

## Assessment By Phenological Stages Of Development And Decorative Properties Of Floribunda Roses Group For Further Use In Ornamental Gardening

### **Valentin Vasilevich Polishchuk**

*Professor, Doctor of Agricultural Sciences, Dean of the Faculty of Forestry and Gardening, Uman National University of Horticulture, 20300, Ukraine*

*E-mail: pol.val@i.ua,*

*ORCID: 0000-0001-8157-7028*

### **Anna Andreevna Brovdi**

*Post-Graduate Student of the Department of Landscape Gardening, Uman National University of Horticulture, 20300, Ukraine*

*E-mail: abrovi@ukr.net*

### **Anatolii Fedorovich Balabak**

*Professor, Doctor of Agricultural Sciences, Head of the Department of Landscape Gardening, Uman National University of Horticulture, 20300, Ukraine*

*E-mail: abalabak@meta.ua*

*ORCID: 0000-0002-1016-4442*

### **Irina Vladimirovna Kozachenko**

*Candidate of Agricultural Sciences, Associate Professor of the Department of Forestry, Uman National University of Horticulture, 20300, Ukraine*

*E-mail: kozachenko\_irina79@ukr.net,*

*ORCID.ORG/0000-0002-2609-4987*

### **Yuliya Anatolievna Velichko**

*Candidate of Agricultural Sciences, Associate Professor of the Department of Forestry, Uman National University of Horticulture, 20300, Ukraine*

*E-mail: velychkojulya@gmail.com*

*ORCID: 0000-0002-7793-1124*

### **Irina Mikhailovna Pushka**

*Candidate of Agricultural Sciences, Associate Professor of the Department of Forestry, Uman National University of Horticulture, 20300, Ukraine*

*E-mail: rekun.ira@ukr.net*

*ORCID: 0000-0002-3906-4138*

### **Mikhail Yurievich Osipov**

*Candidate of Agricultural Sciences, Associate Professor of the Department of Forestry, Uman National University of Horticulture, 20300, Ukraine*

*E-mail: m3dsad@gmail.com*

*ORCID.ORG/0000-0001-7004-1164*

### **Lesia Mykhailivna Karpuk**

*Professor, Doctor of Agricultural Sciences, Professor of the Department of Farming, Agrochemistry and Soil Science Bila Tserkva National Agrarian University, 09100, Ukraine*

*E-mail: lesya\_karpuk@ukr.net,*

*ORCID: 0000-0002-2303-7899*

---

### **Abstract**

Goal. To study the main decorative features of the varieties of floribunda roses group and the duration of their manifestation for further use in the ornamental gardening of the Right-Bank Forest Steppe of **Ukraine**. **Methods. Phenological - for the study of seasonal phases of development of varieties of roses;** mathematical and statistical - for processing of obtained research

results. The reliability of the obtained research results was determined by the methods of statistical analysis of Microsoft Office Excel 2010. Results. Based on the observations, the varieties of floribunda roses were selected according to the main features of decorative. It is revealed that originality of color of a variety is crucial when choosing a variety from one group of roses for their further use in ornamental gardening. The varieties with rare orange (Westpoint and Lilli Marleen) and purple (Minerva, Santa Monika and Let's Celebrate) and mottled pink (Mathias) color are the most attractive among other varieties. The duration of flowering of varieties is established.

As a result of the conducted researches the average duration of vegetation of rose varieties of floribunda group was determined, which was 231 days, with the longest duration in the Westpoint variety - 234 days, and the shortest in the Minerva variety - 215 days. The duration of flowering of varieties is established. In the vast majority of varieties it lasted 138 days. The longest blooming rose varieties of Arthur Bell, Westpoint, Rotkappchen, Iceberg and Santa Monika (150 days), the least - Carmagnola, Lilli Marleen and Minerva (120 days or less).

Keywords: decorative features, variety, floribunda roses, blossoms, flower color, ornamental gardening.

## **INTRODUCTION.**

The rose is one of the most economically valuable and ancient ornamental plants. The genus *Rosa* L. belongs to the family Rosaceae. It includes more than 150 different species distributed in the temperate latitudes of the Northern Hemisphere and has about 30 thousand varieties [1]. Most of these species resulted from hybridization, which was often accompanied by polyploidization [2].

