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POPULATIONAL REDUCTION OF *AMBROSIA ARTEMISIIFOLIA* SPECIES FROM SOYBEAN CROP

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Abstract

Ambrosia artemisiifolia is an annual herbaceous weed within the Asteraceae family, native to North America.

In recent years, this species is increasingly present in Romanian crops (corn, sunflower, soybean, sugar beet), causing significant damage by decreasing the quantity and quality of production as well as by decreasing harvesting efficiency. A study by Coble et al. (1981) revealed that Ambrosia artemisiifolia, at a density of 4 plants per 10 m, reduced production of Glycine up to 8%. Similarly, Shurtleff and Coble (1985) reported that at a density of 1.6 plants / m^2, Ambrosia artemisiifolia caused a decrease in soybean production up to 12%. The damage caused by the common ragweed is numerous and continues to grow with along to its spreading into crops. Ambrosia artemisiifolia is a very competitive towards to soybean plants.

There are postermergent herbicides which control Ambrosia artemisiifolia in soybeans, but the weed's reaction can be altered if they are applied in mixture or with adjuvants that can influence the degree of control. This study aimed to assess the efficacy of herbicides in the population reduction of Ambrosia artemisiifolia from soybean culture. The research was carried out in 2018, near Folea, Timis county. The experience included 5 variants / replicates. The substances used in the control of the species were: 480 g/l bentazone + 22.4 g/l imazamox, 40 g/l imazamox, bentazone 480 g/l, 50% thifensulfuron-methyl. After application of herbicides, observations were made regarding their efficacy Ambrosia artemisiifolia population reduction and at the end of the vegetation period the yield was determined. Applied herbicides had an efficacy in population reduction of Ambrosia artemisiifolia, ranging between 71.5-93.25%. The population of Ambrosia artemisiifolia was significantly reduced in the variants treated with 480 g/l bentazone. The lowest control of this invasive species was achieved in the variant treated with 50% methyl thifensulfuron. Soybean yield correlated with the degree of control and had values ranging from 1550 kg/ha to 3159.67 kg/ha.

Key words: reduction, population, Ambrosia artemisiifolia, herbicide

INTRODUCTION

Soy was credited alongside barley, wheat, millet Holy plant (b. Zamfirescu, 1965, cited by Manea, 2006). The oldest reference to soy given Shows From the year 2838 B.C, written by Chinese Emperor Sheng-Nung. It grew mainly in China, spread to other countries in Asia, happened at the end of the 19th century. In Europe, although it was brought in the middle of the 18th century, its cultivation on smallarea only begins at the end of the 19th century, following the Vienna Agricultural exhibition in the year 1873.

In Romania, first attempts to introduce the culture of the soybean, dates since 1911 – 1913, failed due to the tardivity of the varieties. In the year 1931 they oververetaken experimentations using earlier varieties with satifying results.

Soy is considered a valuable culture, being useful for human nutrition, animal nutrition and industry. It is also a vegetable that contributes substantially to increasing the fertility of the soil, but can be the main raw material for obtaining bio-diesel (USA and Brazil) (Rusu, 2018).

Soy, being a small-middle-waist plant, is easily competed by weeds, which produce large production losses (30-80%), sometimes even compromising culture (Rusu, 2016). It is a sensitive culture to weeding, the critical period being in the early stages of growth. The most common weeds encountered in soy culture are those with late spring germination (classification by biological criterion).

In the last ten years, in the western part of Romania, the invasive species *Ambrosia artemisiifolia* is increasingly common in soybean culture.

Ambrosia artemisiifolia L. is an annual weed, which belongs to the *Asteracea* family and is native to North America (Dickerson and Sweet, 1971; Coble et al., 1981). This weed has spread being present on and other continents: Asia, Australia and Europe (Ştef, 2017).

