

PRODUCTION OF CASCADE CHRYSANTHEMUMS IN PUBLIC UTILITY COMPANY "GRADSKO ZELENILU" NOVI SAD

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SUMMARY: The study was conducted in a semi-controlled greenhouse conditions in the nursery of the Public Utility Company "Gradsko zelenilo" in Novi Sad. In order to broaden the range of potted chrysanthemum, in addition to multi-flowered ones, four new varieties suitable for getting cascade chrysanthemums are introduced experimentally in the manufacturing, whose production required special breeding technology. Testing decorative features included measurement of cascades' length as well as number of flowers per dm² of a plant, and measurement parameters are presented in tables and charts. There are many possibilities in their use and some of the solutions are shown in the photographs.

Key words: Chrysanthemum, cascade, production.

INTRODUCTION

Chrysanthemums are perennial or annual plant species of the family *Compositae* from China and now widespread in the Mediterranean, the Middle East, East Asia and parts of South Africa (Potkonjak et al., 2006, Welch, 2008; Wolff et al., 1995). The most important hybrid is *Chrysanthemum x morifolium* sin. (*C. grandiflorum*) originating from *C. indicum*. (Bradley et al., 1997; Herrington, 2008; Chen et al., 2010). The demand for chrysanthemum production, encompassing cut-flower, garden, potted plants and ground-cover types, is increasing worldwide. (Zhang et al., 2011).

There are a number of classifications and one of the most important divisions is in the garden and exhibition chrysanthemums (Salter, 2009). Garden chrysanthemums are able to survive winter in the open in most northern countries, they tolerate wind and rain and form a multitude of tiny flowers without mechanical aid. Group of exhibition chrysanthemum includes many varieties and has a very complex classification system (Cooke, 2007). During their growth they need a mechanical support and they survive winter in greenhouse conditions (Smith, 2000). The most common classification is according to a flower form, its blossoming time and whether you manually pruned buds or not. Chrysanthemums which do not need to

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be pruned include the following groups: spray, pompons, bushy, charm and cascade, which are categorized according to the shape and size of a plant (Norris-Brenzel , 2001).

Cascade chrysanthemum is a type of exhibition chrysanthemum and, while it is very popular and appreciated in the global market because of its attractive and unusual appearance, it is not widespread among domestic manufacturers. This form requires special manufacturing technology because its type is not genetically determined (Anderson, 2007; Silverman, 2004). Varieties suitable for obtaining a cascade characterized by considerable growth potential in length and width and a soft stem, are formed through special growing technology. Beside cascades, so-called railings, pillars and pyramids can be produced from the identical varieties in a similar manner (Norris-Brenzel , 2001). Form of growing cascade chrysanthemum started in Japan and it is called *kengai*, which is a traditional expression for waterfall, symbolizing the resemblance. Flat Korean variety is mostly used to obtain the cascade that can reach the length up to 3m (Dey, 2002). The largest exhibitions of chrysanthemum in the world are organized in the United States, England and Japan during "National Holiday of Chrysanthemum" (Singh, 2006). In addition to the remarkable cascade chrysanthemum, there are also bonsai forms, as well as hanging baskets (Maisano et al., 1971).

Because of their drop-down looks and different range of colors and flower shapes, which are offered by a large number of varieties, cascade chrysanthemums can be applied to open spaces (terraces, balconies, street lights and planters) for a short period of time. As short-day plants they may suffer from early autumn frosts. Exposed within the interior of the bus and train stations, airports, major shopping centers and similar spaces, they may provide a much longer flowering effect.

The aim of this study was to investigate the possibility of growing four varieties of chrysanthemum suitable for cascade growing and show the great potential of this type of chrysanthemum in horticultural production and landscape architecture.

MATERIALS AND METHODS

The surveys were conducted in 2012. in experiments performed in semi-controlled greenhouse conditions in the nursery of the Public Utility Company "Grasko zelenilo" in Novi Sad. In that nursery, the production of potted tiny-flowered varieties, so called multi-flowered chrysanthemums, has been carried out for many years, and the end of production is scheduled for 1st November, the Day of the Dead.

To expand the range of potted chrysanthemum, authors of the paper started the experimental production of cascading chrysanthemums after developing the detailed plan of production by using the guidelines of the National Society of Chrysanthemum USA. Four French varieties were taken as research subjects: *Alba Tourly*, *Berruyere Cuivre Tourly*, *Armoricainte Tourly*, *Petite Maman Pichery*.

The experiment started 22.07.2012. by planting rooted cuttings in accordance with biological requirements of species, which were provided by the supplier DOO POMEX Sremski Karlovci. 50 rooted cuttings of each variety were planted in pots with a diameter of 19 cm. Flower pots were filled up to 2cm below the top with substrate manufactured by REKYVA, which made milled peat obtained by special technology of drying and processing. Then 9g of fertilizer OSMOCOTE

