INFLUENCE OF THE RIZOGENE SUBSTANCES ON ROOTING AND ON BIOCHEMICAL COMPOSITION OF *PELARGONIUM PELTATUM* PLANTS

INFLUENȚA UNOR SUBSTANȚE RIZOGENE ASUPRA ÎNRĂDĂCINĂRII ŞI ASUPRA COMPOZIȚIEI BIOCHIMICE LA PLANTELE DE *PELARGONIUM PELTATUM*

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Abstract. *The present researches were focused on the effect of stimulating products on the rooting process of the cuttings on various specific substrates and on post rooting morphological development in Pelargonium peltatum plants. Also, some biochemical parameters were analyzed to show if the substances used to stimulate rooting influence the biochemical composition of leaves formed on shoots. Rooting percentage values and morphological indicators were minimal in untreated cuttings (control plants). The maximum percentage of rooting cuttings and the highest number of leaves on the shoot was determined in stimulated variants. The stimulation of the roots growth determined an increased accumulation of dry matter in the leaves, so that also the content in proteins and lipids registered high values in the analyzed leaves.*
Keywords: rooting stimulators, *Pelargonium*, rooting substrate, biochemical composition

Rezumat. *Prin prezentele studii s-a urmărit identificarea comparativă a efectului unor produse stimulatoare (rizogene) asupra procesului de înrădăcinare pe difertite substraturi specifice şi evoluția postînrădăcinare la butaşii de Pelargonium peltatum. De asemenea, au fost analizați unii parametri biochimici pentru a evidenția dacă stimulatorii de înrădăcinare influențează compoziția chimică a frunzelor nou formate pe lăstari. Valorile procentului de înrădăcinare şi ale indicatorilor morfologici determinați au fost minime în cazul butaşilor netrataţi (plantele martor). Cel mai mare procent de înrădăcinare şi cel mai mare număr de frunze pe lăstar a fost determinat în cazul variantelor tratate cu stimulatori. Stimularea creşterii rădăcinilor a determinat o creştere a acumulării de substanță uscată în frunzele formate, deci şi a conținutului în proteina brută şi în lipide totale.*
Cuvinte cheie: stimulatori de înrădăcinare, substrat de înrădăcinare, Pelargonium, compoziție biochimică

INTRODUCTION

Plant propagation is through flower, seeds and vegetative. Currently known and used many types of vegetative propagation, but the most common is the

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cuttings method, based on the ability of vegetative organs (or parts of organs) for delivering roots and form a new individual.

Ability propagation by cuttings depends on the species, stock type, and environmental factors (Bhekithemba, 2010). To improve the training process there are used some different rooting stimulators that enhances and speed the rootedness process. By using these substances to enhance the penetration of water and treated portions become centers of attraction of nutrients. Products on the market are different forms: powder, gel, solution.

Genus Pelargonium includes over 170 species, originating in South Africa. One of the most decorative species is *Pelargonium peltatum*, known as „the flowing geranium", much appreciated thanks to the spectacular flowering in many colors. Very popular, it provides the setting balconies, terraces, windows and gardens throughout the summer (Amăriuței and Zamfir-Vâşcă, 2010).

The present researches were focused on the effect of stimulating products on the rooting process of the cuttings on various specific substrates and post rooting morphological development of the new plants.

Also, some biochemical parameters were analyzed to show if the substances used to stimulate rooting influence the biochemical composition of leaves formed on shoots. Thus, were determined: dry matter content accumulated in the leaves, crude protein content and total lipid and assimilatory pigments content in leaves (chlorophylls and carotenes).

MATERIALS AND METHODS

In order to estimate the effect of stimulating products on the rooting process and after rooting of *Pelargonium peltatum* were studied plants from the cuttings cultivated on different specific substrates in the greenhouses USAMV Bucharest, during February-March 2011.

As rooting stimulators, which constituted the experimental variants, were used: V_1-Clonex (gel, powerful formula of hormones, vitamins and mineral nutrients); V_2-Coralite (powder containing vitamin A, B complex, vitamins C, D, E, amino acids, trace elements); V_3-Radistim (powder, rooting stimulant). The control variant (Vm) cuttings were not treated.

The biological material consisted of the shoot tip cuttings with standard sizes of 6-7 cm long, harvested from mother plants of *Pelargonium peltatum*.

After trimming, the cuttings were treated with listed rizogene substances. Thus prepared cuttings were distributed on two types of classical rooting substrates: peat (100%) and peat mixed with perlite (50% +50%). For each experimental variant were selected 10 rooting cuttings by for each type of substrate.

Throughout the rooting cuttings were maintained in greenhouse multiplier, where they were provided the same conditions in terms of environmental factors (temperature, humidity, light).

After rooting were made observations and measurements on rooted cuttings on: the percentage of rooting, main root length, main shoot length, number of leaves on the vine.

