

RESEARCH ON THE INFLUENCE OF THE AGE AND SIZE OF THE PLANTS ON GROWTH AND FLOWERING OF SOME CULTIVARS OF HERBACEOUS PEONY

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Abstract

The quality and the type of the planting material, the behavior in different conditions of culture, growth and blooming, as well as the appearance of the plant are important elements in choosing the variety and the cultivar or peony for plating in the landscape place. Also, the manner, appearance and duration of blooming, the earliness of the blooming, the aspect of the flower and the duration of the flowers on the plant or in vases are elements that render some qualities in the choice of peony varieties used in parks and gardens. In this paper, we present the results of the research on the influence of the age and size of the plants on the growth and blooming of some cultivars of herbaceous peony. The age of the plants had a major influence on the growth and blooming both in plants over 25 years and in young plants of over 2 years from planting. Likewise, the size of the plants had a different major influence on the growth and blooming both in older plants as well as in younger ones. The age and the size of the studied plants had a major influence also on the potential of reproduction of each studied cultivar. It analyzed the particularities of growth and blooming of the reproduction potential of each studied cultivar. The studied cultivars came from the collection of the University, as well as from the personal collection, having different ages such as 2 years, 4-5 years, 7 years, 8 years and over 25 years as well as various sizes of the ballot of the roots of herbaceous peony, i.e. 15-62 cm.

Key words: age, breeding, flowering, growth, herbaceous peony.

INTRODUCTION

This paper is topical and majorly important in the culture technology of the peony, providing new information, both to growers and to landscape artists in studying some important indicators regarding the choice of peony varieties and their cultivation. The indicators studied in this paper are important elements in the choice of the varieties of peonies and influence the growth, blooming and decorative appearance of the plant. The analyzed indicators are: the quality and type of the planting material, the behavior in various culture conditions, the growth particularities of growth and the particularities of blooming, the reproduction potential as well as the appearance of the plant. The herbaceous species of peony reproduce by the division of the bush, operation made by the mature plants, at the age of 4-5 years. After part of the soil is removed from the roots, the mother plants are cut by hand or with a very sharp knife in 3-6 parts, depending on the size of the mother plant

(Toma, 2005). The division of the bush may be annual for flower-plants with intensive growth (*Aster*, *Chrysanthemum*), every 2 to 3 years (*Delphinium*) and every 5 to 6 years in slow growth plants or plants sensitive to separation (*Paeonia*) (Cantor, 2009).

Actual plants in the herbaceous peony are usually obtained by dividing the peony roots in 3-5 divisions, each division having 4-5 sprouts. The node stems and the underground rhizomes may be used for division (Wang & Zhang, 2005).

Cucu et al. (2009) mention that in the cultivars of the *Paeonia lactiflora* Pallas species it was observed the highest potential for reproduction. In plants older than 5 years, the maximum numbers of first quality divisions was 7 ('Candy Stripe' and 'Victoire de la Marne'). Plants aged 4, obtained a maximum number of 4 first quality divisions of the 5 of the cultivars subject to vegetative reproduction ('Albatre', 'Grover Cleaveland', 'Red Sarah Bernhardt', 'Top Brass', 'Wine Red').

As far as the flower production is concerned, Cucu et al. (2009), report that among the 5 years old plants (batch 1), 14 cultivars reached or exceeded 10 bloomed flower shoots/plant and there were over 50% bloomed flower shoots formed on a plant, during all the three years of the study. Among the 4 years old plants (batch 2), 19 cultivars reached or exceeded 10 bloomed flower shoots/plant and there were over 70% bloomed flower shoots formed on a plant, during all the three years of the study. The 33 cultivars were recommended for the production of cut flowers.

MATERIALS AND METHODS

The experiment developed in the research years 2016/2017 and 2017/2018 in two research locations: in USAMV Bucharest and in Singureni, Giurgiu County. The research took place in the field in the two locations studying the herbaceous peony cultivars in the University collection, as well as the cultivars existing locally. The presented results are obtained pursuant to the biometric measurements and the individual observations on the following indicators: quality and type of planting material, behavior of the plants in the culture, the particularities of growth and blooming and the decorative appearance of the plant.

The research is a two-factor experience consisting of two factors: factor A represented by the peony cultivars ('Festiva Maxima', 'Singureni pink', 'Singureni' with fringed scented flowers, Singureni pink, pink in the USAMV Bucharest collection, red in the USAMV Bucharest collection); factor B represented by the age of the plants (2 years, 5 years, 7 years, 8 years, and over 25 years); and the size of the plants (diameter of the root ballot). The combination of the two factors resulted in 13 experimental varieties (Table 1).



