

Research Concerning the Behavior of *Sempervivum* Plants under Treatments with Herbicides

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Abstract. The research conducted focused on determining the behavior of *Sempervivum montanum* plants when treated with herbicides. Six products were used with the following commercial names: Fusilade, Select, Pantera, Goal, Afalon Premiant. From each herbicide were prepared three solutions of different concentrations (0.2%, 0.1%, 0.05%). With these solutions the *Sempervivum montanum* plants were sprayed. The effects on the plants were observed after 10-14 days. By determinations was established the number of plants fatally affected, partially affected and unaffected. The research results shows that herbicides applied at a concentration of 0.2% are harmful to *Sempervivum montanum* plants, but in a very variable amount depending on the herbicide. The most powerful harmful effects was observed in treatment with Goal herbicide. Definitive recommendations can not be made, for this further research is required.

Keywords: *Sempervivum*, herbicides, Fusilade, Pantera, Select, Goal, Afalon, Premiant.

INTRODUCTION

Sempervivum plants have become in our country, too, an essential elements in arrangement of green spaces. They are used with other ornamental plants, but more commonly are found alone in green areas like rocks arrangement, green roofs, green walls, flower stands, etc (Mitchell, 1973; Zaharia, 2007; Zaharia, 2010).

It is known that *Sempervivum* plants are highly resistant to extreme temperatures, both negative and positive, as well as strong insolation and drought and the soil requirements are very low (Britton, 1903; Clausen, 1940; Fournier, 1936; Zaharia, 2007; Zahary, 1980).

Given these characteristics, *Sempervivum* plants have a long lifespan, more than 7-10 years, acting as perennial plants and are very appreciated. But very often, the viability of these plants is affected by the emergence of weeds in the crops. They compete in terms of soil nutrients and having a taller waist will suffocate them by shading, causing in this way their death (Zaharia, 2010).

To counter these unwanted plants, mono and dicotyledonous, annual or perennial, it is sometimes difficult to achieve, even manually. This explains the fact that in certain situations, green spaces planted mainly with *Sempervivum* plants, deteriorates after only 2-3 years after being established.

These frequent situations led to organize the research concerning the behavior of *Sempervivum* plants when are in contact with some herbicides that are used in weed control.

MATERIALS AND METHODS

For the experiment were used *Sempervivum montanum* plants. Plants were grown in pots. Fusilade, Select, Pantera, Goal, Afalon and Preminat were used as herbicides (Tab. 1).

Each of these products has been used in three concentrations 0.2%, 0.1% and 0.05%, and the resulting solutions were sprayed on the plants.

Tab. 1

Active substance and some features of the studied herbicides

No.	Commercial name	Active substance	Other characteristics	Recommended dose
1.	Fusilade	fluazifop-p-butyl 150g/l	systemic, postemergent, removes annual and perennial grasses, (Poaceae) including Cockspur (<i>Echinochloa crus-galli</i>);	1,0-1,5 l/ha
2.	Select	cletodim 120 g/l	removes annual monocotyledonous weeds and Cockspur (<i>Echinochloa crus-galli</i>);	0,6-2,0 l/ha
3.	Pantera 40 EC	quizalofop-p-tefuzil 40 g/l	removes annual and perennial grasses;	0,8-2,0 l/ha
4.	Goal 2 XL	oxifluorfen 240 g/l	removes broad-leaved weeds and annual grasses ;	1,0-2,0 l/ha
5.	Afalon 50 SC	linuron 450 g/l	removes dicotyledonous weeds and some of the monocotyledonous weeds;	1,0-2,0 l/ha
6.	Premiant	dicamba 100 g/l + acid 2,4 d 300 g/l	removes annual and perennial dicotyledonous weeds;	1,0 l/ha

(Source: www.pestcontrol-expert.ro)

The experiment was bi-factorial, where factor A represent the herbicide (6 items) and factor B – the concentration with three variants.

Experience has a total of 18 variants in three replication each. The treated plants were *Sempervivum montanum* and were grown in pots.

Observations and measurements. When the experiment was organized the plants were measured to determine their size, to assess further effects caused by the applied herbicides. During the ensuing period, determinations were made on the effects of herbicides on plants, establishing their level of viability and decorative appearance.

The results were statistically processed, presented in tabels and interpreted in text.

