

# SOIL MOISTURE EFFECT ON THE GROWTH AND DEVELOPMENT OF SEEDLINGS SPECIES

## OF THE GENUS *RHODODENDRON* L. IN KIEV

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The results of experimental studies on the moisture provision of the soil substrate as one of the factors that affect the resistance of plants against drought by the example of the growth and development of annual planting rhododendrons introduced under Kyiv conditions are provided.

**Keywords:** *environmental characteristics, drought-resistance, soil moisture, seedlings, rhododendrons.*

The problem of studying the water schedule due to drought-resistance tree and shrub species is complex and distinctive as it covers a large group of plants that requires various conditions of growth and development. Although it has been studied by many researchers, namely P. Henkel [2] M. Gusev [3] T. Kozlovsky [6] M. Melik [8] Sleycher [11] and others, there are a lot of still unsolved issues, particularly concerning the classification of this group of plants according to their attitudes and adaptation to water schedule and drought-resistance as well as the choice of methods for determining these features.

Relevance of the work consists in the need to identify optimal soil moisture for rhododendrons seedlings.

The purpose of the research is to examine the characteristics of water treatment of rhododendrons seedlings in relation to their drought-resistance during the introduction in Kiev.

Material and studies methods. The object of the research is the species of the genus *Rhododendron* L introduced under Kyiv conditions. Research methodology is based on a systematic approach and specific methods such as environmental, ontogenetic, phenological.

Research results. The influence of soil moisture on the substrate characteristics of water schedule and the development of one-year seedlings of rhododendron under Kyiv conditions was analyzed while conducting survey.

With the decrease in water content such vital functions as photosynthesis and respiration are experiencing significant changes. Drought also affects the enzymatic system of woody plants. The minimum humidity on conditions that the possible vitality of plants is possible is different for different types of rhododendrons and is crucial for the distribution of species [2, 9, 10].

Relations to soil moisture are an important issue in studies of ecological characteristics of exotic species for delineating the limits of soil moisture which provide the normal functioning of plants. Effect of lack of soil moisture on the growth and development of growing rhododendrons was defined by experiments [12]. In the course of these experiments healthy one-year rhododendron seedlings nearly the same size were planted in the same vessel capacity (0,3 liters), which were filled with the substrate of one composition (gray forest soil, transitional peat, pine needles (2:1:1)). Substrate humidity was maintained at <30%, 30-50%, 50-70% and > 80%.

In embedded versions of the experiment a significant difference in the reactions and the rate of plant growth on the degree of wetting of the soil substrate was revealed. Due to the considerable lack of moisture and strong constant wetting of the substrate all plants immediately ceased to grow and soon after planting roots and aerial parts of plants were dying off totally.

Limitations of soil moisture to 30-50% quite depressed and slowed the growth immediately after the beginning of the experiment. Already in the early stages chlorosis of the leaf blades developed and in some cases complete destruction of plants was observed. However, some specimens that continued vegetation actually reached almost the same size of the plants that were grown under normal moisture levels (50-70%). This indicates a high ecological plasticity of species in general due to the process of adaptation to the extreme and stressful

situations and enables selective way of increasing the resistance of plants against drought.

Results of seedlings growing due to different degree of moisture of the soil substrate are shown in the table.

**Effect of soil moisture on the growth of seedlings of different species of rhododendrons**

| Variant of experiment                      | The degree of wetting of the soil substrate % | Characteristics of plants |                               |                             |                                    |
|--|---|---------------------------|-------------------------------|-----------------------------|------------------------------------|
|  |   | height, cm                | length of the root system, cm | air-dry weight of plants, g | number of shoots 1st order, units. |
| <i>Rh. japonicum</i> (A. Gray) Suring. (1) |   |                           |                               |                             |                                    |
| 1-1  | 1 (< 30%)                                     | –                         | –                             | –                           | –                                  |
| 2-1  | 2 (30–50 %)                                   | 7,2±0,2                   | 4,6±0,3                       | 5,32±0,6                    | 2                                  |
| 3-1  | 3 (50–70 %)                                   | 15,4±0,8                  | 12,5±0,4                      | 11,65±0,7                   | 1                                  |
| 4-1  | 4 (> 80 %)                                    | –                         | –                             | –                           | –                                  |
| <i>Rh. poukhanense</i> Levl. (2)           |   |                           |                               |                             |                                    |
| 1-2  | 1 (< 30%)                                     | –                         | –                             | –                           | –                                  |
| 2-2  | 2 (30–50 %)                                   | 5,6±0,15                  | 4,2±0,2                       | 4,43±0,35                   | 3-4                                |
| 3-2  | 3 (50–70 %)                                   | 10,4±0,23                 | 10,1±0,46                     | 7,98±0,21                   | 1-2                                |
| 4-2  | 4 (> 80 %)                                    | –                         | –                             | –                           | –                                  |
| <i>Rh. sichotense</i> Pojark. (3)          |   |                           |                               |                             |                                    |
| 1-3  | 1 (< 30%)                                     | –                         | –                             | –                           | –                                  |
| 2-3  | 2 (30–50 %)                                   | 8,6±0,12                  | 6,4±0,25                      | 5,88±0,62                   | 4-5                                |
| 3-3  | 3 (50–70 %)                                   | 17,5±0,56                 | 11,3±0,17                     | 11,20±0,21                  | 1                                  |
| 4-3  | 4 (> 80 %)                                    | –                         | –                             | –                           | –                                  |

