FOLIAR AND STEM CHEMICAL CONTROL OF THE INVASIVE SPECIES *AILANTHUS ALTISSIMA* FROM PASTURES

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Keywords: Ailanthus altissima, glyphosate, Roundup

ABSTRACT

The present paper presents the results of the chemical foliar control research of the species Ailanthus altissima. In the shrubs sprayed on the foliar apparatus, the effect was 100%, only where the solution reached the leaves, and in the tops of the trees where the solution did not spread, the leaves were not affected, having a normal vegetation. It should be noted that this method applied by spraying the foliar apparatus did not affect other shrubs in the vicinity, only the treated herbicide had an effect on those treated. In conclusion, the herbicide had its effect only where it came in contact with the leaves, the rest of the leaves not being affected. In those injected with a herbicide dose of 4 ml / cm in the diameter of the tree (15 cm in diameter corresponds to a dose of 60 ml pure herbicide) at a distance of 30 cm above the ground, the herbicide made its effect 100%, these shrubs drying completely. They were also affected, in addition to those injected a no. of 10 and 12 trees, respectively, on a perimeter of 10 m^2, but not entirely, the foliar apparatus being affected 70-80% of the foliage and at the same time new shoots of approx. 30-40 cm long, and the tendency of herbicidal trees to regenerate after approx. 35 days.

INTRODUCTION

Tree-of-heaven, Ailanthus altissima (Mill.) Swingle, is endemic to central China, where it grows in six provinces. It was brought to Europe in the early 17th century. Tree-of-heaven grows to 20–25 m tall, usually with a low trunk and a broad crown. Its decorative qualities include very large, odd-pinnate leaves, flowers and yellow- or red-colored fruits borne in panicles. It is a valuable ornamental tree for cultivation in urban areas. Its soil requirements are modest; it can grow in dry, low fertility, and transformed anthropogenic soils with a high admixture of rubble. It often sows itself and regenerates

in places where other plants are unable to grow. It displays an excellent ability to adapt, also to the difficult urban and industrial conditions continually changing under the human impact. Research carried out in the cities of Central and Southern Europe, has shown tree-of-heaven to be a kenophyte whose time of introduction is easy to establish, and whose expansion occurred over the last 50 years. In Central European cities the distribution of tree-of-heaven was determined with reference to the level of area development. An assessment was made of the ability of the tree to grow in habitats showing a specified degree of human impact, or its hemeroby. Tree-of-heaven classified as a thermophilic species, i.e., growing the warmest areas in many Central European cities (Bonciu Elena, 2019; Bonciu Elena., 2020; Paraschivu Mirela and Cotuna Otilia, 2021; Partal Elena and Paraschivu Mirela, 2020; Bąbelewski P. and Czekalski M, 2005).

Invasive species are recognized as one of the main threats to European forests, especially at regional level. One of the most dangerous alien trees all around the world is *Ailanthus altissima* (Mill.). *A. altissima* has a wide ecological range, due to its very high growth rate, effective reproductive and dissemination systems, and general lack of natural enemies in its secondary range. For these reasons *A. altissima* can compete effectively against the native flora in disturbed and degraded sites, such as roadsides and other urban areas. *A. altissima* has also invaded natural habitats, along forest edges and open gaps especially in the presence of anthropic disturbance. For instance, occasional fires favors *A. altissima* spread because of its impressive capacity of resprouting by injured stumps and superficial roots. In addition to damaging ecosystems, *A. altissima* causes serious problems for forest management because it competes directly with the woody species of sylvicultural interest and makes forest utilization more difficult and expensive. Under favorable conditions, *A. altissima* can form almost pure stands, which obviously reduce biodiversity and change the abiotic characteristics of the ecosystems, including the chemical and physical characteristics of the soil. Within only a few years after its initial invasion and in the absence of appropriate control, this fast-growing tree makes the recovery and restoration of native vegetation extremely difficult. For these characteristics, *A. altissima* is considered a fast-growing and contamination resistant species (Badalamenti, E., and T., La Mantia, 2013; Velea Liliana et al., 2021; Durău Carmen Claudia et. al., 2021).

MATERIAL AND METHOD

The experiment was located in the same perimeter where such research was conducted in 2020 to control this species, by injecting the total systemic herbicide Roundup, based on glyphosate, directly into the stem of the tree in specially made holes, with the drill . (SALCEANU C. et. al., 2020).

This year, we continued with another method to control this species, namely, spraying dilute herbicide + water solution on the foliar device, in the amount of 400 ml of herbicide per 10 l of water. The herbicidal active substance glyphosate has a total systemic action, in the sense that it affects the protein metabolism of the plant, leading, depending on the amount absorbed by the plant, to its death (Dobre M., 2019). Roundup herbicide has a concentration of 360 g / l glyphosate. The time required for the herbicidal active substance to take effect is about 3 weeks. The experiment was performed on a number of 10 trees. The spraying was carried out on May 15, 2021. The moment of application of the herbicidal solution coincided with the maximum development phase of the foliar apparatus. It should be mentioned that this tree begins to grow in spring, in the first decade of March, depending on the weather conditions of that year. The minimum temperature threshold for the start of vegetation of this species is about 8-100C. The application of the herbicidal solution on the foliar apparatus of the trees was done using a portable spraying equipment. Observations on the effect of herbicide application on the foliar apparatus were made 3 weeks after herbicide application, using the European Weed Research Council (EWRC) scale.