Figure 1. Unseparated bush stalks of 'Festiva Maxima' peony

Table1. Experimental varieties and quality of the materials used in the research

Variety	Cultivar	Plant age	Diameter of the root ballot min/max cm
V1	'Festiva Maxima' (white cultivar from Singureni)	over 25 years	54 - 62
V2	'Festiva Maxima' (white cultivar from Singureni)	7 years	35 - 47
V3	'Festiva Maxima' (white cultivar from Singureni)	2 years	15 - 22
V4	White flower peony from Singureni	over 25 years	57 - 61
V5	White flower peony from Singureni	7 years	40 - 48
V6	White flower peony from Singureni	2 years	17 - 25
V7	Pink cultivar with fringed perfumed flowers from Singureni	over 25 years	48 - 56
V8	Pink flower peony from the USAMV collection	8 years	36 - 42
V9	Pink flower peony from the USAMV collection	5 years	28 - 33
V10	Pink flower peony from the USAMV collection	2 years	17 - 20
V11	Red flower peony from the USAMV collection	7 years	33 - 40
V12	Red flower peony from the USAMV collection	5 years	25 - 31
V13	Red flower peony from the USAMV collection	2 years	15 - 19



Figure 2. Pink peony from Singureni, undivided bush



Figure 3. Pink peony from Singureni, undivided bush

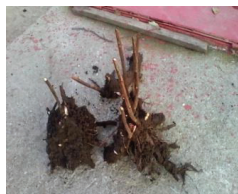


Figure 4. 'Festiva Maxima', undivided bushes

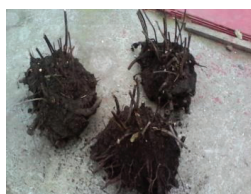


Figure 5. Pink peony from Singureni, undivided bushes



Figure 6. Pink peony from Singureni, undivided bushes



Figure 7. Red peony from USAMV Bucharest

RESULTS AND DISCUSSIONS

The results of the research are obtained pursuant to the analysis of the following indicators through visual observations and measurements of the ballot of roots, the potential of vegetative reproduction, the percentage of divisions, the particularities of growth and blooming, the percentage of flower shoots, the percentage of blooming, the dynamics of growth and blooming.

One can observe a minimum number of divisions of 7 and 8 and a maximum number of 9 and 10 divisions resulted from the cultivars ages over 25 years in the varieties V1, V4 and V7. In the cultivars aged 7 it was noticed a minimum number of 4 and 5 divisions resulted and a maximum number of 6 and 7 divisions resulted in the varieties V2 and V5, and in the cultivars of 4-5 years a minimum number of 4 divisions and a maximum number of 5 and 6 in V9 and V11 (Table 2).

The diameter of the root ballot in the cultivars over 25 years has a minimum value of 5 cm and 8 cm, and a maximum value of 11 cm, 12 cm and 14 cm in varieties V1, V4 and V7. In the cultivars of 7 years it was observed a minimum diameter of 5 cm and maximum diameter of 8 cm. In the cultivars of 4-12 years a minimum diameter of 4 cm and a maximum diameter of 8 and 9 cm in the varieties V9 and V11 (Table 3).

Table 2. Number of divisions resulted on the plant of some herbaceous peony cultivars

Variety	Cultivar	Plant age	Number of resulted divisions	
			Min.	Max.
V1	'Festiva Maxima' (white cultivar from Singureni)	over 25 years	7	9
V2	'Festiva Maxima' (white cultivar from Singureni)	7 years	4	6
V4	White flower peony from Singureni	over 25 years	8	10
V5	White flower peony from Singureni	7 years	5	7
V7	Pink cultivar with fringed perfumed flowers from Singureni	over 25 years	7	10
V8	Pink flower peony from the USAMV collection	8 years	5	8
V9	Pink flower peony from the USAMV collection	12 years	4	5
V10	Red flower peony from the USAMV collection	8 years	4	8
V11	Red flower peony from the USAMV collection	12 years	4	6

Table 3. Diameter of the root ballot of the divisions in herbaceous peony cultivars

Variety	Cultivar	Plant age	Root ballot diameter (cm)	
			Min.	Max.
V1	'Festiva Maxima' (white cultivar from Singureni)	over 25 years	8	12
V2	'Festiva Maxima' (white cultivar from Singureni)	7 years	5	8
V4	White flower peony from Singureni	over 25 years	8	14
V5	White flower peony from Singureni	7 years	5	8
V7	Pink cultivar with fringed perfumed flowers from Singureni	over 25 years	5	11
V8	Pink flower peony from the UASVM collection UASVMB.	8 years	5	8
V9	Pink flower peony from the UASVM collection	12 years	4	8
V10	Red flower peony from the UASVM collection	8 years	5	9
V11	Red flower peony from the UASVM collection	12 years	4	9

Table 4 presents the particularities of growth of the peony plants depending on age and size. The following are confirmed: the older the plants, the later the phenophases compared to

the younger plants. The length and the diameter of the shoot increase with age, as well as the number of shoots.