In Europe, it was introduced for the first time in the 19th century (Brandes and Nitzsche, 2007). Expanding species *Ambrosia artemisiifolia* it has been delayed, but since the mid-twentieth century it has become a harmful species in several Eastern European countries and Central Europe (Chauvel et al. 2006; Brandes and Nitzsche 2007; Dullinger et al. 2009; Smolik et al., 2010; Richter et al., 2012).

Studies conducted so far show that *Ambosia artemisiifolia* is an invasive species with a negative impact on agriculture, human health and biodiversity. (Brandes and Nitzsche 2007; Essl, Dullinger and Kleinbauer 2009; Vilà et al., 2010; Ziska et al. 2011; Bullock et al., 2012).

The main problem of this plant is the production of pollen with a strong allergen character, which generates huge medical costs and a reduced quality of life among the allergic population (Fumanal et al., 2007), a single plant can produce, on average, approximately 1 billion pollen grains (Fumanal, Chauvel and Bretagnolle 2007).

Ambrosia artemisiifolia it has also became a major weed in European agriculture, especially in spring-drilled crops such as sunflower, maize, sugar beet and soybeans (Ştef, 2017).

Ambrosia artemisiifolia successfully competes crop plants in respect to light, water and nutrient substances in the soil, producing direct losses. Competitiveness is also given by morphological characters being a plant that can grow to 2 m in height (Bassett and Crompton, 1975; Clewis and Colab., 2001), producing even 62 000 seeds (Dickerson and Sweet, 1971) that can remain viable in the soil for 39 years (Bassett and Crompton, 1975).

Coble et. al. (1981) reported that four plants of *Ambrosia artemisiifolia* to 10 m^{-1} reduced soy yield by 8%. Similarly, Shurtleff and Coble (1985) and Weaver (2001) reported that 1.6 plant *Ambrosia artemisiifolia*/m^{-1} reduced soy yield by 12 and 11% respectively.

It is clear from the foregoing that the need to combat species *Ambrosia artemisiifolia*, both agro-ecosystems and ecosystems.

Research carried out by Byker H. et al., 2018 showed that by applying preemergence herbicide (PP) (2.4-D, saflufenacil/dimetenamid-P, linuron and metribuzin) reduced the population density of *Ambrosia artemisiifolia* from soy culture of 82% - 94% and 55%, respectively - 89%. They (Byker H. et. al., 2018) notes that the eradication of the species can reach 97% - 99% and 93% - 98%, respectively, if a PP herbicide followed by fomesafen applied as post emergence is applied.

Metribuzin applied to 824 and 1015 g.a.i. $ha^{(-1)}$ controlled *Ambrosia artemisiifolia* 90% to 4 and 8 weeks respectively after application.

Prosulphuron, clopyralid, mesotrione controls *Ambrosia artemisiifolia* from the corn crop in the proportion 90% (Hodişan N., 2008).

Chemical control of the species *Ambrosia artemisiifolia* became more difficult because its populations developed resistance to ALS inhibitors in the US in 1998, to FTA and protoxinhibitors in the state of Delaware in 2005 (Béres et. al., 2006).

Studies in Soy GR (glyphosate-resistant) showed that 37 species of weeds became resistant to glyphosate (Heap, 2017), among them being mentioned and *Ambrosia artemisiifolia* (Béres and colab., 2005; Ganie and Jhala, 2017).

In Romania, chemical control methods have not been developed sufficiently to eradicate *A. artemisiifolia* from soy culture. Therefore, the work aims at testing postemergent applied herbicides in reducing the population of *Ambrosia artemisiifolia.*

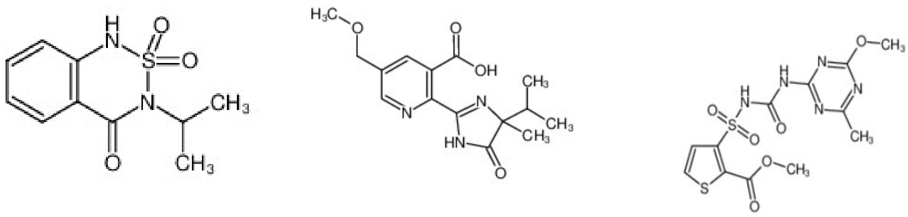
MATERIAL AND METHOD

Trial, reducing the population of *Ambrosia artemisiifolia*from the soybean culture, it was placed in Folea, a distance of 73 km from the municipality of Timisoara, Timiş County.