It has been established that roses were cultivated 5,000 years ago by the ancient civilization of China, West Asia, and North Africa [3]. In antiquity they decorated the tombs of Greece and China, used as symbols in Rome, the Far East and Egypt. Much information about roses in antiquity can be found in the writings of Greek historians and philosophers. In the works of the Roman naturalist Pliny noted that the Romans grew roses in greenhouses [4, 5].

The introduction of roses in Ukraine was carried out from the beginning of the establishment of botanical gardens in its territory. A prominent place in the history of the introduction of plants of Ukraine was left by the Karazin Acclimatization Garden, which became the nursery of many parks (Nataliyevsky, Sharivsky, Sofiyivka, Askaniya-Nova) and the botanical gardens of Ukraine [6].

No ornamental plant has such a diversity of varieties as a rose. Their height ranges from 10-15 cm in dwarf roses to 10 m in semi climbing and gigantic climbing roses. The roses have odd pinnate compound leaves, consisting of 5-7 to 9-13 leaves. Shoots are most often covered with spines of various shapes and sizes, although there are varieties without spines [7].

People have long been selecting and cultivating the types and forms of flower roses, which had the most decorative color, doubling, abundance and duration of flowering. As a result of long-term selection of roses gradually became more perfect shape and color of the flower [8].

Given the different climatic and soil conditions, breeders have for many centuries sought to obtain more sophisticated varieties of garden roses [7].

As a result of crossing dwarf polyanthus roses with tea-hybrids, the Danish breeder Poulsen in 1924 obtained more stable, brightly colored varieties, which were referred to as a group of floribundas, which literally translates as «many-flowering» [9, 10].

Among the huge diversity of varieties, floribunda roses group is very popular now, they are widely used for landscaping settlements, because in abundance and continually flowering, they exceed almost all varieties of other garden groups.

Floribunda rose varieties are complex interspecific hybrids. Evergreen, multi-flowered, long-flowered and abundantly flowering species from subtropical regions of China and India (*Rosa chinensis* Jacq., *R. gigantean* Collet., *R. multiflora* Thunb., *R. moshata* Herrmann) were used to create them. These species conveyed to the roses of the floribunda group a highly valued in ornamental horticulture ability to produce abundant and long-lasting remontant flowering [11].

According to the biological characteristics flower of floribunda roses group are simple, large, collected in inflorescences up to thirty pieces, may have semi-double or dense double flowers, have a bright color. The leaves are green, medium in size, matte or glossy [10, 12].

A distinctive feature of floribunda roses is the flowers in racemose inflorescences. They have a bright color, in each raceme several flowers are revealed at the same time. The color range is very wide: from white to dark red, orange, cream with motley flowers and so on. There are varieties in which the color changes during flowering.

The main advantage of floribunda roses is that they flower not in separate waves, but almost continually throughout the summer and fall, until the first frost and produce many more flowers than other garden groups. In addition, floribunda roses form a more compact bush, with many shoots and abundant leaves. The height of the bush varies from 30-40 cm to 1.3 m. Plants of this group can be grown in the form of a bush or shrub tree [9].

Varieties of this group differ from tea-hybrid roses with better winter hardiness, resistance to diseases and pests. They also effectively propagated as cuttings and grafting [10, 12].

Thanks to the work of the breeders, the size and shape of the flower of the floribunda roses are not inferior to the hybrid tea in elegance and size, as it was before [13]. Among the modern floribunda roses are many large and fragrant flowers. *Rosa Honey Bouquet* can be an example for hybrid tea roses, and *Rosa Ronald William Pearc* demonstrates the highest elegance of flower structure [14].

According to literary sources [15], the vegetation of floribunda roses begins in the first half of March, but depending on the weather conditions, the terms may shift by 10-15 days. Budding occurs 47-76 days after bud dissolution. Due to the formation of inflorescences with many flowers, the duration of budding of the floribunda roses is longer than that of other garden groups. The vast majority of varieties bloom in early June that is, 6-10 days later than the hybrid tea. In most varieties of floribunda roses, there are four flowering periods. The most abundant is the first wave of flowering, which lasts 40-60 days. The total duration of flowering of floribunda roses is 90-200 days.