Table 4. Particularities of growth in some herbaceous peony cultivars, depending on the age of the plants

Variety	Sprouting	Shooting	Length of shoots (cm)	Diameter of shoots (mm)	Total shoots
V1	06.03	08.03	102	10	443
V2	27.02	01.03	89	9	276
V3	24.02	06.03	83	8	154
V4	05.03	07.03	107	11	667
V5	26.02	28.02	98	9	495
V6	24.02	05.03	93	8	352
V7	05.03	07.03	98	10	377
V8	03.03	05.05	86	6	197
V9	07.03	09.03	70	5	154
V10	04.03	10.03	65	4	98
V11	02..03	05.03	97	5	157
V10	09.03	11.03	66	5	114
V11	04.03	12.03	60	4	57



Figure 8. Pink peony bushes in the USAMV collection



Figure 9. 'Festiva Maxima' peony bushes



Figure 12. Red peony of the collection USAMV Bucharest, divided bushes



Figure 13. Ping peony, undivided bush, collection USAMV Bucharest

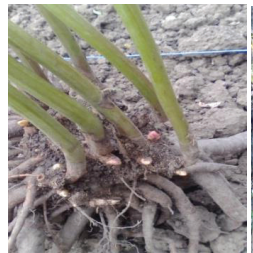


Figure 10. Undivided bush, ping peony from Singureni



Figure 11. Divided bushes of 'Festiva Maxima'



Figure 14. Red peony, undivided bush, collection USAMV Bucharest



Figure 15. Pink peony, divided bush, collection USAMV Bucharest



Figure 16. Red peony, collection USAMV Bucharest, divided bushes



Figure 17. Red peony, undivided bush, collection USAMV Bucharest



Figure 18. Pink peony, undivided bush, collection USAMV Bucharest



Figure 19. Divided bushes, pink peony, collection USAMV Bucharest



Figure 20. Pink peony, undivided bush, collection USAMV Bucharest

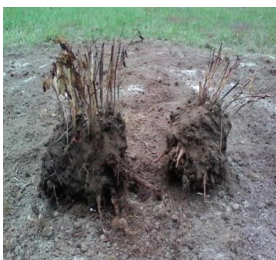


Figure 21. Red peony, undivided bush, collection USAMV Bucharest

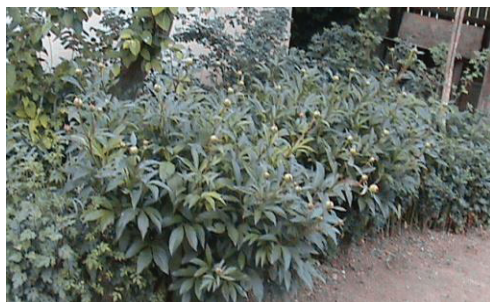


Figure 22. Peony bushes, over 25 years, cultivar 'Festiva Maxima' and pink peony from Singureni



Figure 23. Peony bushes, 7 years, cultivar 'Festivals Maxima' and Singureni pink



Figure 24. Peony bushes, 7 years, cultivar 'Festivals Maxima' and Singureni pink



Figure 25. Bush of over 25 years, pink scented cultivar with double flowers



Figure 26. Appearance of the flower in pink perfumed cultivar, of over 25 years



Figure 27. Appearance of the blooming in bushes of over 25 years, pink and white cultivar



Figure 28. Appearance of the blooming, in 'Festivals Maxima' cultivar, aged 7



Figure 29. Appearance of the blooming in the pink cultivar from Singureni, aged 7

In Table 5 there is a drop in the percentage of flower shoots in plants of over 25 years as compared to the plants aged over 4 years and a growth of the plants of over 4 years as compared to the 2 years old plants.

