RESEARCH REGARDING THE INFLUENCE OF THE DRAINAGE AND THE FERTILIZATION ON *SEMPERVIVUM* PLANTS CULTIVATED IN POTS

CERCETĂRI PRIVIND INFLUENȚA DRENAJULUI ŞI A FERTILIZĂRILOR ASUPRA PLANTELOR DE *SEMPERVIVUM* CULTIVATE ÎN GHIVECE

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Abstract. *The research has been focused on the behaviour of Sempervivum montanum plants, grown in pots, to which were applied three graduations of fertilization and drainage. The purpose of the research was to determine the need for an asset drainage that ensures that the excess water is eliminated. On the other hand it was aimed at establishing the effect of fertilizer application to ensure normal growth and development of crops in a limited substrate volume and nutrient reserves. The results established that the variants which the drainage were unsatisfactory, water accumulated in excessive quantities, so the plants had suffered and eventually died, but the plants couldn't be saved even if they were taken from the harmful culture medium. The second factor applied proved to be beneficial, but the effect did not lead to significant differences. These results lead to the conclusion that Sempervivum plants are not demanding of the physico-chemical characteristics of the soil if drainage is performed properly.*
Keywords: sempervivum, excess water, drainage, fertilization

Rezumat. *Cercetările au vizat comportarea plantelor de Sempervivum montanum cultivate în ghivece la care s-au aplicat trei graduări de fertilizare şi de drenaj. Scopul cercetărilor a fost de a stabili necesitatea realizării unui drenaj activ, care să asigure eliminarea excesului de apă. Pe de altă parte s-a urmărit stabilirea efectului aplicării unor fertilizanți care să asigure o creştere şi o dezvoltare normală a plantelor cultivate într-un substrat limitat ca volum şi rezerve ale elementelor nutritive. Rezultatele au stabilit că variantele la care drenajul a fost nesatisfăcător, apa s-a acumulat în cantități devenite în exces, iar plantele au suferit şi în final au pierit, fără a putea fi salvate nici dacă au fost schimbate din mediul de cultură nociv. Al doilea factor aplicat s-a dovedit a fi benefic, dar efectul nu a condus la realizarea de diferențe semnificative. Aceste rezultate conduc la concluzia că plantele de Sempervivum nu sunt pretențioase la însuşirile fizico-chimice ale solului, dacă este realizat drenajul corespunzător.*
Cuvinte cheie: *Sempervivum, exces umiditate, fertilizare*

INTRODUCTION

In many parts of the world especially in western europe *Sempervivum*

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plants are known and appreciated for their herbal qualities (Abram et al., 1995, Blozovics et al., 1994), but especially as ornamental plants (Coste, 1937, Murfitt, 1998), due to their varied but pleasant aspect as well as their high resistence to environmental factors, which facilitates the use of these plants in different places, many unsuitable for other plants (Zaharia, 2010).

The studies concerning these plants target especially their therapeutical qualities and on a much smaller scale the technological factors used in their cultivation. Considering these facts it has been considered a good opportunity to study and establish the effect of some technological factors on *Sempervivum* plants (Zaharia, 2007, Zaharia et al., 2010, Zaharia, 2010). In this study water drainage and fertilization were taken into consideration.

MATERIAL AND METHODS

The biological material used in the experience consisted in plants of *Sempervivum montanum*. The plants had the same size and age.

The culture substrate consisted of soil low in nutrients, with a sandy texture. Depending on the experimental variant the soil was enriched with Multicare, a complex fertilizer that contains macroelements as well as microelements (S, B, Fe, Mn, Zn etc.).

