

# Efficacy of Herbicides on Controlling *Ambrosia Artemisiifolia* in Maize Crop

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## Abstract

Although, morphologically, maize is one of the most vigorous species, with a well-developed root system and stem, lately it has become sensitive to one particular species of weeds, namely *Ambrosia artemisiifolia*. With devastating effects on agriculture, on the environment and on human health, *Ambrosia artemisiifolia*, commonly named ragweed, is one of the most harmful invasive species. Currently, it belongs to the category of dominant weeds in some agricultural crops, which causes significant damage in production and from observations made in the maize crop, its frequency exceeds 50 individuals on a square meter. This paper presents the results of herbicides efficacy tests regarding the control of this invasive species in maize crop. The research was carried out in the Timiș Plain, on a eutricambosol soil type, poorly gleyed, with high fertility, due to good physical and chemical properties. Of the four herbicides applied post-emergence in maize crop, the best efficacy was obtained by Glyphos Ultra herbicide, applied in doses of 3.5 l / ha, which ensured a significant reduction in coverage, of over 90% 15 days after application, while Kideka herbicide has been situated at the opposite pole, with an efficacy of about 82%. Also, the results of the same set of herbicides applied indicate very high efficacy of Glyphos Ultra herbicide, which exceeds a percent of 98% 30 days after application, while the lowest results were obtained by the herbicide named Dicash 480 SL of approximately 67%.

**Keywords:** *Ambrosia artemisiifolia*, herbicides, maize

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## 1. Introduction

Maize is known as one of the oldest crops, occupying one of the largest cultivated areas in the world.

In Romania, maize cultivation occupies a large part of the arable land area, providing between a quarter and a third of the total maize production in the European Union. The year of 2018 has represented a remarkable year for this crop, recording the largest maize production in the history of the country, respectively 18.9 million tons. Even though in the following years the productions have slightly decreased, the year of 2020 has brought Romania the first place in

Europe as far as having the largest area cultivated with maize and the second place in terms of production obtained, after France [1].

Chemical weed control in maize has always made significant progress, but the development of new herbicides due to the emergence of new endurance of certain weeds requires further research to identify suitable herbicides, with high efficacy, but low toxicity [2-6].

*Ambrosia artemisiifolia* or ragweed is known as a very aggressive invasive and non-native species, that causes the deterioration of biodiversity, human health and economic structures.

Native from North America, this weed causes significant allergies for many people, who can develop both mild and severe respiratory symptoms for a long period of time [7].

As many studies have shown, *Ambrosia artemisiifolia* is a species of weed that can be

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found ruderal, on the edges of the roads and ditches, as well as in wastelands, but also on meadows and pastures, in vineyards, orchards and even in forests [5].

Regarding its presence in agricultural crops, ragweed can be found especially in sunflower, soy and maize crops [8].

According to descriptions found in the specialty literature, ragweed is not particular regarding the soil type, thus it is found on different types of soil from saline soils to skeletal soils. It grows intensely on brown forest soil, alluvium or light sandy soils, forming large populations [2, 3, 9, 10].

The direct damages show that this species competes with the crop plant for obtaining the mineral substances in the soil, the light, heat and water, being a large consumer of nutrients [11]. Also, in some situations, its size may be larger compared to the size of the crop plant and it determines the shading effect, by slowing down the growth of the crop plant [2, 3, 11].

Weed control is considered a necessary step in order to protect crops which can be potentially affected by ragweed and the methods of controlling may involve both mechanical and chemical methods, such as application of herbicides [6].

However, regarding the two methods we have to state the fact that herbicide application has proven its efficacy over time, especially when used in the early stages of plant development [4-6].

The purpose of this research is to test the sensibility of *Ambrosia artemisiifolia* to some herbicides applied post-emergence in maize.

## 2. Materials and methods

The research was carried out in the Timis Plain, mainly Şag locality, Timiş county, in the year of 2020.

The experience field was located according to the method of randomized blocks in 3 repetitions and 5 variants, each variant was treated with herbicide applied in a single dose: Dicash, Glyphos Ultra, Lumax 537.5 SE, Kideka, in the phenophases of BBCH 12-14 (2-4 leaves) and BBCH 15-16 (5-6 leaves).

