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## **PRODUCTION OF CHRISTMAS ROSE YOUNG PLANTS FROM SEEDLINGS DURING ONE VEGETATION SEASON**

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[ABSTRACT](#)  
[INTRODUCTION](#)  
[MATERIALS AND METHODS](#)  
[RESULTS](#)  
[DISCUSSION](#)  
[CONCLUSIONS](#)  
[REFERENCES](#)

### **ABSTRACT**

The aim of work was to investigate the possibility of producing young white Christmas rose plants of commercial value from seedlings during one vegetation season. One, two, three, four, or five seedlings each were planted in containers and then cultivated according to commonly accepted rules.

In autumn the quality of young plants was evaluated by determining the weight of plants tops and roots, number of leaves, length of leaf petioles, and length of roots. The effect of wintering young plants in the open air or in the cold glasshouse on their quality was also evaluated on the basis of fresh weight of leaves and roots, and the leaf blade area.

The obtained results show that young Christmas rose plants of commercial value can be produced during 14 weeks from planting with four or five seedlings planted in one container. Young plants kept in a cold greenhouse during the winter show a better quality than those kept in open air.

**Key words:** christmas rose, number of seedlings, young plants

## INTRODUCTION

A serious challenge is currently posed to Polish nurserymen: they should efficiently compete with importers of ornamental plants from the countries of Western Europe where the gardeners have an incomparably greater financial and technological potential at their disposal. In these conditions an urgent need arises to develop such technologies in nursery production, which would ensure obtaining plants of the best quality at the possibly lowest costs.

The christmas rose is a valuable perennial while its supply is still insufficient owing to the troublesome and non-efficient vegetative reproduction of these plants. The aim of the present study was to obtain transplants of this ornamental during one vegetative season, the time of pricking out the seedlings being taken into consideration.

## MATERIALS AND METHODS

Christmas rose seedlings were grown from seeds harvested from plants selected by the investigator. In one-factor experiments the variables were the numbers of plants pricked to a container. In the years 1997 and 1999 1, 2, 3, 4, or 5 seedlings each were pricked. In a successive year when it was found by the end of the vegetation season that the young plants composed of one or two seedlings had no commercial value, these two combinations were discarded.

In 1997 the experiment lasted for the period June 3-September 1. The seedlings were pricked into cells 6 cm in diameter in multipot trays filled with peat substrate, pH 7. From June 15 to July 30 12.5 ml of 0.1% fertilizer Florovit was poured, every two weeks in each cell of the tray. A further experiment was conducted from June 21 to September 27, 1999. The seedlings were pricked to cells of multipot tray 5.5 cm in side length, filled with peat substrate containing 30 mg N, 60 mg P, 250 mg K, and 150 mg M in  $1 \text{ dm}^{-3}$ , of the salinity  $\text{EC} = 0.65 \text{ mg}\cdot\text{cm}^{-1}$  and pH 6.8. The substrate was enriched with Osmocote Plus Mini fertilizer at the dose of  $2 \text{ g dm}^{-3}$ . In a successive experiment conducted from June 29 to October 5, 2001 the seedlings were pricked to square pots  $0.25 \text{ dm}^{-3}$  in volume with a mixed substrate of Pluggtorv peat, leaf mould, and perlite at the ratio of 4:2:2. Osmoform fertilizer was added at the dose of 3 g per  $1 \text{ dm}^{-3}$  of the substrate.

The treatments comprised 120 plants each; the experiment being conducted in 4 replications of 30 plants each. In 1997 the seedlings were additionally pricked into 160 cells in multipot trays in each of the five treatments.

The plants were cultivated according to the generally accepted rules [3]. The quality of young plants was estimated by determining the fresh matter of leaves and roots. In 1999 and 2001 the number and length (cm) of leaves and the length (cm) of roots were also determined. In 1997 the evaluation was carried out on the 1<sup>st</sup> of October. 160 pots, additionally pricked from each object in 1997, were used in an experiment concerning the effect of the place of wintering on the quality of christmas rose young plants. From each treatment 80 pots, covered with nets used for shading, were left outdoors in the open air or transferred to an unheated greenhouse. The quality of young plants was estimated in April 1998 determining the fresh matter (g) of leaves and roots and the area ( $\text{cm}^2$ ) of leaf blade surface.

