

***Primula officinalis* results regarding plant organs and the influence of planting distance**

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Abstract The main objective of the current paper was the elaboration of an ecological technology for the species *Primula officinalis* Hill. The plants necessary for the establishment of the experiments for this species were brought in the spring of 2016 from the spontaneous flora of Braşov county. The research, from a biological point of view, aims to highlight the phenological stages of the plant, the formation of vegetative and generative organs, the development of the foliar apparatus, the initiation of flowering stems and flower buds, the seed formation. Different planting distances were tested, allowing the mechanization of maintenance works, correlated with the planting period corresponding to the climatic conditions of the Bârsa Depression, as well as to establish the optimal nutrition needs, the optimal spatial range for development and profitable production per hectare. The experiments were located in the experimental field of the National Institute of Research and Development for Potato and Sugar Beet Braşov, Technology Department, Laboratory of Medicinal and Aromatic Plants. The climate of the Brasov Depression is temperate-continental, characterized by the transition from temperate oceanic climate to temperate continental: wetter and cooler in mountainous areas, with relatively low rainfall and slightly lower temperatures in lower areas.

Key words

Primula officinalis,
technology, planting
distance, weight

Primula officinalis Hill. is a small plant, it is usually found in calcareous pastures, poor in nutrients, meadows or coastal dunes. It can also be found along forest edges and in open mixed forests of oak and beech [2].

Genetical *Primula officinalis* Hill. $2_n = 22$. Phylogenetically framed in *Querco-Fagetea*, *Arrhenatheretea* [3].

The botanical name of the genus *Primula* is the feminine diminutive of the Latin term "primus", meaning "first", referring to the flowering period and the epithet "veris" = spring. Popular names more common are: cuckoo's beak, eagle, buzzard, five bells, cuckoo's boot, bear's ear, sheep's tits, cow's tits [4].

Taxonomic, *Primula officinalis* Hill. specie is classified as follows:

- Kingdom: *Plantae*
- Subregnum: *Viridiplantae*
- Order: *Primulales*
- Family: *Primulaceae*
- Genus: *Primula*
- Species: *Primula officinalis* Hill. Sau *Primula veris* L. (<https://ro.wikipedia.org>).

Primula veris L. (synonymus with *Primula officinalis* Hill.) is an important medicinal plant, with documented use for the treatment of gout, headaches and migraines, since the Middle Ages. Triterpenoid saponins, found in the underground parts and flowers are used in the current phytotherapeutic treatment of

bronchitis and colds, due to their expectorant effects (LYSANNE et al., 2017).

Preliminary studies by MARCHYSHYN et al. (2015) showed that *Primula* contains polysaccharides, tannins, phenolic compounds (flavonoids), triterpene saponins, essential oils, organic acids, including ascorbic acid.

Primula officinalis Hill. it is characterized by lack of toxicity, with side effects that occur very rarely, covering a wide range of diseases, being recognized the effects of its application in herbal medicine. Phenolic compounds such as flavonoids and coumarin are highly valued [6].

BAŞBÜLBÜL (2008), found in a series of pharmacological studies that *Primula* extracts are rich in saponins, having antibacterial and antifungal effects.

Some *Primula* species are traditionally used to treat epilepsy and seizures [8].

Studies on the evolution of growth systems, ecology and biogeography of *Primula officinalis* species have been conducted for a long time [9; 10].

Also ecology and biodiversity conservation of *Primula* species have been studied over time by many researchers [11; 12].

The observations of VALVERDE and SILVERTOWN (1997) indicate that demographic trends in different populations of *Primula*, demonstrate the importance of studying variation in the dynamics of plants and populations of this species, while analyzing the environmental conditions in which they reproduce

naturally, to obtain a complete picture of demographic patterns.

Habitat destruction is the main cause of species extinction. TILMAN (1994) states in a study that the time in which organisms react to deteriorating environmental conditions delays the decline and disappearance of the population. He examined how local processes, at the population level, contribute to the extinction of the species. The species *Primula veris* L. was analyzed demographically, after the cessation of pasture management, using a unidirectional succession model for forest habitat and a rotation model with a period of forest growth, followed by a clear clearing and a new successive cycle.