Following the application, satisfactory results were obtained, reducing the species *Ambrosia artemisiifolia* from the maize crop.

## 3. Results and discussion

The research on the sensitivity of *Ambrosia artemisiifolia* to some herbicides were carried out in the Timiş Plain, which is an important part of the Western Plain because of its favorability for most crops, such as cereal crops, maize, soybean, peas, beans, sunflower and rape [1]. Also, potato cultivation occupies significant areas, both in terms of early and summer potatoes, as well as autumn-winter potatoes, because of the high fertility of the soils and of their clayey to clayey-sandy texture [12].

The experimental field was located in Şag locality, Timiş county, on a weakly gleyed eutricambosoil soil type, with a high fertility due to remarkable physical and chemical properties.

The field of experience was placed according to the method of randomized blocks with variants in three repetitions. The experience included 5 variants / repetition. The length of the plots was 10 meters, and the width was 3.0 meters. The width of the paths between the repetitions was 1.0 meter.

In **Table 1** are described the 5 experimentals.

The variants, with a control variant and 4 variants using commercial products used for the control of the species *Ambrosia artemisiifolia*, but with different epoch of application.

The experimental variants within the experiment differed by:

- application of the 4 herbicides used in the control of the species *Ambrosia artemisiifolia*;
- the epoch of application of herbicides (BBCH 12-14, 2-4 leaves and BBCH 15-16, 5-6 leaves)

Observations made during the researches in the maize crop have shown that the frequency of *Ambrosia artemisiifolia* has exceeded 50 individuals on a square meter.

As shown in Figure 1, in the BBCH 12-14 stage, 15 days after the post-emergence application of herbicides, the reduction of the ragweed plants was obtained in a proportion of 68.57 - 98.11%, which is a very significant difference compared to the untreated variant.

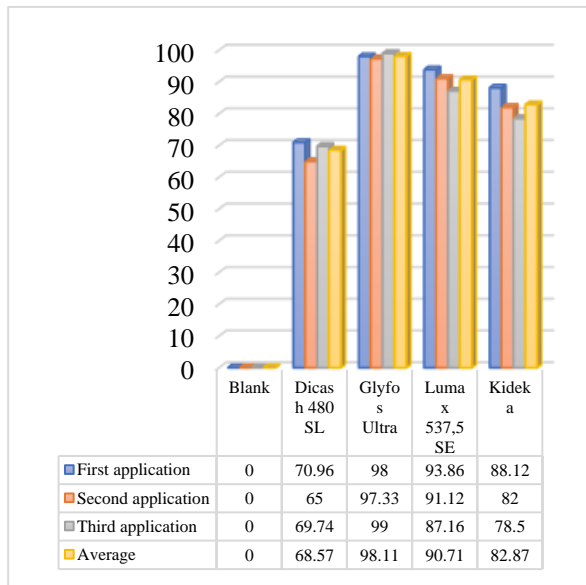
Also in the same stage, 30 days after the application of herbicides, a slight decrease was observed in the efficacy of the hormonal herbicide Dicash 480 SL and the herbicide Kideka, while the product Glyphos Ultra (V3) proved to be the only one able to effectively control the weed *Ambrosia artemisiifolia*, with

the highest percentage of 98.44% efficacy (Figure 2).

**Table 1. The detailing of the experience**

No.	Commercial product	Active substance	Dose
<b>Application epoch – phenophase BBCH 12-14 (2-4 leaves)</b>			
1	Blank	-	-
2	Dicash 480 SL	dicamba 480 g/l	0.6 l/ha
3	Glyfos Ultra	360 g/l glifosat acid	5.0 l/ha
4	Lumax 537,5SE	37.5 g/l mesotrione 375 g/l S-metolaclor 125 g/l terbutilazin	3.5 l/ha
5	Kideka	100 g/l mesotrione	1.5 l/ha
<b>Application epoch – phenophase BBCH 15-16 (5-6 leaves)</b>			
1	Blank	-	-
2	Dicash 480 SL	dicamba 480 g/l	0.6 l/ha
3	Glyfos Ultra	360 g/l glifosat acid	5.0 l/ha
4	Lumax 537,5SE	37.5 g/l mesotrione 375 g/l S-metolaclor 125 g/l terbutilazin	3.5 l/ha
5	Kideka	100 g/l mesotrione	1.5 l/ha