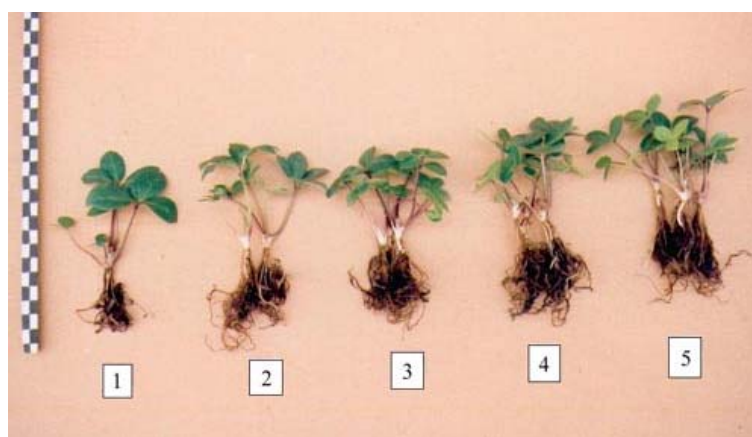
The results of the experiments were statistically evaluated using the method of analysis of variance for one-factor experiment, using the Student t test at the significance level of 0.05. The results of the experiment with the wintering place of transplants only were statistically verified using analysis of variance for the experiment with two variables.

## RESULTS

The quality of christmas rose young plants improved with the growing number of seedlings pricked to pots ([table 1](#) and [figure 1](#)).

The results of the experiment conducted in 1997 show that the weight of leaves increased with the number of seedlings in one cell of a multipot tray ([table 1](#)). In 1999 and 2001 the weight of plant tops of the young plants obtained from four or five seedlings did not differ, exceeding that found in the case of three seedlings in a container. The number of leaves in the young plants increased with the number of seedlings in a single cell. In 2001 the shortest leaves were recorded in the case of young plants obtained from one seedling pricked to a pot, the longest leaves being noted when five plants were used. However, in 2001 an increased density of seedlings in a container did not affect the length of leaves in the young plants ([table 1](#)).

**Figure 1. Quality of young plants depending on the number of christmas rose seedlings grown in one pot**



**Table 1. Effect of the number of christmas rose seedlings grown in one container on the quality of plant tops**

Number of seedlings in one pot	Fresh weight of leaves, g			Number of leaves		Length of petioles, cm	
	1997	1999	2001	1999	2001	1999	2001
1	1.3 a*	3.4 a		5.3 a	-	9.5 a	-
2	2.4 b	4.4 b		8.9 b	-	10.6 ab	-
3	3.2 c	6.0 c	5.7 a	12.6 c	13.9 a	11.6 b	13.5 a
4	3.6 d	6.9 cd	7.1 b	15.9 d	17.9 b	10.9 b	13.7 a
5	4.3 e	7.0 d	6.9 b	20.1 e	20.3 c	13.0 c	13.5a

\*Means in columns marked with the same letters do not differ significantly

**Table 2. Effect of the number of seedlings grown in a container on the quality of underground parts of christmas rose plants**

Number of seedlings in one pot	Fresh weight of roots, g			Length of roots, cm	
	1997	1999	2001	1999	2001
1	3.0 a*	2.4 c	-	8.2 a	-
2	3.1 a	2.4 c	-	9.7 b	-
3	4.7 bc	2.1 b	2.6 b	9.8 b	12.7 a
4	5.3 c	2.1b	2.5 b	16.1 c	12.3 a
5	3.9 b	2.0 a	1.8 a	9.1 b	11.4 a

see [table 1](#)

In 2-years of the experiment the lowest weight of fresh matter of the root system was found in the case of planting five seedlings of christmas rose in one pot ([table 2](#)). A greater weight though not differing between the combinations, was found with pricking three or four seedlings in one pot. In 1999 young plants obtained from planting four christmas rose seedlings in one pot developed the longest roots. In 2001 no differences were noted in the length of roots in young plants obtained with planting three to five seedlings into the pots.

The place where the young plants were wintered in a varied measure affected the quality of the above- and underground parts of christmas rose young plants ([table 3](#), [figure 2](#)).