Figure 1. Aspect from foliar application of the herbicide

RESULTS AND DISCUSSIONS

Observations on the effect of foliar application of the herbicide Roundup, based on glyphosate, on the species Ailanthus altissima were made 3 weeks after the date of application of the herbicide, respectively, on 21.06.2021. To quantify the herbicidal effect, the EWRS scale was used to assess the degree of control. This scale is shown below.

Table 1

EWRC (European Weed Research Council) scale for assessing the control effectiveness of herbicides on weeds

Mark	Control (%)	Description
1	100	total control
2	99.0-96.5	very good control
3	96.5-93.0	good control
4	93.0-87.5	medium control
5	87.5-80.0	lower than medium control
6	80.0-70.0	unsatisfactory control
7	70.0-50.0	unsatisfactory control
8	50.0-1.0	unsatisfactory control
9	1.0-0.0	no control
10	100	total control

Three weeks after the application of the herbicide, it was observed that where the leaves came in contact with the herbicidal solution, the effect was 100% control, in the sense that the leaves were completely dry. It should be noted that, where the herbicidal solution did not reach, the foliage was not affected at all, which proves that the active ingredient acted only where it had contact with the leaf, although the herbicide is systemic. Due to the height of the trees, it was not possible to apply the herbicidal solution on their top, which represents about 30% of the volume of the canopy.

Table 2

The evaluation of the chemical control of A*ilanthus altissima* trees by applying Roundup total systemic herbicide (glyphosate 360 g/l). by foliar application. in 2021

Tree number	Tree height. cm	Tree diameter. cm	EWRC mark	Description
1	350	5.0	1	Total control
2	280	3.5	1	Total control
3	450	6.2	4	70 % control
4	670	10.4	6	40 % control
5	258	3.0	1	Total control
6	470	12	5	50 % control
7	640	8.3	7	30 % control
8	720	12.0	9	10 % control
9	365	5.3	2	90 % control
10	720	12.5	9	10 % control

Figure 2. Aspects of observations on the effect of Roundup herbicide (glyphosate) on Ailanthus altissima trees. It is observed that the tops of the trees are not affected because the herbicidal solution did not reach the foliage from a height of over 350 cm.

Given that the species *Ailanthus altissima* has one of the fastest vegetative growths among invasive species, of about 3 cm per day, the foliar application of the total systemic herbicide Roundup should be done until it reaches a height of about 3.5 m. This is necessary in order to be able to spray the herbicidal solution on the entire canopy of the tree. Above this height of the trees it is necessary to use mechanical spraying equipment, with higher pressure. Under these conditions, the neighboring crops, be they orchards, vineyards, field crops, pastures, hayfields, etc. will be affected by the herbicide. We recommend that, in this type of application; first of all, avoid spraying in time with strong wind and before the rains that contribute to the washing of the herbicidal solution on the plants. Also, a protective strip with a width depending on the height of the trees and the wind speed (at least 25 m) must be

considered. For these reasons, we recommend applying the herbicide solution in quiet, windless, sunny weather, due to the danger of being carried by the suspended herbicide particles by the wind.

Following the observations made, after applying the treatment, we determined that new sprouts appeared from the roots of the trees. It should be noted that the root of this species can reach 50 m, from it growing several trees that have the ability to regenerate if the treatment is not applied to the entire infested area. Other features that determine the invasive nature of this species are:

- the huge number of seeds that a single tree produces, of about 1 million;
- preservation of seed germination during winter and in case of immersion in water;
- ability to adapt to all types of soil, including sandy, calcareous or rocky soils;
- very high density per unit area determined by the high percentage of sprouting and the high germination capacity of the seeds.

Figure 3. Aspect in the experimental field demonstrating the invasive nature of *Ailanthus altissima*

The very intense, aggressive, invasive regeneration rhythm that this species shows determines the difficulty of eradication. For this reason, it is necessary to repeatedly apply non-selective

systemic treatments in order to make the control of this species more efficient.

CONCLUSIONS

1. The species Ailanthus altissima is native to Asia and has an invasive character, proliferating on all soil types in our country.
2. The invasive character is determined by the high germination capacity of the seeds, the large number of seeds per tree, the preservation of the germination capacity, the high percentage of dredging and the capacity to adapt to all types of soil.
3. The experiment shows that this invasive species can be radically controlled only by performing several treatments with total systemic herbicide during the vegetation period (May - September).

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