Table 5. Number and percentage of shoots of varieties of herbaceous peony depending on the age of the plants

Variety	Total shoots	Total flower shoots	Total bloomed flower shoots	Percentage of bloomed flower shoots
V1	443	224	102	45.53%
V2	276	270	268	99.25%
V3	154	135	85	64.96%
V4	667	336	177	52.67%
V5	495	492	489	99.39%
V6	352	292	221	75.68%
V7	377	175	112	64.00%
V8	275	268	266	99.25%
V9	154	148	145	97.97%
V10	98	42	12	28.57%
V11	221	210	202	96.19%
V12	114	102	96	94.11%
V13	57	36	3	8.33

As far as the percentage of plants with bloomed flower shoots, there is observed a decrease in the older plants and a maximum percentage in the plants aged 5 and 7 years, and the percentage of flowers decreases with the age of the plants, according to the data in Table 6.

Table 6. Percentage of plants with flower shoots and the percentage of blooming in varieties of herbaceous peony depending on the age of the plants

Variety	Percentage of plants with flower shoots	Percentage of plants with bloomed flower shoots	Blooming percentage
V1	100%	66%	45.53%
V2	100%	100%	99.25%
V3	100%	100%	66.05%
V4	100%	75%	52.67%
V5	100%	100%	99.39%
V6	100%	100%	97.59%
V7	100%	70%	64.00%
V8	100%	100%	99.39
V9	100%	100%	97.97%
V10	100%	15%	33.33%
V11	100%	100%	99.25%
V12	100%	100%	94.11%
V13	100%	10%	8.33%

Figure 30 presents the chart of the percentage of blooming flower shoots in the studied cultivars. The largest values being in the cultivars aged 5, 7 and 8 and the smallest in the cultivars aged 2.

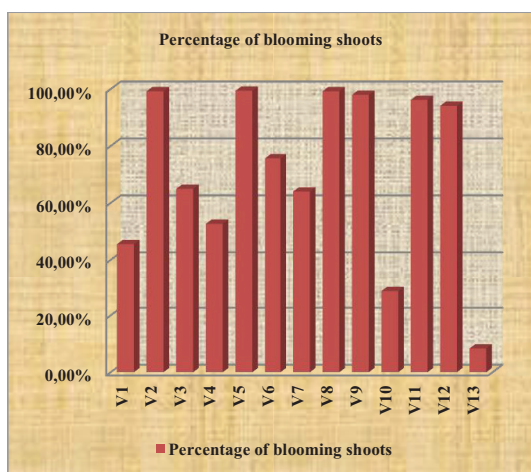


Figure 30. Percentage of blooming shoots in the peony cultivars studied depending on the research varieties

As far as the percentage of plants with flower shoots, it had the value of 100% in all the researched varieties according to the chart in the Figure 31.

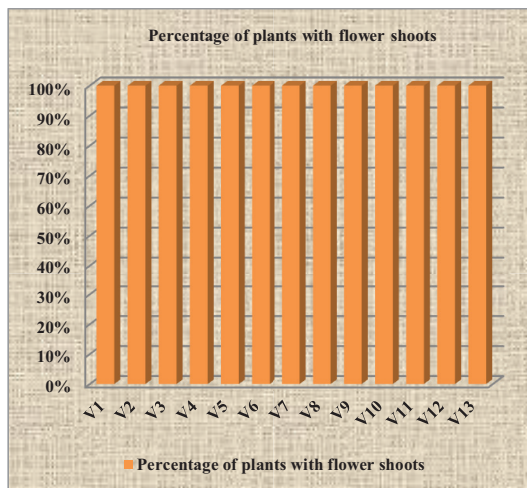


Figure 31. Percentage of plants with flower shoots in the studied cultivars

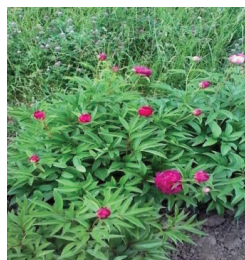


Figure 32. Appearance of the flower in the red cultivar, aged 12, collection USAMV Bucharest

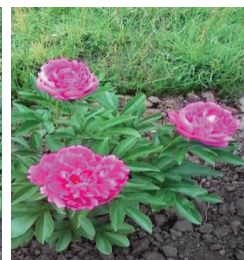


Figure 33. Appearance of the flowers in the pink cultivar, collection USAMV Bucharest, aged 2

In relation with the phenophases and the duration of the blooming there is an earlier occurrence of the bud and of the blooming in the young plants and a later occurrence in the plants over 25 years. As far as the duration of the blooming, there is a decrease of the duration in the older plants and an increase in the younger ones (Table 7).