**Figure 2. Quality of christmas rose young plants depending of wintering in the open air (left) or in the cold greenhouse (right)**

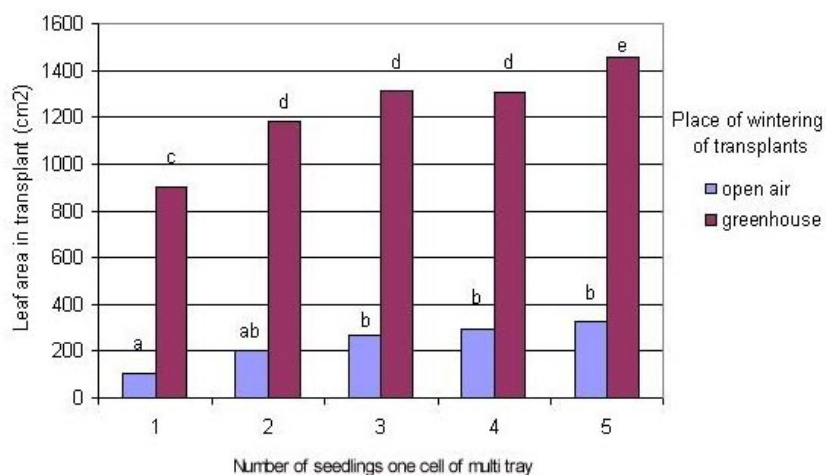


In young plants placed in the glasshouse the fresh matter of plant tops was greater, then in the open air irrespective of the number of seedlings in one cell of a multipot tray though the quality of the root system was poorer (table 3). It was only when one seedling was placed in a cell of the multipot tray that the fresh matter of roots was the same in young plants stored in the greenhouse and in the field. The young plants composed of five seedlings in a pot and wintered outdoors produced the greatest fresh weight of roots. It is worth noting that the quality of the above- and underground parts of young plants wintering in open field was poorer in spring than that found during the estimation conducted in autumn (cf. table 1 and table 2 from the year 1997).

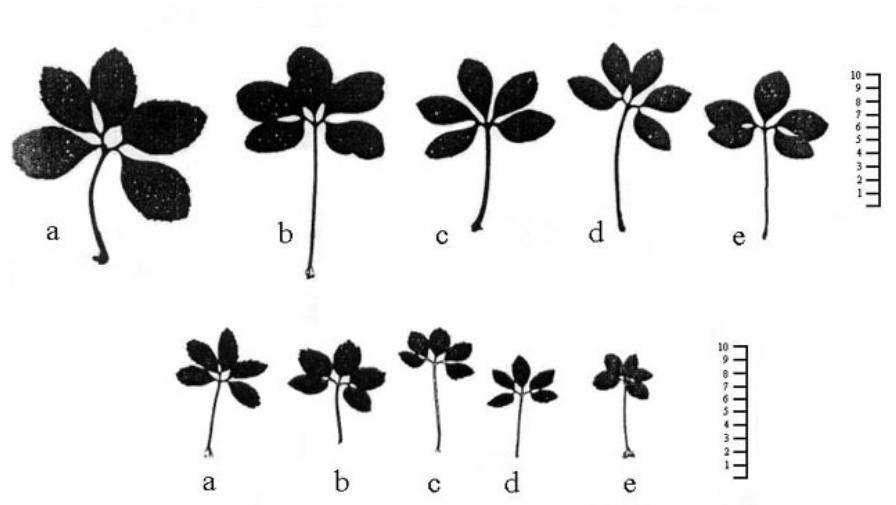
**Table 3. Effect of the number of seedlings in one pot of a multipot tray and of the place of wintering on the quality of christmas rose young plants (evaluation April 1998)**

Number of seedlings in one pot	Fresh weigth, g			
	leaves		roots	
	open air	greenhouse	open air	greenhouse
1	0.9 a*	5.2 e	1.5 a	1.5 a
2	1.7 b	7.4 f	2.6 cd	1.5 a
3	2.1 bc	9.4 g	3.0 de	1.6 a
4	2.3 c	9.0 g	2.9 de	1.8 ab
5	3.1 d	7.5 f	3.2 e	2.2 bc

**Figure 3. Effect of the number of seedlings in one cell of a multipot tray and of the place of wintering on the size of leaf blades in christmas rose young plants**