According to a number of studies [16], floribunda roses are mostly classified as medium- (86-95 days after bud) and late- (occurs in 96-105 days) flowering, depending on the variety and the weather conditions of the year. The roses are characterized by rapid budding and the formation of a large number of shoots, whereby budding, growth of shoots and leaves, as well as the ripening of fruits from previous flowering can be observed in one bush [15].

Floribunda roses are one of the most common and popular in modern landscaping when creating gardens and flower beds in a regular style. They are planted solitarily or as groups on the lawn, in border beds, parterres and in mixboards; used as a lawn accent, selecting by color and duration of flowering. The roses of this garden group are used to create bright large flower arrays, borders, stems, for decoration of parks, gardens, squares, planted along the streets, on squares, in the grounds of sanatoriums, boarding houses, holiday homes, near monuments. Roses bloom well even in hot summer, when the roses of other garden groups cease their flowering [16, 17].

**Materials and methods of research.** In our studies, we used 15 varieties of floribunda roses, which differ in origin, decorative features and resistance to agroclimatic environmental factors. The characteristics of the varieties are shown in Table 1.

Determination of the ultimate stability of the variety to climatic factors is carried out in accordance with accepted by United States Department of Agriculture Plant Hardiness Zones (USDA zones), according to which floribunda varieties belong to the fifth (from -26.1 ° C to -28.9 ° C) and sixth (from -20.6 ° C to -23.3 ° C) frost zones.

Immunological evaluation of roses is performed by the state of plant development, take into account the percentage of plant damage and evaluate the degree of their damage.

The resistance of the variety to the climatic factors of the environment and the immunological evaluation of the roses are listed in the table, according to the declared by originator indicators.

The study of introduced varieties of floribunda roses in the conditions of the Right-bank Forest Steppe of Ukraine was carried out at the experimental sites of the Department of landscape gardening of the Uman National University of Horticulture in accordance with the generally accepted Methods of

examination of varieties of plants of the decorative group for difference, homogeneity and stability and Methods of examination of plant varieties of the group of decorative, ornamental, medicinal and essential oil, forest for distribution in Ukraine [18, 19].

**Table 1. Characteristics of the studied varieties of floribunda roses**

No	Variety	Origin	USDA zone	Resistance to powdery mildew	Resistance to black spot	Resistance to rainfall
1	Lovely Green	France	Zone 6	high	high	medium
2	Carmagnola	France	Zone 6	high	high	high
3	Arthur Bell	Ireland	Zone 5	medium	medium	high
4	Lilli Marleen	Germany	Zone 5	low	medium	high
5	Westpoint	Germany	Zone 6	high	high	high
6	Minerva	Belgium	Zone 6	high	high	medium
7	Rotkappchen	Germany	Zone 5	high	high	medium
8	Friesia	Germany	Zone 5	high	high	medium
9	Iceberg	Germany	Zone 5	medium	medium	medium
10	Santa Monika	New Zealand	Zone 6	medium	medium	high
11	Mathias	France	Zone 5	high	high	high
12	Bella Rosa	Germany	Zone 5	medium	medium	medium
13	Cream Abundance	United Kingdom	Zone 6	medium	medium	medium
14	Hans Gonewein	Germany	Zone 6	medium	medium	low
15	Let's Celebrate	United Kingdom	Zone 6	medium	medium	medium

The city of Uman is located on the Dnieper height above the river Umanka, which belongs to the basin of the Southern Bug. The climate is due to the city's proximity to the steppe zone of the temperate belt and is temperate continental with mild winters and warm summers.

During the years of research the significant variability of climatic indicators in its territory was noted. The average annual temperature was 9.2 °C in 2018 and 10,4 °C in 2019. The rainfall for 2018 and 2019 was 600.8 mm and 377 mm, respectively. The average daily air temperature transition through 0 °C towards the increase in 2019 occurred on February 25, that is, 11 days earlier than in 2018 (March 7). However, despite the positive average daily temperature anomaly in March 2019, there was no rapid increase in heat. Half of the nights in March were frosty and in April with frost. The spring was windy, with a steady deficit of rainfall.