Table 1

Data concerning the characteristics of the experimental variants and the plant rosettes used in organizing the *Sempervivum montanum* experience

Variants		Quantity of fertilizer kg/m^3	Rosettes			
Nr.	Content		Nr.	Diametre (cm)		
				Min.	Max.	Average
1.	Drainage with fine sand + unfertilized soil **(control)**	-	35	2,5	4,2	3,6
2.	Drainage with fine sand + fertilized soil 1/2 dose	3,0	35	2,8	4,4	3,9
3.	Drainage with fine sand + fertilized soil 1 dose	6,0	35	3,0	4,2	3,8
4.	Without drainage + unfertilized soil	-	35	2,9	4,6	3,6
5.	Without drainage + fertilized soil 1/2 dose	3,0	35	2,7	4,4	3,5
6.	Without drainage + fertilized soil 1 dose	6,0	35	3,1	4,5	3,9
7.	Gravel drainage + unfertilized soil	-	35	2,9	4,2	4,0
8.	Gravel drainage + fertilized soil 1/2 dose	3,0	35	3,0	4,1	3,8
9.	Gravel drainage + fertilized soil 1 dose	6,0	35	3,5	4,1	3,6

The pots used for plant cultivation were in a shape of a truncated cone. Their dimensions are 5 cm top diametre and 3 cm lower diametre, with a hight of 5 cm and

a volume of 64 cm^3. The organized experience had two factors. In the experience the effect on plant behavior under the influence of fertilizer and drainage quality was studied.

After the organization of the experience conditions of exces water were created to highlight the effect of drainage. This was done by a daily application of 10 ml of water to each plant.

The experience lasted 21 days. After this period several observations were made concerning plant viability and size.

RESULTS AND DISCUSSIONS

Throughout the research it was determined that some plants modified their appearence by becoming yellowish in color, and eventually loose their plant structure and become mothery. This phenomenon appeared differently for each variant. The determinations concerning the number of plants that were not affected by exces water, and maintained their viability are presented in table 2.

Table 2

Experimental results concerning *Sempervivum montanum* plant rossetes under the influence of drainage and basic fertilization after 21 days

Variants		Viable rossettes at the end of the experience			± d No.	Significance of difference
Nr.	Content	Nr.	%	% to the control		
1.	Drainage with fine sand + unfertilized soil **(control)**	27,2	77,7	100,0	-	-
2.	Drainage with fine sand +fertlized soil 1/2 dose	30,1	86,0	110,6	2,9	-
3.	Drainage with fine sand + fertilized soil 1 dose	29,4	84,0	108,0	2,2	-
4.	Without drainage + unfertilized soil	3,1	8,8	11,3	-24,1	000
5.	Without drainage + fertilized soil 1/2 dose	2,3	6,5	8,4	-24,9	000
6.	Without drainage + fertilized soil 1 dose	4,6	13,1	16,9	-22,6	000
7.	Gravel drainage + unfertilized soil	32,4	92,5	119,1	5,2	*
8.	Gravel drainage +fertilized soil 1/2 dose	33,5	95,7	123,1	6,3	**
9.	Gravel drainage + fertilized soil 1 dose	32,7	93,4	120,2	5,5	*

$LSD_{5\%} = 4,17$
$LSD_{1\%} = 5,76$
$LSD_{0,1\%} = 6,52$

Analyzing the results in table 2 it can be observed that plants that were compromised in a large percent (30-32 plants) came from the variants with no

drainage (V_4, V_5, V_6) regardless of substrate fertilization. The results of these variants compared to the control (V_1) register negative differences between 22,6 and 24,9, values that are statistically ensured as very significant. Comparing the results of V_7 and V_9, both with a gravel drainage, with the control it can be observed that the differences are positive, statistically ensured as significant (V_7 and V_9) and distinctly significant (V_8).

The results presented in table 2 were obtained by statistic processing typical for the study of a combined influence of the 2 factors.

The results of the statistic process of the unilateral influence of the factors are presented in the fallowing.