Material and Method

Different planting distances were experimented, which would allow the mechanization of maintenance works, correlated with the planting period. The aim was to adapt to the climatic conditions in the Bârsa depression, as well as to establish the optimal nutritional needs, the optimal spatial interval for development, but also to obtain profitable productions per hectare.

The biological material was brought in the spring of 2016 from the spontaneous flora of Braşov County.

A two-factor experiment was performed, located according to the method of subdivided plots, with two factors, in three repetitions of the 3x3x3 type, the length of a variant being 2m, and the paths with a width of 1m and 9 rows of plants per plot.

Factor A – distance between rows with graduations: 25 cm, 50 cm, 75 cm;

Factor B – distance between plants on row with graduations: 10 cm, 25 cm, 50 cm.

The interaction with the density of 25 cm /10 cm is considered the witness of the experience.

- the surface of the plots with graduation a_1 (25 cm) = 4.5 m^2 ;
- the surface of the plots with graduation a_2 (50 cm) = 9 m^2 ;

- the surface of the plots with graduation a_3 (75cm) = 13.5 m^2 ;
- the total experimental surface, including the pathway ($27\text{m}^2 * 3 + 13.5 \text{ m}^2 * 2$) = 108 m^2 ;
- number of plants on the plots – b_1 ; (200 cm /10 cm) = $20*9 = 180*3 = 540$;
- number of plants on the plots – b_2 ; (200 cm /25 cm) = $8*9 = 72*3 = 216$;
- number of plants on the plots – b_3 ; (200 cm /50 cm) = $4*9 = 36*3 = 108$;
- total number of plants per experiment: $540 + 216 + 108 = 864$

The dynamics of emergence and growth of the foliar apparatus until flowering was followed. Three plants were harvested from each variant/experimental repetition. For each harvested plant were made the following determinations: plant height, mass of the underground part, number of leaves and their mass, number of flowering stems and their mass, number of inflorescences.

Results and Discussions

During the vegetation period, observations and measurements were made in dynamics on each experimental variant to highlight the phenological stages regarding the formation of vegetative and generative organs, emergence, development of the foliar apparatus, initiation of flower buds, flowering and seed formation.

Following the observations (table 1) made in dynamics in 2017, was a start in the vegetation of plants about 2-3 weeks earlier (03. 03. 2017) than in the spontaneous flora, from where the mother plants were harvested.

The appearance of the flowering stems took place on 27. 03. 2017 and the full flowering on 08. 04. 2017. The harvest for dynamics took place on 16. 05. 2017, the fruiting capsules appeared on 25. 05. 2017, and the seeds were harvested on 07. 07. 2017 (table 1). It is found that, after the first winter spent in the experimental field, the plants of this species have adapted very well to the climate and environment conditions from NIRDSB Braşov.

Table 1. The main phenological data on the experience of establishing the optimal nutrition space (Braşov, 2017)

Phenological observations	2017
Data of planting	20. 10. 2016
Emergence data	03. 03. 2017
Flowering stems data	27. 03. 2017
Flowering data	08. 04. 2017
Harvest data for herba	16. 05. 2017
Fructification beginning data	25. 05. 2017
Harvest data for seeds	07. 07. 2017

1. Results obtained on the surface of the plots from graduation a_1 (25 cm) = 4,5 m²;

Harvesting of *Primula officinalis* plants for the dynamics of all experimental variants was made on 16. 05. 2017.