RESULTS AND DISCUSSIONS

***Sempervivum montanum* plants behavior to treatment with herbicides.**

Sempervivum montanum plants used to organize the experiment were uniform in terms of development. Rosettes diameter values ranged between 9.0 cm and 10.5 cm, and the number of leaves was between 45 and 58 arranged in 5-6 rows in a spiral. Some of the plants had even new baby rosettes. In each variant were followed 10 plants in three replications (a total of 30 plants).

The effect of the treatment was observed after a period of 10 to 15 days, it had a different intensity depending on herbicide and concentration (Tab. 2). Absolute values in the table represent the mean of the replications.

The treatment with herbicides on plants of *Sempervivum montanum* manifested at some variants, by changing the color of the leaves from green to green - yellow, then brown, and the consistency of the leaves was lost they become soft and then dried.

If this aspect spread to the young leaves from the center of the rosette then the plant had dried completely. If the phenomenon was limited to leaves detached from central sprout, the plant survived and recovered after a short period.

Analyzing the data in Table 2 it can be seen that in all cases have been recorded plants lethally affected in variable numbers, except for V4-5-6 where the used herbicide was Select. The highest number of affected plants was recorded under treatment with Goal and Afalon

0.2%, herbicides that are used to control dicotyledonous weeds.

Applying statistical calculation of analysis of variance, was found that the differences from control, considered the mean of the experiment, was statistically assured from significant to very significant. Note, however, that the positive sign in this case is not desirable, the advantage being variants with the negative sign or without signification.

Regarding the results on the number of plants affected or partially affected, it appears that the best values are recorded in the treatment with Select and Premiant herbicides followed by Pantera and Fusilade. This time a positive significance is desirable. Negative results are variants tested with Goal and Afalon 0.2%.

Tab. 2

Experimental results on the treatment of *Sempervivum montanum* plants with different herbicides in different concentrations

No.	Variant Herbicide and active substance	Letaly affected plants				Partially affected or unaffected plants			
		No.	%	± d	Significance of difference	No.	%	± d	Significance of difference
1.	Fusilade 0,2%	1,7	100,0	-	-	8,3	100,0	-	-
2.	Fusilade 0,1%	1,3	76,5	-0,4	-	8,7	104,8	0,4	-
3.	Fusilade 0,05%	0,7	41,2	-1,0	-	9,3	112,0	1,0	-
4.	Select 0,2%	-	-	-1,7	0	10,0	120,5	1,7	*
5.	Select 0,1%	-	-	-1,7	0	10,0	120,5	1,7	*
6.	Select 0,05%	-	-	-1,7	0	10,0	120,5	1,7	*
7.	Pantera 40 EC 0,2%	1,3	76,5	-0,4	-	8,7	104,8	0,4	-
8.	Pantera 40 EC 0,1%	0,7	41,2	-1,0	-	9,3	112,0	1,0	-
9.	Pantera 40 EC 0,05%	0,3	17,6	-1,4	0	9,7	116,9	1,4	*
10.	Goal 2 XL 0,2%	5,7	335,3	4,0	***	4,3	51,8	-4,0	000
11.	Goal 2 XL 0,1%	5,4	317,6	3,7	***	4,6	55,4	-3,7	000
12.	Goal 2 XL 0,05%	3,3	194,1	1,6	*	6,7	80,7	-1,6	0
13.	Afalon 50 SC 0,2%	4,7	276,5	3,0	***	5,3	63,9	-3,0	000
14.	Afalon 50 SC 0,1%	1,7	100,0	-	-	8,3	100,0	-	-
15.	Afalon 50 SC 0,05%	-	-	-1,7	0	10,0	120,5	1,7	*
16.	Premiant 0,2%	1,3	76,5	-0,4	-	8,7	104,8	0,4	-
17.	Premiant 0,1%	-	-	-1,7	0	10,0	120,5	1,7	*
18.	Premiant 0,05%	-	-	-1,7	0	10,0	120,5	1,7	*
19.	Mean of the experiment (Control)	1,7	100,0	-	-	8,3	100,0	-	-

DL 5% - 1,27
 DL 1% - 1,94
 DL 0,05% - 2,53

Analyzing the unilateral influence of herbicide (Tab. 3) it can be observed that the highest number of letaly affected plants is recorded in treatment with Goal. On the other variants, Select and Premiant, the number of affected plants is less than the control, and on the following variants the number is very close to the control.