Soy was drilled on April 23, 2018, at a density of 55 gg (germinable grains)/m^2. The experiment was conducted using the randomized blocks method with 5 treatments in four repetitions. The plot was L/W-10 m/3.0 m. In reducing the population of the common ragweed, four herbicides were applied: Corum (applied with the adjuvant DASH-HC), Listego, Basagran SL, Harmony 50 SG (applied with Trend as adjuvant).

Fig. 1. The geographical location of the experimental field

The treatments were applied POST (postemergent), when soy plants were in the BBCH stage 13-15 (leaf trifoliate) with the recommended dose of the manufacturing company. Herbicides used in the experience are part of the following chemical groups: imidazolinone, sulfonyluretics, benzothiadiazine (Figure 2). For comparison, a control that has not been treated has been included.



Bentazone Imazamox Thifensulfuron-methyl

Fig. 2. Chemical structure of active substances use in species control *Ambrosia artemisiifolia* (https://www.molbase.com/moldata/28480.html)

In the day, before of application of herbicides, the degree of weeding in each variant was established.

Following application of herbicides, observations were made on efficacy in reducing the population of *Ambrosia artemisiifolia* L. and it was determined yield obtained.

RESULTS AND DISCUSSION

In recent years, in Romania, the species *Ambrosia artemisiifolia*, it is in a continuous expansion, being increasingly common in agricultural cultures, which is also revealed in figure 3. That plays the percentage of participation in soy culture.

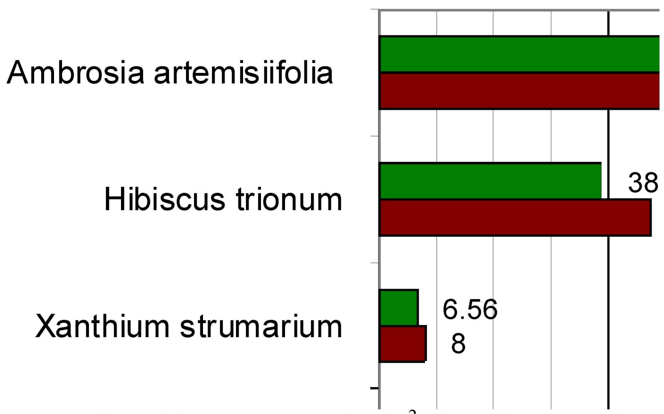


Fig. 3. Graphical representation of the average number/m^2 of weeds per species, present in the control variant (non-herbicidated)

The untreated variant presented a degree of weeding 122 plants/m^2. In the experimental variants, the present species were: *Echinochloa crus galli*, *Xanthium strumarium, Hibiscus trionum, Ambrosia artemisiifolia* (Figure 3.). It is noted that *Ambrosia artemisiifolia* showed the highest percentage of participation (50.82%). The species *Hibiscum trionum* was present in the experimental variants with a percentage of 38.80%, registering a number of 47.33 plants/m^2. The species *Echinochloa crus galli* showed the lowest percentage of participation.

From the data presented in table 1 it can be observed that by post-em application of the treatments, when the soybean plants were in the BBCH 13-15 growth stage, reductions in the degree of weeding with *Ambrosia artemisiifolia* were in the range 71.5 - 93.25%

By applying the substances imazamox s.a. 20-40 g/ha (Listego) and thifensulfuron-methyl sa6 g/ha (Harmony 50 SG), acting as inhibition of acetolactate synthase (ALS), an 85% and respectively 71.5% control of *Ambrosia artemisiifolia* species was obtained.

The results recorded by Hodişan N. et al. (2008) with Béres et al. (2005) claim that the active substance imazomax controls *Ambrosia artemisiifolia* from pea, soybean, sunflower crops if applied in optimum period (2-4 leaves) and under optimum conditions (temperature of 15-20°C and humidity).