The average daily temperature changes in the direction of increase: through + 5 °C in 2018 occurred 31.03, in 2019 - 30.03; through + 10 °C - 1.04 and 20.04; through + 15 °C - 22.04 and 12.05, respectively.

Sustainable transition of daily average air temperature downwards: through + 15 °C in 2018 held on 16.09 in 2019 - 18.09; through + 10 °C - 23.10 and 25.10; through + 5 °C 7.11 and 18.11; through 0 °C 12.11 and 21.11, respectively.

The start of the growing season in 2018 was recorded from 30.03 to 7.04, depending on the variety, while in 2019 roses were in full bud almost three weeks earlier (from 11.03 to 20.03). The beginning of flowering of roses in 2018 was observed from 12.05 to 4.06 and from 20.05 to 7.06 in 2019. The end of flowering in the varieties of floribunda roses in 2018 and 2019 was observed in almost the same period - from 13.08 to 28.10 and from 16.08 to 30.10, respectively. The end of the growing season in 2018 was recorded from 2.09 to 30.10, in 2019 from 28.08 to 4.11.

**Research results.** Floribunda roses are widely used in ornamental horticulture due to their abundant repair flowering. In order to determine the prospects of their use in the conditions of the Right-bank

Forest Steppe of Ukraine the basic decorative properties of the roses of this group and the duration of their manifestation were investigated. It should be noted that the flowers of the introduced rose varieties of floribunda group differ in size, shape, doubling and color, which are presented in table 2. The highest double flower is recorded in varieties of Lovely Green, Rotkappchen, Mathias, Bella Rosa, Cream Abundance, Hans Gonewein. However, it should be noted that the color of the flowers varied from green, orange, purple to yellow, pink and white. The size of the flowers also had a considerable range of variation - small, medium and big.

**Table 2. The main decorative features of the flower of floribunda roses**

<b>№</b>	<b>Variety</b>	<b>Flower size, cm</b>	<b>Flower shape</b>	<b>Flower doubling</b>	<b>Coloring flower petals</b>
1	2	3	4	5	6
1	Lovely Green	medium	rounded	dense double	green
2	Carmagnola	large	irregularly rounded	semi-double	pink
3	Arthur Bell	small	star-shaped	double	yellow
4	Lilli Marleen	medium	irregularly rounded	double	orange
5	Westpoint	medium	irregularly rounded	semi-double	orange
6	Minerva	large	irregularly rounded	double	purple
7	Rotkappchen	large	irregularly rounded	dense double	red
8	Friesia	large	irregularly rounded	double	yellow
9	Iceberg	large	irregularly rounded	double	white
10	Santa Monika	small	irregularly rounded	semi-double	purple
11	Mathias	large	irregularly rounded	dense double	pink
12	Bella Rosa	small	rounded	dense double	pink
13	Cream Abundance	large	irregularly rounded	dense double	white
14	Hans Gonewein	large	rounded	dense double	pink
15	Let's Celebrate	medium	irregularly rounded	dense double	purple

The flower diameter of the vast majority (80%) of the studied varieties of floribunda roses was medium (6-7 cm) or large (over 7 cm), and only three varieties showed a diameter less than 6 cm (Arthur Bell, Santa Monika and Bella Rosa). However, the small diameter of the flowers of the variety Bella Rosa compensates for the abundance of its flowering (Fig. 1).



**Fig. 1. Flowering of variety Bella Rosa**

With regard to the shape of the flower, much of the varieties studied had an irregularly rounded shape; the varieties of Lovely Green, Bella Rosa and Hans Gonewein – rounded, and only Arthur Bell – star-shaped.

The varieties also differ in the flower doubling. We have identified five double flowers varieties as Arthur Bell, Lilli Marleen, Minerva, Friesia and Iceberg.

The smallest number of varieties of roses refers to varieties with semi-double flowers, the number of petals of which are 6-20 - Carmagnola, Westpoint and Santa Monika (Fig. 2). Most of the studied varieties are double (with 21-40 petals) and dense double (with 41-120 petals) varieties.