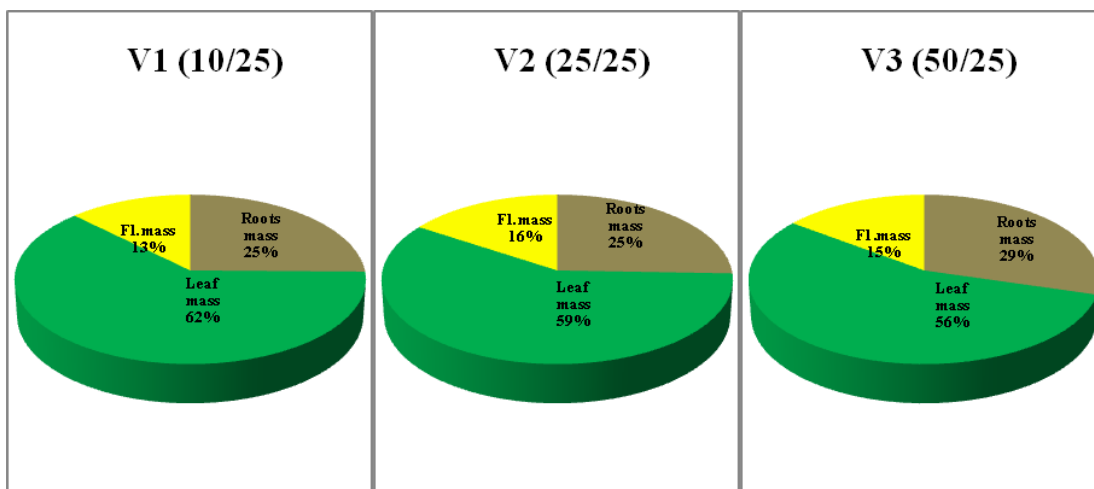


Fig. 1. Graphical representation of root, leaves and flowers weight at graduation a_1

In graduation a_1 with a total area of 4.5 m², the first experimental variant (V_1), planted at a distance of 10 cm between plants per row and 25 cm between rows, reveals that of the total mass of the plant, the flowers have a weight of 13% , the leaf mass represents 62% and the root mass 25%.

Increasing the distance between plants in a row 25/25 (V_2) leads to a slight increase in the mass of

flowering stems (16%) to the detriment of foliage, the mass of the underground part is kept equal to the variant planted at 10/25. V_3 planted at distances of 50/25 cm shows an increase in the mass of the underground parts compared to the other variants (V_1 , V_2) planted at the same distance between rows, by 29%, flowers 15% and leaves 56% (Fig. 1).

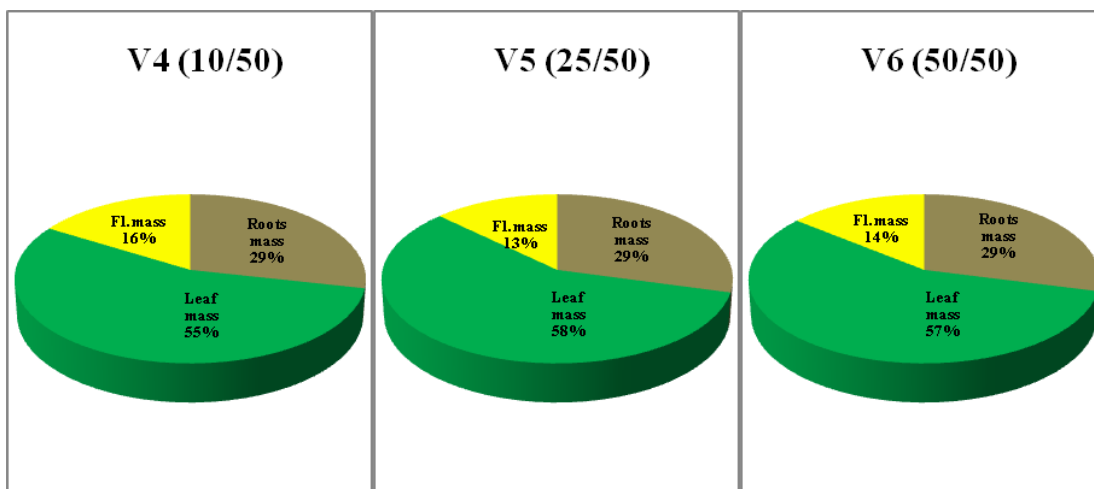


Fig. 2. Graphical representation of root, leaves and flowers weight at graduation a_2

2. Results obtained on the surface of the plots from graduation a_2 (50 cm) = 9 m²;

Graduation a_2 had a total area of 9 m². V_4 planted at a distance of 10 cm between plants per row and 50 cm between rows, presented a mass of

flowering stems of 16%, 55% leaf mass and 29% underground mass. The variant (V_5) planted at a distance of 25/50 cm had the mass of the underground part (29%) equal to the variants V_5 and V_6 .

