

INFLUENCE OF THE NATURAL ILLUMINATION LEVEL ON THE INDOOR GROWTH AND DEVELOPMENT OF PETUNIA HYBRIDA

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ABSTRACT (online version)

*In a room with a natural illumination index (NII) of 4.79, for 70 days, the influence of three illumination levels on the growth and development process of petunias from the *Petunia hybrida* species was studied. After rising, plants were placed in three zones of the room with different illumination levels: zone A (683 lx) – situated on the window's sill, zone B (113 lx) – situated on the floor, at the base of the parapet, and zone C (376 lx) – situated in the center of the room, on a table, at 80 cm from the floor. After two weeks from the pricking out, plants were transplanted in glass pots of 200 ml. At 2, 15, 30, 50 and 70 days the maximum length of the stem, branching level and leaf number were determined. At the end of the experiment and 10 days of room temperature drying, root, stem, leaf and flower biomass quantity was determined. Our results evidence the negative effect of the low illumination level (113 lx and 376 lx) on the growth and development process of petunias from the *Petunia hybrida* species. Being a light and warmth loving plant, *P. hybrida* may be grown only at well-illuminated windows, with a level of minimum 1000 lx.*

KEY WORDS: *illumination level, petunia, growth, blooming, and biomass.*

INTRODUCTION

Petunia is an annual flower almost habitual in parks, gardens and also in the buildings' balconies. *Petunia hybrida* is the most common species, comprising numerous breeds differing through height, flower shape and color. Petunias have a variable height, between 20 and 80 cm, existing tall, medium and dwarf petunias. The flowers are cone-shaped, unicolored or variegated, simple or involute, blooming taking place from the end of spring until fall [3].

Petunias ecological requirements settle to a soil rich in nutritive substances, moderate humidity, warm (sunny) and well illuminated. Water requirement increases proportionally with the vegetative development until blooming, decreasing afterwards. Petunias are sensitive to high humidity and low temperatures.

Regarding light, petunia breeds have a different behavior according to their place of origin and their adaptation to a certain illuminating regime with respect to duration, intensity and spectral composition of the light [2,3].

Actually, petunia is a light and warmth-loving plant. Until rooting, light must be diffuse, light need increasing afterwards, so that at budding and blooming, light intensity must be of at least 4000 lx. When poorly illuminated, the plants tend to elongate, flowers drop and the biomass production is severely diminished.

The aim of the present research was that of studying *Petunia hybrida*'s growth and development process from germination till blooming in indoor conditions.

MATERIAL AND METHODS

The experiment room had a surface of 13.8 m², a volume of 34.5 m³, and the window surface was of 2.88 m². Under these conditions, the natural illumination index (NII) was of 4.79, that is for 1 m² of windowed surface correspond 4.79 m² of floor. Temperature varied during the experiment between 18 to 20°C.

At the beginning of the second decade of February 2004, 250 seeds were sown. After 8-10 days, 200 plants rose. The first pricking out was done at the occurrence of the first true leaf (aprox. 7-8 days from rising), and at two weeks, the seedling was transplanted in a pot-glass of 200 ml with 180 g of soil.

Seedlings were placed in three areas of the room, differing with respect to the illumination level:

- Zone A – window-sill with maximum exposition to natural illumination;
- Zone B – at the base of the window, under the sill, on the floor – the area with the lowest illumination level;
- Zone C – in the center of the room, on a table, at 80 cm from the floor – area with moderate illumination;

According to the development and uniformity criteria, from the risen petunias, 10 plants were chosen for each zone. The illumination level was measured three times a week, on different days (Mondays, Wednesdays and Fridays), for 23 days. The luxmetric results are presented in table 1.

The growth and development level of the plants was studied through measurement of the maximum length of plant's main stem and recording the total number of leaves and branches. These characteristics were determined and recorded at 2 days, 15 days, 30 days, 50 days and 70 days from rising.

TABLE 1. Mean illumination level from the experiment zones (lx)

Specifi- cation	Location													
	Zone A				Zone B				Zone C					
	mor- ning	noon	eve- ning	\bar{x} A	mor- ning	noon	eve- ning	\bar{x} B	mor- ning	noon	eve- ning	\bar{x} C		
1 st week	1	240	1000	860	700	0	370	25	198	70	860	125	352	
	2	900	1000	930	943	200	510	90	267	600	1000	320	640	
	3	700	1000	900	867	200	510	80	263	600	1000	350	650	
2 nd week	1	280	1000	250	510	0	180	90	90	40	650	430	373	
	2	470	1000	630	700	10	190	10	70	150	790	490	477	
	3	180	680	160	340	0	20	0	7	30	31	10	24	
3 rd week	1	880	740	600	740	50	0	0	17	650	80	190	307	
	2	520	730	600	617	0	30	10	13	180	350	110	213	
	3	290	1000	890	727	0	180	90	90	50	650	350	350	
				683					113					376

Of the 23 days, 11 days were clear, 8 days were with variable sky and 4 days were cloudy. At the end of the experiment, which is at 71 days from rising, plants were weighed for the main vegetative parts: root, stem, branches, leaves and flowers. Phytomass quantity was determined at the moment of abolishment of the vital functions of the plants and a period of 10 days of drying at room temperature.

RESULTS AND DISCUSSIONS

The results of the measurements and observations done for the leaf number and the maximum length recorded at different development stages of the plants are presented in table 2.

On the second day from rising, all the petunias, regardless of the illumination level, had a uniform development, and after 15 days, an obvious differentiation was recorded between plants. Thus, leaf number in petunias from zone A (683 lx) and C (376 lx) was on average 10.8 and 11.0 respectively. Plants from zones with more light had the maximum length 2.2 times greater in the zone A and 3.5 times greater in the zone C. Also, in these two zones, petunias had well developed (zone A) and less developed branches (zone C), compared to the plants from zone B (113 lx) which had no branches.