Also, measurements of the biochemical parameters were made in the *Pelargonium* leaves using proper biochemical methods (Iordachescu, 1988):

- The investigations of *chlorophyll and carotenoid pigments* were performed spectrophotometrically, after extraction in 80% acetone, at 663 nm, 646 nm and 470 nm wavelength. The results were calculated with Mackiney formula and were expressed in mg/100 g fresh weight.
- *Dry mass content* was gravimetrically determined with a thermoscales.
- Determination of the content in *crude protein* was made after the digestion of the vegetal material by Kjeldahl method. The content in total nitrogen was measured by volumetrical method and converted in crude protein content.
- Content in *total lipid* was determined using the Soxhlet method: total fat was extracted in petroleum ether; then, the solvent was evaporated at 35ºC using a rotary evaporator; finally, the lipid content of samples was determined gravimetrically.

All measurements were related to the dry matter content.

RESULTS AND DISCUSSION

1.Study of rooting process and of morphological development post rooting

The rooting percentage for the control variant (Vm), untreated cuttings, was between 50% on peat and 66,67% on peat+ perlite, which are the lowest amounts (tab. 1).

Table 1

Summary of the experimental results

Experimental variants	Rooting substrates							
	Peat+ perlite				Peat			
	Rooting percentage (%)	main root length (cm)	main shoot length (cm)	number of leaves on the shoot	Rooting percentage (%)	main root length (cm)	main shoot length (cm)	number of leaves on the shoot
V_m	66,67	12,33	8,40	3,70	50,00	6,50	9,40	4,16
V_1	100,0	18,40	9,66	8,00	100,00	7,50	11,60	6,40
V_2	100,0	14,50	8,66	5,30	83,33	7,00	12,50	5,20
V_3	100,0	20,20	13,0	6,20	83,33	19,50	13,00	6,25

The best results (100%) were registered in V_1 (Clonex), on both cultivation substrates. In V_2 (Coralite) and V_3 (Radistim) the results were identical, 100% in peat+perlite substrate and 83,33% in peat substrate. Regarding rooting substrate, the best results were obtained for peat+perlite.

The main shoot length of control plants also had the lowest (8,4 cm) on peat+ perlite and 9,4 cm on peat. Cuttings treated with Radistim had the highest length of shoots (13 cm) the same for both substrates. The Clonex variant registered values ranged from 9,66 cm (peat + perlite) to 11,6 cm (peat). Values of 8,66 cm (on peat+perlite) and 12,5 cm (on peat) were recorded at Radistim

variant. Lengths of shoots were higher for cuttings rooted in peat than those rooted in peat+ perlite.

Number of leaves per shoot for the control variant was 3,7 in peat+perlite and 4,16 in cuttings rooted on peat. The highest number of leaves per shoot was observed in Clonex variant, both on peat+perlite (8) and on peat (6,4). The values reached by the Coralite and Radistim variants were similar for both rooting substrates.

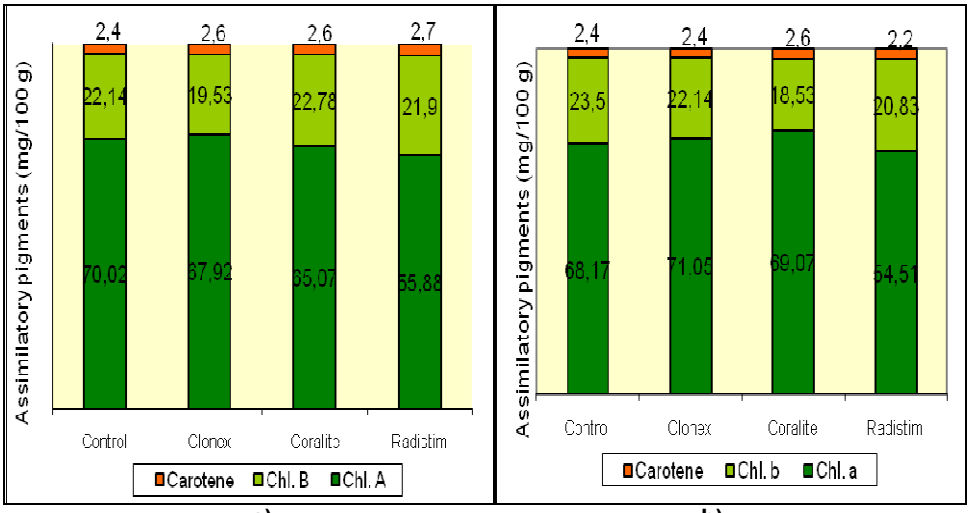
2.Study of biochemical parameters in the *Pelargonium* leaves in all experimental variants

The leaves content in chlorophyll is maximal in growth period of the plants because its role played in the process of photosynthesis.

The researches performed indicated that the content in chlorophyll in the leaves was not influenced by the rooting substrate, nor by the used stimulators. So, the obtained results (fig. 1) showed that content in chlorophyll *a* registered similar values at the control plants (70,02 mg/100 g chlorophyll *a* on perlit+peat as rooting substrate and 68,17 mg/100 g chlorophyll *a* on peat) comparing to the plants which received stimulatory treatments with Clonex and Coralite (between 65,07–71,05 mg/100 g chlorophyll *a*).