**Figure 4. Leaf area in christmas rose young plants depending on the place of wintering with pricking seedlings to cell of a multipot tray: a – one seedling, b – two seedlings, c – three seedlings, d – four seedlings, e – five seedlings; upper row – young plants wintering in an unheated greenhouse, lower row – young plants wintering in open air**



The total area of leaf surface was smaller in plants kept outdoors during the winter in comparison with those placed in the greenhouse (figure 3). Of the christmas rose young plants grown in the greenhouse these composed of five seedlings showed the largest total surface of leaves; the young plants of two, three, or four seedlings had smaller leaf areas not differing between each other. In young plants wintering in the open field the leaf area did differ in cells of multipot trays containing three, four, or five seedlings. However, the data in figure 4 show that an increasing total area of leaf blades was accompanied by a smaller size of single lobes constituting the leaf blade of christmas rose.

## DISCUSSION

With the passage of time plants vegetatively propagated for a longer period can undergo degeneration owing to infections and virus diseases. In this case the simplest method of obtaining plants suitable for further production is to use selected seeds. Seedlings grown from seeds are usually planted singly. The aim of the present investigation was to find if marketable young plants of christmas rose could be produced during one vegetation season, the time from the pricking of seedlings being taken into consideration. Additionally, the effect of wintering plants outdoors or in an unheated greenhouse on the quality of christmas rose young plants was evaluated.

Christmas rose seedlings were pricked into cells of a multipot tray or in single pots. With the pricking of one seedling the smallest fresh weight of plants tops was recorded, the young plants showing no commercial value. The weight increased with an increasing number of seedlings in a container. In the two-year study the same result was obtained with pricking four or five seedlings while the greatest number of leaves was recorded in the case of five seedlings placed in pots of a multipot tray or in single pots. The produced young plants were marketable. According to Lemper [2] the young plants develop 7-8 leaves within 16-30 months of sowing. In the present experiment the young plants obtained from 4 seedlings had about 17 leaves within three months after pricking and these from 5 seedlings – 20 leaves. Moreover, 31% plants had 1 flower bud set, 10% – 2 buds, and 3% – 3 buds. Thus, after a short period of growth the quality and marketability of young plants for planting in the field were very good. A further experiment should check if after a successive year of growth the young plants were suitable for forcing. According to Lemper [2], christmas rose is ready for this aim only after 3-4 years of growing. The fresh weight of plant tops and abundant leaf canopy are important parameters in evaluating the quality of plants and their commercial value. On this basis the pricking of five seedlings to one container seems most appropriate. However, analysis of the quality of the root system – a very important parameter of quality evaluation – shows that the young plants obtained from five seedlings produced the lowest fresh weight of roots. In one year of the investigation the longest roots were produced christmas rose young plants obtained from four seedlings planted in a container. In a year of the investigation no effect of the number of seedlings (from 3 to 5) on this trait was determined. However, in evaluating the quality of the root system its fresh weight seems more important than the length. The above- and underground part of christmas rose young plants being taken into consideration, the highest quality was found with planting four seedlings to a container not exceeding  $0.25 \text{ dm}^{-3}$

in volume. With five seedlings in a container the quality of the aboveground parts of plants was even better but that of the underground part poorer than with four seedlings pricked into a pot. With this number of seedlings pricked to a pot the young plants are marketable after a 14-week production cycle. If one seedling is pricked to a pot, the marketability of young plants can be only achieved after a two-year period [3] or after three year period [1] of growth. If the young plants were not sold in autumn, their wintering in an unheated greenhouse would be beneficial for their quality. This measure heightens production costs to a considerable degree yet the quality of plants is much better in spring than in autumn. If the plants are kept in the field during the winter, their quality is poorer in spring since a part of leaves declines owing to unfavourable climatic conditions in that season.

## CONCLUSIONS

1. Christmas rose young plants of commercial value can be produced in a 14-week period from the time of pricking seedlings
2. Four or five christmas rose seedlings should be pricked in one pot, 0.25 dm<sup>3</sup> in volume.
3. The best quality of plant tops was observed with five christmas rose seedlings in a container, and of underground parts – with four.
4. Christmas rose young plants kept in winter under covers show a better commercial quality in spring than in autumn while if they are left in the open air their quality deteriorates.

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