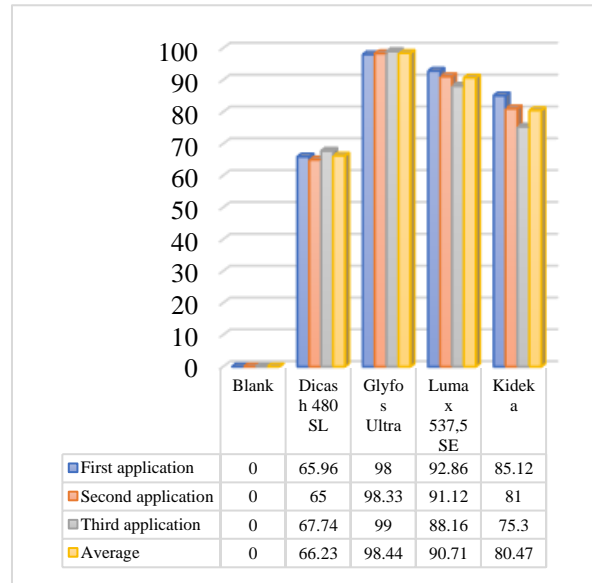
Variant



**Figure 1.** Results regarding the sensitivity of *Ambrosia artemisiifolia* species to herbicides applied post-emergence in maize; Phenophase BBCH 12-14 - 15 days after application

In the BBCH 15-16 stage, 15 days after the post-emergence application of herbicides, the sensitivity of the targeted species to the action of herbicides was situated between the percentages of 51.9 - 98.44% efficacy, as shown in Figure 3. Also in this stage, the herbicides used have shown a declining trend in the control of the species compared to the BBCH stage 12-14. It was also

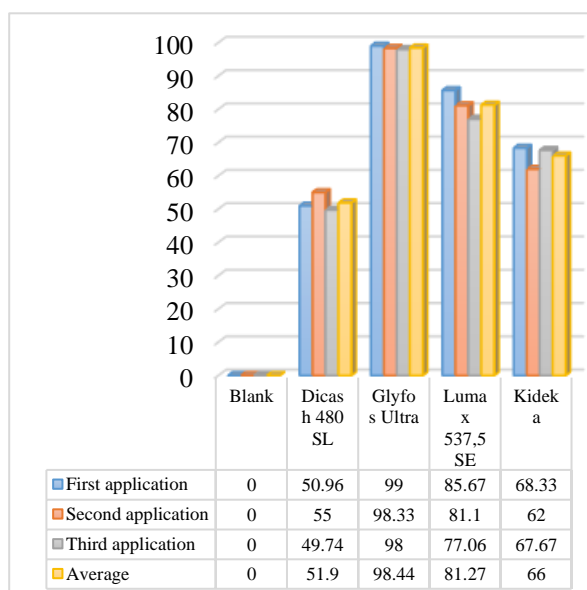
observed that, 30 days after the application, in the BBCH stage 15-16, their efficacy had decreased.



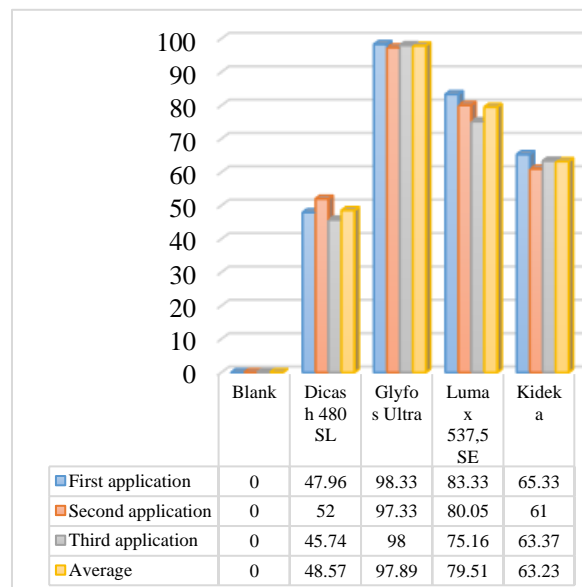
**Figure 2.** Results regarding the sensitivity of *Ambrosia artemisiifolia* species to herbicides applied post-emergence in maize; phenophase BBCH 12-14 – 30 days after application

