIIFOLIA* L. (RAGWEED) IN SUNFLOWER CROPS

Gheorghescu Bogdan*, Sala Florin*, Manea Dan Nicolae*

*Banat´s University of Agricultural Sciences and Veterinary Medicine "Regele Mihai I al României" from Timişoara, Faculty of Agriculture
119 Calea Aradului St., 300645, Timişoara, Romania
e-mail: bogdan.gheorghescu@basf.com; florin_sala@yahoo.com; manea_dn@yahoo.com

Abstract

In Romania, these last years, Ambrosia artemisiifolia L., or ragweed, has become a problem weed in the main weeding crops and not only. Our study tested the efficiency of Ambrosia artemisiifolia L. (AMBEL) control in sunflower with five pre-emergent herbicides. To do so, we organised in the field near Lugoj, Romania, in the hill area of the Timis County, in 2017, a mono-factorial trial after the randomised block method with three replicates of six variants each: V_1 – no herbicide; V_2 – Frontier Forte (EC)(dimetenamid-P 720 g/l) – 1.2 l/ha; V_3 – Stomp Aqua (pendimetalin 455 g/l) – 4 l/ha; V_4 – Dual Gold 960 EC (S-metolaclor 960 g/l) – 1.5 l/ha; V_5 – Gardoprim Plus Gold 500 SC (S-metolaclor 312.5 g/l + terbutilazin 187.5 g/l) – 4 l/ha; V_6 – Wing P (pendimetalin 250 g/l + dimetenamid-P 212.5 g/l) – 4 l/ha. Among tested herbicides, we noted Frontier Forte EC (V_2) applied at rates of 1.2 l/ha, which ensured a significant reduction (75%) of the coverage degree with AMBEL, to a tolerable level for the crop (13.33%).

Key words: *Ambrosia artemisiifolia L., pre-emergent herbicides, sunflower*

INTRODUCTION

Ambrosia artemisiifolia (sin. *Ambrosia elatior* L.) is a sagittal annual species original from Central and North America (Lorenzi and Jeffery, 1987). It was introduced accidentally in a large number of countries as a contaminant of the seeds and grains. *A. artemisiifolia* usually colonises fallows where it produces a large number of small, light seeds that keep viable in the soil for long periods of time (Beres, 1994).

It is one of the oldest summer, annual weed species that can germinate once soil temperature reaches 11-13°C. *A. artemisiifolia* is frost sensitive and it usually grows at 30-50° northern and southern latitude in various regions (King, 1966). It rarely grows above 1000 m of altitude (Allard, 1943). It can grow on limey or sandy soils, and also on moist, heavy soils with a pH 6.0-7.0 (Bassett and Crompton, 1975).

Due to the morphological features of its pollen, *A. artemisiifolia* is one of the most common seasonal sources of airborne allergens causing allergic rhinitis, fever or dermatitis. As a consequence, they reported high medical costs in areas with high infestation (Déchamp, 1999).

A. artemisiifolia can also invade agricultural lands where it acts as a highly damaging weeds in several crops (particularly sunflower, maize, soy, legumes, potato, sugar beet, etc.), causing significant losses.

At present, it grows all over the world in such countries as Italy (Siniscalo and Barni, 1994), Lithuania (Gudzinskas, 1993), Hungary (Beres, 1994), France (Chauvel et al., 2006), Austria (Essl et al., 2009), Germany (Bassett and Crompton, 1975). In Russia, *A. artemisiifolia* was first noticed near Stavropol, in 1918. It was also identified in 1995 in north-east Anatolia, Turkey (Byfield and Baytop, 1998).

A. artemisiifolia is not equally present in sub-tropical and tropical areas and it is rather rare in northern Europe (Norway, Sweden, Scotland and Ireland) because the plants cannot produce flowers or the seeds do not reach maturity (Allard, 1943; King, 1966).

There are no available comprehensive studies for Asia and Africa, but Ling et al. (2012) declared that the species was introduced in China in 1930. It was first recorded in Australia in 1908 (Julien et al., 2012).

In Romania, these last years, *Ambrosia artemisiifolia* L., or ragweed, has become a problem weeds in the main weeding crops and not only.