If it was analyzed the number of unaffected plants, it appears that the best results are recorded in the variants Select and Premiant followed by Fusilade, Afalon and Pantera. Negative results were obtained when using Goal herbicide.

Tab. 3

Summary of experimental results on the behavior of *Sempervivum montanum* plants,
on treatment with herbicides under the influence of the active substance

Variant		Letaly affected plants				Partially affected or unaffected plants			
No.	Herbicide and active substance	No.	%	± d	Significance of difference	No.	%	± d	Significance of difference
1.	Fusilade fluazifop-p-butil 150g/l	1,23	72,3	0,47	-	8,77	105,6	0,47	-
2.	Select cletodim 120 g/l	-	-	-1,7	00	10,0	120,5	1,70	**
3.	Pantera 40 EC quizalofop-p-tefuzil 40 g/l	0,77	45,3	-0,93	-	9,23	111,2	0,93	-
4.	Goal 2 XL oxifluorfen 240 g/l	4,80	282,3	3,10	***	5,20	62,7	-3,10	000
5.	Afalon 50 SC linuron 450 g/l	2,13	125,3	0,43	-	7,87	94,8	-0,43	-
6.	Premiant dicamba 100 g/l + acid 2,4 d 300 g/l	0,43	25,3	-1,27	0	9,57	115,3	1,27	*
7.	Mean of the experiment (Control)	1,70	-	-	-	8,30	-	-	-

DL_{5%} - 1,12
 DL_{1%} - 1,78
 DL_{0,05%} - 2,38

Regarding the influence of concentrations (Tab. 4) note that the highest number of plants that have died as a result of treatment with herbicides is on 0.2% concentration and is decreasing at below concentrations 0.1% and 0.05% respectively.

The differences from the control are significantly positive for 0.2% concentration and distinct significantly negative for 0.05% concentration.

Tabel 4.

Summary of experimental results on the treatment of *Sempervivum montanum* plants with different herbicides under the influence of concentrations

Variant		Letaly affected plants				Partially affected or unaffected plants			
No.	Herbicide and active substance	No.	%	± d	Significance of difference	No.	%	± d	Significance of difference
1.	0,2%	2,45	144,1	0,75	*	7,55	91,0	-0,8	(0)
2.	0,1%	1,52	89,4	-0,18	-	8,48	102,2	0,2	-
3.	0,05%	0,72	0,42	-0,98	00	9,28	111,8	-1,0	***
4.	Mean of the experiment (Control)	1,70	100,0	-	-	8,30	100,0	-	-

DL_{5%} - 0,68
 DL_{1%} - 0,83
 DL_{0,05%} - 1,02

In conclusion the *Sempervivum montanum* plants, under the treatment with the studied herbicides, are letaly affected in a higher number for concentrations of 0.2% than at lower concentrations of 0.1% and 0.05%.

With this conclusion, recommandation of using herbicide in 0.1% and 0.05% concentrations can not be made, because it is not know if this concentrations will remove weeds in the *Sempervivum* crops.

Analyzing the number of unaffected plants by treatment with herbicides, results from the same Table 4, shows that the variants sprayed with a solution of 0.2%, had a lower number than the control and those of lower concentrations (0.1% and 0.05%).

CONCLUSIONS

The first research on the behavior of *Sempervivum* sp. plants under treatment with herbicides led to the following conclusions:

1. *Sempervivum montanum* plants react differently to treatment with herbicides. Thus, undesirable aspects of lethaly affected plants were registered for the use Goal herbicide. The number of dead plants is directly dependent with the concentration used. At a concentration of 0.2% the effect is stronger and occurs with greater frequency. In the present research the percentage of dried out plants is: 33% (conc. 0.05%), 54% (conc. 0.1%) and 57% (conc. 0.2%).

2. Out of the used herbicides, those for annual and perennial grass weeds (Select, Pantera and Fusilade) were less harmful to *Sempervivum* plants. There is hope that further study will determine doses and concentrations that do not affect *Sempervivum* plants, but do remove Poaceae weeds from crops.

3. With the current knowledge there cannot be made safe recommendations regarding the use of herbicides for weed control in *Sempervivum* crops.

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