3. Results obtained on the surface of the plots from graduation a_3 (75cm) = 13,5 m²

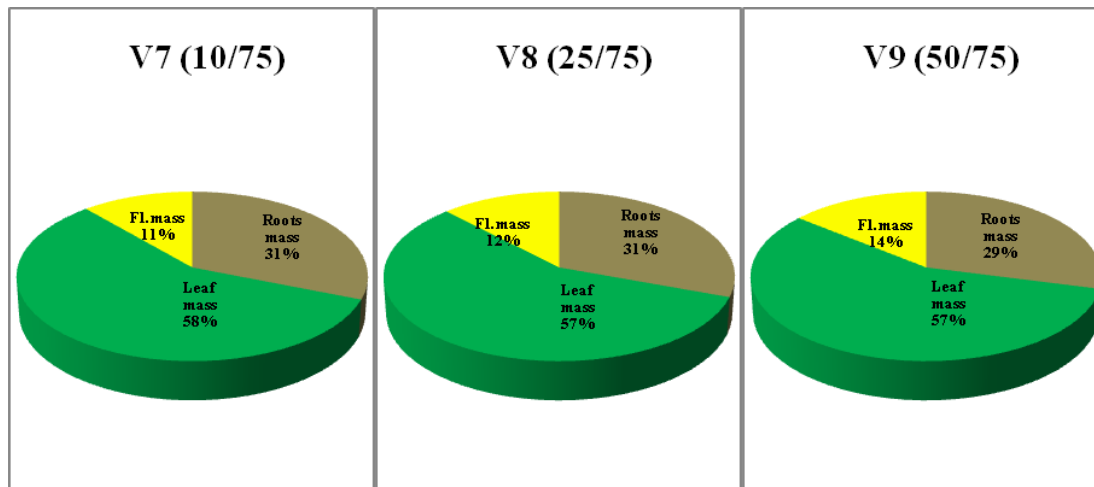


Fig. 3. Graphical representation of root, leaves and flowers weight at graduation a_3

Analyzing the a_3 graduation regarding the weighted average of the mass of *Primula* plants from the experimental variants V_7 , V_8 , V_9 , was find a weight of the mass of flowering stems 11% V_7 , 12% V_8 and 14% V_9 respectively.

With the increase of the distance between the rows (75 cm), the mass of the underground parts increases with the highest values in the whole experience, respectively 31% for the V_7 and V_8 variants.

A total analysis of all experimental variants performed during flowering, when harvested for herba, showed that the average mass of flowering stems represents 13.81% of plant mass, average leaf mass 57.57% and average root mass 28.62%.

Conclusions

The researches were conducted between 2016 - 2017 at the National Institute of Research and Development for Potato and Sugar Beet Braşov, Laboratory of Technology and Good Agricultural Practices, Department of Medicinal and Aromatic Plants, on the aspects of biology and technology for the introduction in the culture of *Primula officinalis* Hill., showed that this species finds good climate and soil conditions for growth and development.

The vegetation period for the species *Primula officinalis* Hill., from emergence to the seed harvest, in the experimental year 2017 was 126 days.

It is recommended as previous annual species, which are harvested in late summer and leave the ground clean of weeds, cereals or other medicinal plants.

The study of the distance between rows and the distance between plants in a row on *Primula* plants

noticed differences in the action of the two factors on plant mass, with a decisive role on the production achieved on each unit of studied area.

The mass of flowers in the species *Primula officinalis* Hill. in the experimental year 2017, registered a significant differences only in the case of B factor (distance between plants per row), A factor (distance between rows) causing insignificant changes of the other variants compared to the control variant.

The average mass of the underground parts of *Primula*, in the first experimental year, was directly influenced by the two factors analyzed (distance between rows and one by one), with distinctly significant values compared to the control.

If a high production of flowers is pursued, a minimum distance of 50 cm between rows and 25 cm between plants in a row creates an optimal nutritional space for the plant.

In the case of large areas, where the works are carried out mechanized, the option of planting at a distance of 50 cm between rows and 10 cm between plants per row ensures high yields of herba.

For root production (radix), the distance of 75 cm between rows and 50 cm between plants per row is favorable for the development of the root system.

The distance of at least 50 cm between rows, validated in terms of plant biology, ensures the mechanized performance of planting work, a maintenance of the crop and harvesting of the entire mass of plants, including of underground parts, in the conditions of the use of narrow-wheeled tractors.

Acknowledgements

The study was conducted as part of research PhD programme of the first author. The first author is thankful to NIRDPSB Braşov for support during PhD programme.

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