MATERIAL AND METHOD

Sunflower is among the most damaged crops of the Timis County, Romania, by the species *Ambrosia artemisiifolia* L. because it is present there in large numbers shortly after sprouting, because it has a long lifespan, and because it is a permanent competitor for vegetation factors.

In this context, we tested the efficacy of five pre-emergent herbicides on the weed *Ambrosia artemisiifolia* L (AMBEL) in sunflower.

To measure the efficacy of these herbicides on this weed species, we used the randomised block method. The trial was organised on a trial field in Lugoj, in the hill area of the Timis County, in 2017; the trial had three replicates with six variants each.

The trial variants were:

V_1 – no herbicide;

V_2 – Frontier Forte (EC)(dimetenamid-P 720 g/l) – 1.2 l/ha;

V_3 – Stomp Aqua (pendimetalin 455 g/l) – 4 l/ha;

V_4 – Dual Gold 960 EC (S-metolaclor 960 g/l) – 1.5 l/ha;

V_5 – Gardoprim Plus Gold 500 SC (S-metolaclor 312.5 g/l + terbutilazin 187.5 g/l) – 4 l/ha;

V_6 – Wing P (pendimetalin 250 g/l + dimetenamid-P 212.5 g/l) – 4 l/ha.

Weed mapping was done 15, 30 and 45 days after applying the pre-emergent herbicides (at the target-weed development stages BBCH 12, 14, and 20-24, respectively). To measure the weeding degree, we used the global coverage degree method.

We also made observations regarding herbicide selectivity in relation to the sunflower crop.

The sunflower hybrid cultivated in the trial was NK Kondi, a hybrid with a high yielding potential and a high content of oil, resistant to hydric and thermal stress conditions.

RESULTS AND DISCUSSION

As shown in Table 1, 15 days after applying the pre-emergent herbicide, the control variant V_1 – no herbicide had a coverage percentage with *Ambrosia artemisiifolia* of 88.33%, which points to the ability of this weed of quickly invading sunflower nutrition area since the first growth stages (BBCH 12). Among tested herbicides, we noted Frontier Forte EC (V_2) (dimetenamid-P 720 g/l), applied at rates of 1.2 l/ha, which ensured a very significant reduction (75%) of the coverage degree by AMBEL to a tolerable level for the crop of 13.33%. Satisfactory results were in the variants V_5 – Gardoprim Plus Gold 500 SC (S-metolaclor 312.5 g/l + terbutilazin 187.5 g/l) - (56.66%) and V_6 – Wing P (pendimetalin 250 g/l + dimetenamid-P 212.5 g/l) - (63.33%). The herbicide Stomp Aqua (pendimetalin 455 g/l), applied at rates of 4 l/ha, did not visibly affect the plants of *Ambrosia artemisiifolia.*

Table 1

Reduction of coverage degree with *Ambrosia artemisiifolia* L (AMBEL) 15 days after herbicide application

Variant	Rate	Coverage degree by AMBEL (%)			Mean (%)	Relative value in relation to the control (%)	Difference in relation to the control (%)	Significance of the difference
		Rep I	Rep II	Rep III				
V_1 – no herbicide	-	90	90	85	88.33	100.00	-	Control
V_2 – Frontier Forte	1.2 l/ha	15	10	15	13.33	15.09	-75.00	000
V_3 – Stomp Aqua	4 l/ha	80	75	75	76.66	86.79	-11.67	-
V_4 – Dual Gold 960	1.5 l/ha	65	70	75	70.00	79.25	-18.33	0
V_5–Gardoprim Plus Gold 500 SC	4 l/ha	60	55	55	56.66	64.14	-31.67	00
V_6 – Wing P	4 l/ha	65	60	65	63.33	71.70	-25.00	00

$LSD_{5\%}$= 14.27%; $LSD_{1\%}$=21.60 % $LSD_{0.1\%}$=33.78 %

This trend also characterised the following measurement sessions: the product Frontier Forte EC (V_2) (dimetenamid-P 720 g/l) applied at rates of 1.2 l/ha proving to be the only one capable of controlling effectively the weed *Ambrosia artemisiifolia.* Even in this variant, 30 and especially 45 days after application, there was a diminution of the curative effect on the target species assessed by a coverage degree of 33.33% and 46.66%, respectively (Tables 2 and 3).