The herbicide Dicash 480 SL and Kideka managed to control the population of *Ambrosia artemisiifolia* in a percentage of 48.57 - 63.23%, while the herbicide Lumax 537.5 SE showed a superior herbicide efficacy of 78.51% (Figure 4).

Compared to the control variant, in which no herbicides were applied, the products used in the experiment have proved a very significant efficacy. Also, as shown before, the herbicides studied have maintained their hierarchy in the control of the species - *Ambrosia artemisiifolia*. Regarding the productions of maize obtained in the experimental variants, the application of herbicides against ragweed in the phenophase BBCH 12-14 stage have led to increases between 5676.67 - 9460 kg / ha, with significant differences of the production compared to the control variant (2103.33 kg / ha) (Table 2).



**Figure 3.** Results regarding the sensitivity of *Ambrosia artemisiifolia* species to herbicides applied post-emergence in maize; phenophase BBCH 15-16 – 15 days after application



**Figure 4.** Results regarding the sensitivity of *Ambrosia artemisiifolia* species to herbicides applied post-emergence in maize; phenophase BBCH 15-16 – 30 days after application

As shown in Table 3, in the phenophase BBCH 15-16 stage, the productions of maize obtained have also increased, with a value situated between 313.55 - 562.52 kg, compared to production of the control variant.

**Table 2.** Results regarding maize production obtained by the treated variants in the phenophase BBCH 12-14 (2-4 leaves)

Treatment number	Herbicide	Application epoch	Maize production kg/ha			Average	Relative difference	Absolute difference
1	Blank	12 – 14	2325	1960	2025	2103,33	100	0
2.	Dicash 480 SL	12 – 14	7900	7980	76550	7780	369,89	5676,67**
3	Glyphos Ultra	12 -14	11720	11130	11840	11563,33	549,76	9460***
4	Lumax 537,5 SE	12 -14	10410	9750	10200	10120	481,14	8016,67***
5.	Kideka	12-14	9550	9110	9901	9520,33	452,63	7417***

**Table 3. Results regarding maize production obtained by the treated variants in the phenophase BBCH 15-16 (5-6 leaves)**

Treatment number	Herbicide	Application epoch	Maize production kg/ha			Average	Relative difference	Absolute difference
1	Blank	15 – 16	2325	1960	2025	2103,33	100	0
2.	Dicash 480 SL	15 – 16	6390	6995	6400	6595,00	313,55	4491,66*
3	Glyfos Ultra	15 -16	11850	11745	11900	11831,67	562,52	9728,33***
4	Lumax 537,5 SE	15 -16	9389	9013	9420	9274,00	440,92	7170,67**
5.	Kideka	15-16	7938	8011	8270	8073,00	383,82	5969,67*

#### 4. Conclusions

From the researches carried out, we conclude that *Ambrosia artemisiifolia*, is increasing its presence in maize crops in Western Romania, including Timiș Plain, well known for its very fertile soil, with a frequency that exceeds 50 plants / square meter.

It is imperative to combat this weed in order to ensure the safe growth and development of plants. Herbicide control is effective and safe, and the efficacy of the tested herbicides was higher when applied in the phenophase BBCH 12-14 stage (2-4 leaves).

Maize production was closely related to the active substances and the period of application, which are in fact, correlated.

#### Acknowledgements

Combating *Ambrosia artemisiifolia* has become imperative in order to ensure the safe growth and development of plants and the most efficient way is throughout the use of herbicides.

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