**Fig. 2. Flowering of variety Carmagnola**

Within one garden group, most varieties are similar in overwhelming majority of decorative features. The originality of the variety is determined by the distinctive differences of its color, which plays a prominent role among the many features that establish the decorative value of the variety of roses. Among the studied varieties of floribunda rose varieties, attention is paid to varieties with rare orange (Lilli Marleen and Westpoint) and purple (Minerva, Santa Monika and Let's Celebrate), as well as variety Mathias with mottled pink color (Fig. 3).



**Fig. 3. Flowering of variety Mathias**



**Fig. 4. Flowering of variety Minerva**

Flowers of some varieties have changed their color throughout the flowering, without losing their decorative. Thus, the Westpoint variety changed color from orange to orange-pink, and Arthur Bell varied from bright yellow to light yellow (Figs. 4, 5). As a rule, flowers of different colors could be observed at the same time in one inflorescence, which gave the bushes additional charm.



**Fig. 4. Flowering of variety Westpoint**



**Fig. 5. Flowering of variety Arthur Bell**

According to phenological observations, the duration of the growing season as a whole was determined and the duration of flowering in particular was determined (Table 3).

The average vegetation duration of the floribunda roses varieties during the study period was 231 days, with the longest duration in the Westpoint variety 234 days and the shortest in the Minerva variety - 215 days.

The average duration of flowering varieties ranged from 107 days in the variety Lilli Marleen to 158 days in the variety Westpoint, in general, the average flowering duration for the years of the study was 138 days.

According to Table 3, the varieties can be divided into 4 groups, depending on the duration of their flowering. The first is Arthur Bell, Westpoint, Rotkappchen, Iceberg and Santa Monika with the longest flowering period of more than 150 days; the second - Lovely Green, Mathias, Bella Rosa and Let's Celebrate, whose flowering duration is more than 140 days; the third - Friesia, Cream Abundance, Hans

Gonewein - more than 130 days and the fourth - Carmagnola, Lilli Marleen and Minerva, whose flowering duration is the lowest and is 120 days or less.

**Table 3. The duration of the growing season of the introduced varieties of floribunda roses, 2018-2019.**

№	Variety	Starts blooming - 90% fading, days			Duration of the growing season, days		
		2018 p.	2019 p.	average	2018 p.	2019 p.	average
1	2	3	4	5	6	7	8
1	Lovely Green	141±3	138±3	140±3	220±2	245±3	232±13
2	Carmagnola	123±3	114±3	119±13	218±1	243±4	230±13
3	Arthur Bell	150±2	154±2	152±2	219±3	245±3	232±14
4	Lilli Marleen	106±3	107±2	107±2	218±2	243±3	231±13
5	Westpoint	164±3	151±3	157±7	221±2	247±3	234±14
6	Minerva	115±3	101±2	108±8	203±1	226±3	215±12
7	Rotkappchen	155±4	151±3	153±4	221±3	244±5	234±13

**Continuation of Table 3.**

1	2	3	4	5	6	7	8
8	Friesia	135±3	125±3	130±6	218±2	240±3	229±11
9	Iceberg	154±2	153±2	154±2	221±2	243±4	232±12
10	Santa Monika	154±2	149±3	152±4	220±2	244±2	232±13
11	Mathias	153±4	140±3	146±7	219±3	245±3	232±14
12	Bella Rosa	142±3	141±2	141±3	221±3	237±2	229±9
13	Cream Abundance	137±2	128±3	132±5	221±2	245±5	233±13
14	Hans Gonewein	136±3	122±4	129±8	218±3	248±2	233±16
15	Let's Celebrate	148±3	141±2	144±5	220±2	243±2	231±12

The duration of flowering in 2018 was longer than in 2019 by 3-14 days, depending on the variety, which is probably due to the fact that in 2018 the total rainfall during the flowering period (May-October) was 315 mm, which is 37% more than in 2019 (199 mm). However, the overall length of the 2018 growing season was less, which can be explained by the early spring of 2019 and the and the late steady transition of temperatures below 0°C in the fall (21.11). The average daily temperature since the first decade of March 2019 was + 4.5° C, while in 2018 it was frosty, with a steady snow cover and an average daily air temperature of - 1.5° C. In November 2019 recorded an unusually high average daily temperature for this month (+ 8 ° C during the day and 4 ° C at night). Whereas the average daily temperature in November 2018 was + 3 ° C during the day and 1 ° C at night, and the steady transition of temperature through 0 ° C in the direction of decrease occurred 9 days later than 2019 - 12.11.