Table 3

The synthesis of experimental results concerning the viability of *Sempervivum montanum* plant rossettes grown in pots under the influence of drainage

Variants		Viable rossettes at the end of the experience		±d No.	Significance of difference
Nr.	**Content**	**Nr.**	**%**		
1.	Fine sand drainage **(control)**	28,9	100,0	-	-
2.	Without drainage	3,3	1,1	- 25,6	000
3.	Gravel drainage	32,9	113,8	4,0	*

$LSD_{5\%}$ = 3,8
$LSD_{1\%}$ = 4,9
$LSD_{0,1\%}$ = 6,2

The experimental results of the unilateral effect of drainage are presented in table 3. The results have very different values, especially the variant without drainage, which registered heavy plant loss compared to the variants with drainage.

The difference between the control and the variant without drainage is 25,6, statistically ensured as significantly positive. The difference between the variant with gravel drainage and the one with fine sand drainage is of 4 plants, a value statistically ensured as significantly positive.

Based on these results the conclusion that can be drawn is that the lack of drainage lead to an exces of water, to which the *Sempervivum montanum* plants showed a high sensibility, a fact that lead to the death of the plants in 5-7 days. The statistical analysis of the results of the unilateral influence of fertilization on *Sempervivum montanum* plants resistence to moisture excess lead to the conclusion that the supply of nutrients, regardless the administered amount, does not influence significantly the plant behavior concerning plant resistence to moisture excess.

The viable rossettes were biometrically measured to establish the possible changes. The diametre and hight of rossettes were measured. The results confirmed that in the experimental period changes occured concerning rossette

size, changes that were different for each variant. Analyzing the 2 variables (hight and diametre) it was considered that they were insuficiently relevant for the determination of plant growth and so the measurement was continued by establishing the mass of the plants. The obtained results are presented in table 4.

Table 4

Experimental results concerning rossette size of *Sempervivum montanum* plants grown in pots under the combined influence of drainage and fertilization

Variants		Rosettes size		±d g	Significance of difference
Nr.	Content	g	%		
1.	Drainage with fine sand + unfertilized soil **(control)**	10,3	100,0	-	-
2.	Drainage with fine sand +fertilized soil 1/2 dose	12,5	121,3	2,2	*
3.	Drainage with fine sand + fertilized soil 1 dose	19,8	192,2	9,5	***
4.	Without drainage + unfertilized soil	7,4	71,8	-2,9	0
5.	Without drainage + fertilized soil 1/2 dose	9,5	92,2	-0,8	-
6.	Without drainage + fertilized soil 1 dose	12,1	117,4	1,8	-
7.	Gravel drainage + unfertilized soil	11,2	108,7	0,9	-
8.	Gravel drainage + fertilized soil 1/2 dose	14,3	138,8	4,0	**
9.	Gravel drainage + fertilized soil 1 dose	20,1	195,1	9,8	***

$LSD_{5\%}$ = 2,17
$LSD_{1\%}$ = 3,86
$LSD_{0,1\%}$ = 5,28

To establish the plant mass the rossettes were cut at ground level and weighed.

Analyzing the results from the table and comparing them with the control it can be observed that the variants without drainage, unfertilized or fertilized with half a dose have a lower mass. The other variants, with drainage and fertilized, show an increase in mass, the differences compared to the control being positive and statistically ensured as significant (V_2), distinctly significant (V_8) and very significant (V_3 and V_9).

Based on these results the conclusion that can be drawn is that the plants of *Sempervivum montanum* are not indifferent to the culture conditions especially to the nutrient supply of the soil.

CONCLUSIONS

The undertaken research established that:

1. *Sempervivum* plants show a high sensitivity to water exces (the soil is

soaked in water, wet to marshy).

2. In conditions of water exces the plants suffer from biodegradation that affects all the leaves from the rossette and the plants eventually die.

3. The duration of biodegradation and eventually death is of 5 to 7 days from the infliction of water exces.

4. The application of fertilizers on a soil that lacks nutrients influences the evolution of *Sempervivum* plants in a positive way. The quantity of fertilizer applied to the substrate is of 3 to 6 kg for 1 m^3 of culture substrate.

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