TABLE 2. Mean leaf number and the maximum length of the plants in the three zones according to the illumination level of the room

Control period	Zone A (high illumination level)			Zone B (low illumination level)			Zone C (moderate illumination level)		
	n	Mean leaf nr.	Max. length (cm)	n	Mean leaf nr.	Max. length (cm)	n	Mean leaf nr.	Max. length (cm)
At 2 days	10	2	0.5	10	2	0.5	10	2	0.5
Obs. at 2 days	Uniformly developed plants			Uniformly developed plants			Uniformly developed plants		
At 15 days	10	10.8	7.24	10	3.6	3.3	10	11.0	11.6
Obs. at 15 days	All plants have well developed branches			Plants without branches			Plants with poorly developed branches		
At 30 days	10	34.9	14.0	8	5.0	7.12	10	30.4	24.9
Obs. at 30 days	Great number of leaves and branches			Small number of leaves and branches			Great number of leaves and sufficient branches but elongate		
At 50 days	10	47.6	17.7	5	6.6	11.1	10	45.8	34.5
Obs. at 50 days	All plants have flowers			Plants without flowers			50% plants with flowers and 50% plants at the beginning of the bloom		
At 70 days	10	56.3	20.2	3	7.3	15.7	10	54.8	38.9
Obs. at 70 days	All plants have flowers			All plants without flowers			All plants have flowers		

After 30 days from rising a more obvious difference is recorded. In petunias from zone A, a 40 leaf mean number is recorded, 1.14 times greater than that of the zone C and almost 7 times greater than that from zone B. Petunias from this zone, characterized by the lowest illumination level, experience the most dramatically natural light insufficiency, manifested through a small number of leaves and branches. Moreover, during this period, two plants withered.

Analyzing the petunias grown on pots in the center of the room, on the table, shows a good development of leaves and branches. Unlike the petunias from well-illuminated zones, these plants had filiform, elongate and less productive vigor branches.

Starting with the 40th day from rising, the first flowers appear, so that at 50 days all the 10 petunias of the well-illuminated zone had flowers. In the zone C (less illuminated) only 5 petunias had flowers. In the zone B, with the lowest illumination level, 3 more petunias die, and of the five remained none had flowers.

At the end of the experiment (70 days from rising), leaf mean number was of 56.3 for zone A petunias, 54.8 for those in zone C and only 7.3 for those in zone B. Even though plants from zone C recorded a maximum length clear superior, productive vigor appreciated according to leaf and flower number is less compared to plants grown in the well-illuminated zone.

Of the presented data, a significant differentiation of the growth and development of *Petunia hybrida* is noticed with respect to light quantity. The best results are obtained for plants grown in zones A and C compared to zone B where the mean illumination level was of 113 lx. Even though plants from zone C (376 lx) record a maximum length almost double to that of plants from the well-illuminated zone A (683 lx), the mean leaf number was smaller, recording a quantitative compensation of the raw primary production. At the end of the experiment, flowering level is maximum for plants of zones A and C. In the zone B only 5 petunias remained without flowers, all the others withering during the experiment.

Petunias from zone A presented a dark green color and 4-5 branches on the main stem whose maximum diameter was of 10-12 mm. All the plants bloomed at 40-45 days from rising. Flowers had a mean diameter of 7 cm and an intense color.

Petunias from zone B had a dark green color, no branches on the main stem, small and just some leaves. Withering percent was of 70%, and of the 3 remained petunias, none had flowers.

Petunias from zone C presented at the end of the experiment a dark green color and 2-3 branches on the main stem. Flowers had a diameter of 5-6 cm, smaller and lighter colored.

After ending the experiment, biomass quantity was determined for each plant. Weighing was repeated after 10 days of room temperature drying. The obtained results are shown in table 3.

TABLE 3. Influence of the illumination level on the biomass production in *Petunia hybrida*

	Zone A (\bar{x} =683 lx)			Zone B (\bar{x} =376 lx)			Zone C (\bar{x} =113 lx)		
	n	Raw mass (g)	Mass after drying (g)	n	Raw mass (g)	Mass after drying (g)	n	Raw mass (g)	Mass after drying (g)
Root	10	2.5	1.5	3	0.5	0.3	10	2.0	1.0
Stem	10	11.0	6.0	3	3.5	1.5	10	9.5	5.5
Leaves and flowers	10	11.5	5.0	3	1.5	0.7	10	11.5	5.0
total	10	25.0	12.5	3	5.5	2.5	10	23.0	11.5

We noticed that the weight of the main organs, and those of the entire plants, is superior in the case of petunias bred in zones well-illuminated, especially those from zone A placed on the window sill, where the highest natural photoreception level was recorded. For plants placed in zone B, the lowest illumination level had a severe negative influence. Thus, of 10 plants, at the end of the experiment, only three lived, whose biomass is almost 5 times smaller.

We consider that *Petunia hybrida* is a long-day species, light loving, stimulated in its growth and development by long photoperiods with a mean illumination level of over 1000 lx. Therefore, breeding petunia in indoor spaces may be done only beside well-illuminated Southeastern exposed windows.

CONCLUSIONS

1. An illumination level of 113 lx, provided for 70 days from rising, influences negatively the growth and development process, as well as the vitality of petunias of the *Petunia hybrida* species.
2. Plants from the zones A and C with an illumination level of over 1000 lx obtained significantly superior values regarding both growth and development, and the phytomass production.
3. For a good growth and development process of the plants from the *Petunia hybrida* species we recommend an illumination level of at least 1000 lx. This ecological condition can be easily obtained by placing the plants in well-illuminated areas such as windowsills and balconies with southern exposition.

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