Table 7. Phenophases and duration of the blooming in some peony cultivars, depending on the age of the plants

Variety	Budding	Blooming	End of blooming	Duration of blooming (days)
V1	15.04	17.05	22.05	5
V2	11.04	13.05	22.05	9
V3	08.04	11.05	18.05	7
V4	18.04	19.05	24.05	5
V5	14.04	15.05	23.05	8
V6	10.04	13.05	20.05	7
V7	14.04	18.05	24.05	6
V8	07.04	14.05	20.05	6
V9	09.04	17.05	24.05	7
V10	06.04	15.05	21.05	6
V11	05.04	14.05	20.05	6
V10	09.04	17. 05	23.05	6
V11	06.04	16.05	21.05	5



Figure 34. Appearance of the blooming in the pink cultivar, aged 12, collection USAMV Bucharest



Figure 35. Aspect of the blooming in the red cultivar, aged 2, collection USAMV Bucharest

Figure 36. Aspect of the blooming in the pink cultivar, from Singureni, aged 2



Figure 37. Appearance of the flower in the pink cultivar, from Singureni, aged 2

Figure 38. Aspect of the blooming in ‘Festivals Maxima’ cultivar, aged 2



Figure 39. Appearance of the blooming in the red and pink cultivars, aged 8, collection USAMV Bucharest



Figure 40. End of the blooming in the pink cultivar, from Singureni, aged 7

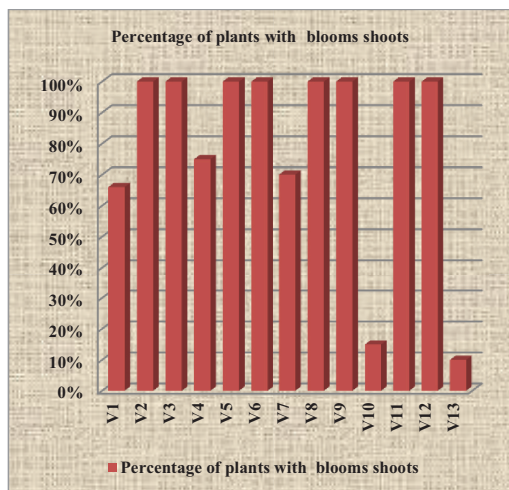


Figure 41. The percentage of plants with blooms shoots in the herbaceous peony cultivars studied

The percentage of plants with shoots bloom was over 50% to 11 variants of 13 and 66% at V1, 70% of V7, 75% in V4 and the percentage of 100% to V2, V3, V5, V6, V8, V9, V11, V12. Only two variants had a percentage below 50%, respectively the variants V10 and V13 (Figure 41).

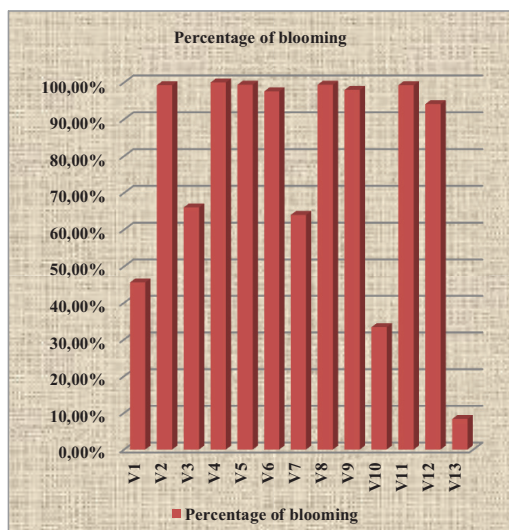


Fig.42. The percentage of blooming in the herbaceous peony cultivars studied.

The blossoming percentage shown in the chart in Figure 42, was over 50% for 10 variants of 13, starting from V4 with 52.67% to 99.39% for V5 and V8, and three variants had a

percentage below 50% and 45.53% respectively at V1, 33.33% at V10 and 8.33% at V13.

CONCLUSIONS

The undertaken researches in this experience led to the following conclusions:

In the cultivars aged over 25 years there was a minimum number of 7 divisions and a maximum number of 10 divisions.

In the cultivars aged 7 years there was a minimum number of 4 and a maximum number of 7 divisions.

In the cultivars aged 4-12 years there was a minimum number of 4 and a maximum number of 7 divisions.

The growth phenophases have a delay as duration in the older plants as compared to the younger ones.

In older plants, there was a growth in height and the diameter of shoots, as well as their number.

The percentage of bloomed flower shoots decreases in older plants and it increases in younger plants, as well as the percentage of flower shoots.

The percentage of plants with flower shoots in all varieties is 100%.

The percentage of plants with bloomed flower shoots decreases in older plants and increases in plants younger than 3 years.

The blooming percentage decreases in older plants and increases in plants younger than 3 years.

The appearance of the bud and the beginning of the blooming is later in older plants and earlier in the younger plants.

The duration of the blooming is smaller in older plants as compared to the younger plants.

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