Table 2

Reduction of coverage degree with *Ambrosia artemisiifolia* L (AMBEL) 30 days after herbicide application

Variant	Rate	Coverage degree by AMBEL (%)			Mean (%)	Relative value in relation to the control (%)	Difference in relation to the control (%)	Significance of the difference
		Rep I	Rep II	Rep III				
V_1 – no herbicide	-	85	85	85	85.00	100.00	-	Control
V_2 – Frontier Forte	1.2 l/ha	35	35	30	33.33	39.21	-51.67	000
V_3 – Stomp Aqua	4 l/ha	75	75	80	76.66	90.19	-8.34	-
V_4 – Dual Gold 960	1.5 l/ha	60	60	75	65.00	76.47	-20.00	0
V_5–Gardoprim Plus Gold 500 SC	4 l/ha	55	55	55	55.00	64.70	-30.00	00
V_6 – Wing P	4 l/ha	60	65	65	63.33	74.50	-21.67	0

$LSD_{5\%}$= 11,62%; $LSD_{1\%}$=23,10 % $LSD_{0,1\%}$=34,19 %

The observations conducted regarding herbicide selectivity show that neither of the tested herbicides produced visible effects of phyto-toxicity on sunflower hybrid plants used in the trial.

These results confirm the increasing and more aggressive presence of the sagittal species *Ambrosia artemisiifolia* L. in crops, with sunflower among the most aimed at. In this context, we believe that, to control effectively and long term the ragweed in weeding crops, we need to adopt an integrated control strategy that include using post-emergent herbicides, mechanical weeding, rational crop rotations, etc.

Table 3

Reduction of coverage degree with *Ambrosia artemisiifolia* L (AMBEL) 45 days after herbicide application

Variant	Rate	Coverage degree by AMBEL (%)			Mean (%)	Relative value in relation to the control (%)	Difference in relation to the control (%)	Significance of the difference
		Rep I	Rep II	Rep III				
V_1–no herbicide	-	80	85	85	85.00	100.00	-	Control
V_2 – Frontier Forte	1.2 l/ha	55	45	40	46.66	54.89	-38.34	000
V_3 – Stomp Aqua	4 l/ha	70	75	80	78.33	92.15	-6.67	-
V_4 – Dual Gold 960	1.5 l/ha	65	70	70	68.33	80.39	-16.67	0
V_5–Gardoprim Plus Gold 500 SC	4 l/ha	50	50	50	50.00	58.82	-35.00	000
V_6 – Wing P	4 l/ha	60	60	60	60.00	70.59	-25.00	00

$LSD_{5\%}$= 8.57%; $LSD_{1\%}$=19.44 % $LSD_{0.1\%}$=28.43 %

CONCLUSIONS

1. Sunflower is one of the most damaged crops in the Timis County by the species *Ambrosia artemisiifolia* L. because it thrives in large number shortly after crop sprouting, has a long life span and is a permanent competitor for vegetation factors.
2. He control variant V_1 – no herbicide was almost 90% covered by plants of *Ambrosia artemisiifolia.*
3. Among tested herbicides, we noted the product Frontier Forte EC (V_2) (dimetenamid-P 720 g/l) applied at rates of 1.2 l/ha, which ensured a very significant reduction of the coverage degree with AMBEL, from 75% to a tolerable level of 13.33%.
4. There were satisfactory results in the variants V_5 – Gardoprim Plus Gold 500 SC (S-metolaclor 312.5 g/l + terbutilazin 187.5 g/l) – 56.66% and V_6 – Wing P (pendimetalin 250 g/l + dimetenamid-P 212.5 g/l) – 63.33%.
5. The herbicide Stomp Aqua (pendimetalin 455 g/l) at rates of 4 l/ha did not affect visibly the plants of *Ambrosia artemisiifolia* L.
6. To control effectively and long term the ragweed in weeding crops, we need to adopt an integrated control strategy that include using post-emergent herbicides, mechanical weeding, rational crop rotations, etc.

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