Thus, given the basic characteristics of the floristic identity of the floribunda roses and the duration of their manifestation, we can say that they are valuable material for modern ornamental gardening. The varieties of this garden group will be a good addition to the creation of gardens and flower beds, they



can be planted solitary or in groups. Due to their brightness and long-lasting flowering, they will be a garden decoration throughout the summer and autumn season.

#### REFERENCES

1. Wissemann V (2003) Conventional Taxonomy (Wild Roses). In: Roberts A, Debener T, Gudin S (eds) Encyclopedia of Rose Sciences. Elsevier Science, Oxford, UK, pp 326–334.
2. Chittaranjan Kole (2011) Wild Crop Relatives: Genomic and Breeding Resources Plantation and Ornamental Crops Springer-Verlag Berlin Heidelberg 303 P.
3. Shepherd, R E. 1954. History of the rose. Macmillan, New York.
4. Rowley, G. D. 1966. The experimental approach to rose breeding. *Scientia Hort.* 18:131-135.
5. G. R. Askew, F. A. Bliss, M. Gilbert (2000) Plant Breeding Reviews Volume 17 edited by Jules Janick Copyright by John Wiley & Sons, Inc. Canada 348 P.
6. Rubtsova O. L. Genus *Rosa L.* in Ukraine: gene pool, history, research areas, achievements and prospects: monograph. - K.: Phoenix, 2009. – 375 P.: Ill.
7. Klimenko Z. K. Secrets of growing roses M.: Fiton, 2009. - 128 P.
8. Klimenko V. N., Klimenko Z. K. Roses Simferopol: Tavria. 1974. 207 P.
9. Karpov A. A. Roses. Growing. Design. Sale. Ed. 4th. Rostov N / D: Phoenix, 2007. 160 P.
10. Sokolov N. I. Roses. M.: Agropromizdat, 1991. - 142 p.: Ill.
11. Klimenko Z. K. Biological features and selection of roses of floribunda group in Crimea. Author's abstract on the nipple. scientist. Bachelor of Science degrees. Yalta, 1971, 25 P.
12. Vlasenko E. We grow favorite roses. Publisher: Exmo. 2012. 192 P.
13. Titchmarsh A. Roses: (translated from English by M. Reshetina). SPb.: Petroglyph LLC. 2011. 64 P.: Ill.
14. Pankratova G. M. Garden roses. Big Encyclopedia / Galina Pankratova. - M.: Eksmo, 2012. - 272 P.: ill.
15. Klimenko Z.K. Features of cultivation of floribunda roses in the conditions of the southern coast of Crimea. GNSS Bulletin. 2017. Issue. 125. pp 136-140.
16. Gorodnaya E.V. Biological features of representatives of the genus *Rosa L.* collection of the Botanical Garden. N.V. Bagrov Taurida Academy of the Crimean Federal University named after V.I. Vernadsky. Thesis for the competition. scientist degrees of candidate biol.science. Yalta, 2017. 191 P.
17. Kafarova O.O. Varieties of roses of the floribunda group perspective for landscaping Absheron are introduced by the Central Botanical Garden. Proceedings of the Central Botanical Garden. Volume X. Baku, Elmo, 2012, p. 281-288.
18. Methods of examination of varieties of plants of the decorative group for difference, homogeneity and stability [Text] / Ministry of Agrarian Policy and Food of Ukraine, Ukr. Institute of Plant Variety Examination. - 2nd edition, corrected and supplemented. - Vinnitsa: Nilan LTD, 2016. - 1130 p. - ISBN 978-966-924-592-2.
19. Methods of examination of plant varieties of the group of decorative, ornamental, medicinal and essential oil, forest for distribution in Ukraine [Text] / Ministry of Agrarian Policy and Food of Ukraine, Ukr. Institute of Plant Variety Examination. ed. S.O. Weaver; Contribution: Z.B. Kienko, V.M. Matus, N.B. Pavlyuk [and others]. - 2nd edition, corrected and supplemented. - Vinnitsa: Nilan-LTD, 2016. - 130 p. - Bibliogr.: p. 51. - ISBN 978-966-924-577-9.