In vessels with optimal soil moisture (50-70%) on average rates at the end of the vegetation period the seedlings of *Rh. sichotense* (17 cm) reached the greatest height and *Rh. poukhanense* (10 cm) reached the smallest height. Length of root systems of all types was almost of the same height and was 10-12 cm, but the average phytomass was higher in *Rh. japonicum* - 11,6 g and *Rh. sichotense* – 11,2

Plants *Rh. poukhanense* formed more shoots of first order (one or two), while *Rh. japonicum* and *Rh. sichotense* had only one shoot on conditions of the normal humidity. On conditions of the limited moisture there is a tendency of increasing the number of shoots of first order, but they are far behind in their development. Thus, when humidity is 30%, their number increased to two in *Rh. japonicum*, three or four in the *Rh. poukhanense*, four or five in *Rh. sichotense* (see table). This is because of the lack of moisture in the soil promotes the awakening of dormant buds. This finding corresponds to opinion of S.S.Pyatnytskogo (С. С. П'ЯТНИЦЬКОГО) [12], who believes that the deterioration of growth condition reduces cambium productivity and increases the number of buds that wake.

With a limited amount of moisture in the substrate (30-50%) seedlings of all species that were under research significantly reduced energy growth and the end of the vegetation were smaller. Thus, the difference between the increases in the aerial parts of the first and second variants was: *Rh. japonicum* - 8,2 cm, *Rh. poukhanense* - 4,8 cm, *Rh. sichotense* - 8.9 cm; between increments between root systems: *Rh. japonicum* - 7,9 cm, *Rh. poukhanense* - 5,9 cm, *Rh. sichotense* - 4.9 cm; between the masses: *Rh. japonicum* - 6,33 g, *Rh. poukhanense* - 3,55 g, *Rh. sichotense* - 5.32 g. From these rates it is clear that among the studied species most affected by the lack of moisture were *Rh. japonicum* and *Rh. sichotense* because the difference in increments of height and weight appeared to be greatest. Some of these rates are lower for *Rh. poukhanense*.

Also it was found that the lack of soil moisture leads to earlier yellowing and defoliation followed by reduction of the vegetation period, and also the difference between sufficient and insufficient moisture is quite significant and lasts 14 -17 days.

Reducing energy growth of seedlings due to the limited amount of moisture is a common phenomenon that can be explained by the fact that the water in the plant has a significant impact not only on physiological processes, but also operates mechanically. It affects the spreading of the cells. With water shortages sizes of all organs are reduced compared with the normal water supply. According to

P.A.Henkelya the negative effect of drought on cell growth is conditioned not only by inhibition of extension, but also by strong dehydration of the cytoplasm [2].

The improvement of water schedule of rhododendrons seedlings can be possible for growing plants of soil substrates with certain physical properties that ensure stability of the structure, a high buffer capacity, large porosity, allowing to provide sufficient aeration of root-inhabited zone.

In recent years substrates for growing rhododendrons are prepared from many natural materials, including acidic peat, pine and heather land, sphagnum moss, forest litter [1, 4, 5, 7]. For the selection of the substrates components it must be remembered that there are no standard components with once and for all given parameters pH and physical properties. In every area one should make up soil composition and it has several features that are interest for the experience. Also one should strive to bring their structure and properties according to the natural rhododendrons soils habitats during the selection of the components for the soil substrate

### **Conclusions**

1. Types of rhododendrons that were under research are medium demanding for soil moisture and better tolerate partial lack of moisture than its excess surplus, indicating their greater xeromorphy more than hydrophilicity.

2. Rhododendrons need regular moisture soil substrate at 50-70% degree and react strongly to the prolonged lack of soil moisture.

3. It is necessary to form soil substrates with components that can ensure stability of the structure, a high buffer capacity, greater porosity for adequate aeration, air and water are favorable properties for the formation of root-inhabited zone to maintain optimal water schedule.

4. Heavy loamy, clay, pure sand-textured soils are not suitable for growing rhododendrons.

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**ВПЛИВ ВОЛОГОСТІ ҐРУНТІВ НА РІСТ І РОЗВИТОК  
САДЖАНЦІВ ВИДІВ РОДУ *RHODODENDRON L.*  
В УМОВАХ М. КИЄВА**

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Наведено результати експериментальних досліджень щодо забезпечення вологості ґрунтового субстрату, як одного з факторів, що впливає на стійкість рослин проти посухи, на прикладі росту і розвитку однорічних саджанців рододендронів, інтродукованих в умови м. Києва

*Ключові слова: екологічні властивості, посухостійкість, вологість ґрунтів, саджанці, рододендрони*

**ВЛИЯНИЕ ВЛАЖНОСТИ ПОЧВ НА РОСТ И РАЗВИТИЕ  
САЖЕНЦЕВ ВИДОВ РОДА *RHODODENDRON* В УСЛОВИЯХ  
ГОРОДА КИЕВА**

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Предоставлены результаты экспериментальных исследований обеспечения влажности ґрунтового субстрата, как одного из факторов, влияющих на стойкость растений к засухе на примере роста и развития однолетних саженцев рододендронов при интродукции в условия г. Киева

*Ключевые слова: экологические свойства, засухоустойчивость, влажность почв, саженцы, рододендроны.*