The control of the species *Ambrosia artemisiifolia* from the plots treated with bentazone 960 g/ha increased to 93.25%. The bentazone substance reduced the common ragweed population by inhibiting photosynthesis - photosystem II.

The population of *Ambrosia artemisiifolia* was reduced by 90.5% in the plots where the herbicide Corum associated with the DASH-HC adjuvant was applied.

Table 1

The effect of herbicides on the population of *Ambrosia Artemisiifolia* present in soybean culture, 30 days after application

Herbicide/adjuvant (active ingredient)	Trade Name	Content of in a.i..	Dose		Control *A. artemisiifolia* (%)
			Commercial product	a.i.	
Untreated Control	-	-	-	-	0.0
Imazamox + Bentazone	Corum + Dash-HC	22.4 g/l 480 g/l	1.9 L/ha + adjuvant (DASH-HC)	955 g/ha	90.50***
Imazamox	Listego1.0 l/ha	40 g/l	1.0 l/ha	20-40 g/ha	85.0***
Bentazone	Basagran SL 2l	480 g/l	2.0 l/ha	960 g/ha	93.25***
Tiphensulfuron – Methyl	Harmony 50 SG 0.012 kg/ha + Trend 0.1	50%	0.012 kg/ha + 0.1% Trend 90	6 g/ha	71.50***

The studies performed by Hager, A. et al., 2015 reported a control of the species *Ambrosia artemisiifolia* of 95-97% by applying the substance bentazone 560 g/ha. Similar results were reported by Hodişan N. et al. (2015), Béres et al. (2005), Hager A. et al. (2015) regarding the effectiveness of herbicides used in the control of the species *Ambrosia artemisiifolia* from soybean culture.

The research carried out so far, highlights the importance of applying pre-plant, pre-em and post-em herbicides as well as adjuvants to increase the effectiveness of the substances in reducing the degree of weeding, of agricultural crops, with *Ambrosia artemisiifolia*

The most used active substances for post-emergence application are:

- For dicotyledonous weeds and some annual monocotiyedones: imazamox,
- For annual dicotyledonous: bentazone, thiofensulfuron-methyl;

The lowest production of soybean was obtained in the untreated control (1550 kg/ha) and in the plots treated with thifensulfuron - methyl a.i. 6 g/ha (2370 kg/ha). The application of 960 g/ha bentazone active substance brought the highest production increase (203.85 kg/ha).

Use of herbicide Corum brought a very significant production increases (194.73 kg/ha), by reducing the population of *Ambrosia artemisiifolia* up to 90%.

Table 2

Herbicide efficacy on soybean production

Herbicide/ adjuvant(active ingredient)	Trade name	Dose	Yield kg/ha	Relative yield	Absolute yield
Untreated	-		1550	100	0
Imazamox + Bentazone	Corum + Dash-HC	1.9 l/ha + adjuvant (DASH-HC)	3018.33***	194.73	1468.33
Imazamox	Listego1.0 l/ha	1.0 l/ha	2695.67***	173.91	1145.67
Bentazone	Basagran SL 2l	2.0 l/ha	3159.67***	203.85	1609.67
Thifensulfuron-methyl	Harmony 50 SG 0.012 kg/ha + Trend 0.1	0.012 kg/ha + 0.1% Trend 90	2370***	152.90	820

DL 5% = 77.57; DL 1% = 112.84; DL 0.1% = 169.25

CONCLUSIONS

The results of this study show that by post-emergence application (BBCH 13-15) herbicides (Corum + Dash-HC, Listego 1.0 l/ha, Basagran SL 2l, Harmony 50 SG 0.012 kg/ha + Trend 0.1), *Ambrosia artemisiifolia* is effectively controlled. Most herbicides tested in this study were effective, controlling 71.5% - 93.25% of the common ragweed. Soybean yields were correlated with the effectiveness of herbicides.

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