Generally, the values of the assimilatory pigments content determined in the leaves of stimulated plants were comparable in all the variants except for the plants treated with Radistim, which registered lower values of the content in chlophyll *a* (55,88 and 54,51 mg/100 g) on both rooting substrates

In all the studied variants the amount of chlorophyll *a* was higher that chlorophyll *b* in the leaves tissues, the ratio chlorophyll *a*/chlorophyll *b* varied between 2,5–3,4 at the plants cultivated on peat+perlite and between 2,6–3,7 at the plants cultivated on peat.



a) **b)**

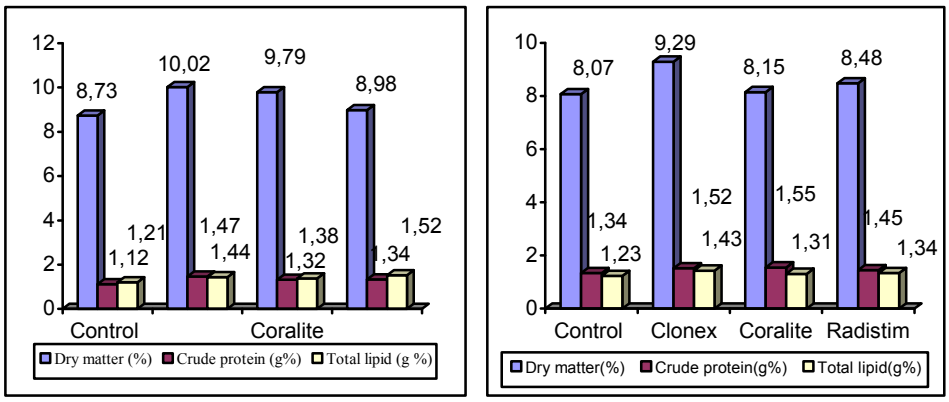
Fig. 1 - Content in assimilatory pigments at the variants cultivated on peat +perlite (a) and on peat (b)

Also the synthesis of the carotenes was not influenced by the stimulatory treatments of the roots. The differences between values of carotenes registered at the plants treated with roots stimulators and at the control plants were not significant: in average 2,4 mg/100 g carotenes registered at the control plants compare with 2,5 mg/100 g carotenes in the stimulated plants.

According to the literature, the plants use water and mineral compounds absorbed by the roots from the soil in order to biosynthesize its own organic compounds (Burzo, 2005). Thus, the amount of biochemical compounds in leaves may be influenced by the developing stage of the plant roots (Denny, 2001).

The results of the researches indicated that the stimulation of the roots growth determined an increased accumulation of dry matter in the leaves, so that also the content in proteins and lipids registered high values in the analyzed leaves (fig. 2).

Although the differences between the stimulated variants were not significant, the plants treated with Clonex registered the highest values of the analyzed parameters. At the plants cultivated on peat+perlite 1,47 g% crude proteins and 1,44 g% total lipids were determined in the Clonex variant compare with 1,32 g% crude protein and 1,38 g% total lipids in the Coralite variant. Also at the variants that used peat as rooting substrate were registered better results at the Clonex variant: 1,52 g% crude protein and 1,43 g% total lipids.



a) **b)**

Fig. 2 - Content in biochemical parameters at the variants cultivated on peat+perlite (a) and on peat(b)

The accumulation of biochemical compounds was also influenced by the rooting substrate, so that the plants cultivated on peat+perlite registered a higher content in dry matter in all analyzed variants. In the leaves of control plants was determined 8,73% dry matter at the variant cultivated on peat+perlite compare with 8,07 % dry matter at the variant cultivated on peat. The plants treated with stimulators reached 9,59% dry matter in average on peat+perlite and 8,64% dry matter in average on peat.

CONCLUSIONS

The results obtained in the researches performed indicated that the treatment with rooting stimulators of the *Pelargonium peltatum* plants influenced the rooting process and the morphological and biochemical features of the plants in post rooting period:

- Rooting percentage values and morphological indicators were minimal in untreated cuttings (control plants); the maximum percentage of rooting cuttings and the highest number of leaves on the shoot was determined in Clonex variants.
- The main root length was highest in Radistim variants.
- Treatment with Clonex influenced the growth of shoots: the highest values were noticed on peat+perlite as rooting substrate; on peat the treatment with Coralite determined the best results.
- Treatment of the plants with root stimulators did not influenced the content in assimilatory pigments of the leaves.
- The stimulation of the roots growth determined an increased accumulation of dry matter in the leaves, so that also the content in proteins and lipids registered high values in the analyzed leaves. However, the differences between the stimulated variants were not significant.
- The accumulation of biochemical compounds was also influenced by the rooting substrate: the plants cultivated on peat+perlite registered a higher content in dry matter in all analyzed variants.

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