formulations (15:9:12) is added to each pot. Cuttings were planted at a depth of 3 cm in the middle of the pot, placed at a distance of 40 cm from each other. In order to prevent lodging of seedlings caused by *Pythium spp.* plants were watered 0.15% with a product PREVICUR ENERGY, and then preventively treated with a mixture of medicines DECIS 2.5 EC 0.05% + ALERT S 0.08% + TREND 0.02% for preventing fungal diseases and insects. Pots were placed on the parapets from where it was possible to carry out irrigation by a process of subirrigation and also to recharge with water soluble fertilizer. First pruning of 3-4 leaves was done in early August 2012 and growth of all branches was stopped, except for the main one, in order to stimulate lateral branching (Swithinbank et al., 2006). After two days, the plants were fed with water soluble NPK fertilizer by FERTICARE KEMIRA formulations (10:5:26) at a concentration of 0.1% once a week. After nine days a wire grid, support of the edge of the pot, was set at an angle of 40 degrees to the edge. Ellipsoidal bracket tied main stems of plants in order to reverse direction of growth of the main stem towards the ground instead the height. Tying to the bracket was performed with a soft flexible wire in a hook shape. In late August, the second pruning of the sprouts was performed on 3-4 leaves of lateral sprouts in order to stimulate branching and to get a flat, thick and long, in other words, peltate shape (Swithinbank et al., 2006). In mid-September, when days became shorter, the process of budding began so any further pruning was halted. After the red mites *Paonychus ulmi* were observed on plants, the mixture of following products was applied: ACTARA 25WG 0.05% + DECIS 2.5 EC 0.05% + NISSORUN 10EC 0.05% + TILT 250EC 0.05% + TREND 0.02%. The treatment was repeated the next day with acaricides NISSORUN 0.05% + TREND 0.02%.

Also, in order to encourage flowering process, it was subjected to the new formulation of the same fertilizer in the process of feeding (15:30:15). Supplemental feeding was intensified twice a week. During the last part of October, out of four varieties, the first blossomed *Berryere Cuivre Tourly*, after two days *Petite Maman Pichery*, and all the other varieties three days after that one.

RESULTS

On a sample of 200 pots, all four varieties in 50 pots, which were treated in an identical agro-technical conditions, the number of flowers and the length of the cascadeas indicators of decorative properties of the varieties were tested.

Parameters of descriptive statistics presented in Table 1 were calculated based on the values in a program "STATISTICA".

Table 1. The descriptive statistic parameters of decorative properties of tested varieties

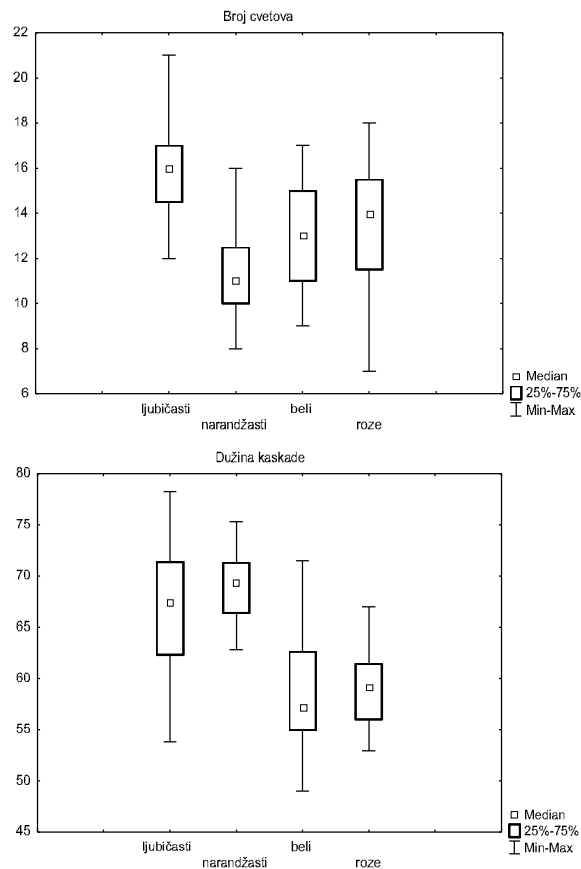
Variety		Arithmetic mean	Median	Modus	Minimum	Maximum	Variance	Standard deviation	Coefficient of variation in %
Armoricainte Tourly Purple flower	Flower number	16,13	16,00	15,00	12,00	21,00	5,65	2,38	14,74
	Cascade length	67,09	67,40	71,40	53,80	78,30	38,78	6,23	9,28
Berruyere Cuivre Tourly Orange flower	Flower number	11,30	11,00	12,00	8,00	16,00	3,81	1,95	17,26
	Cascade length	69,09	69,35	66,00	62,80	75,30	10,68	3,27	4,73
Alba Tourly White flower	Flower number	12,90	13,00	12,00	9,00	17,00	5,12	2,26	17,54
	Cascade length	58,52	57,15	55,30	49,00	71,50	33,67	5,80	9,91
Petite Maman Pichery Pink flower	Flower number	13,23	14,00	14,00	7,00	18,00	8,28	2,88	21,76
	Cascade length	58,83	59,10	Multiple	52,90	67,00	10,10	3,18	5,40

Based on these indicators we can conclude that, on average, *Berruyere Cuivre Tourly* variety had the lowest number of flowers, 11.3 flowers per dm², and the biggest variety *Armoricainte Tourly* with 16.13 flowers per dm², recorded the absolute maximum number of flowers, 21 flower per dm². When it comes to the average length of the cascade the poorest results were given by the variety of *Albatourly*, 58.52 cm, and the best *Berruyere Cuivre Tourly* variety 69.09 cm. The minimum length of a cascade of only 49.0 cm was recorded with *Alba Tourly* variety.

In most of the pots of *Armoricainte Tourly* variety was 15 flowers per dm² and the most common length of the cascade was 71.40 cm. The largest number of pots of *Berruyere Cuivre Tourly* and *Alba Tourly* had 12 flowers per dm², with a cascade

length of 66.0 cm and 55.30 cm. Variety of *Petite Maman Pichery* gave bimodal result in measuring the length of cascades (55 cm and 56.8 cm), while the most common number of flowers per dm² was 14.

The greatest variability in the number of flowers came from the variety with pink flowers *Petite Maman Pichery* CV = 21.76%, and in the length of the cascade from *Alba Tourly* CV = 9.91%. Graphical representation of the calculated parameters of decorative properties of the varieties is presented in the Box - Whiskers diagrams. (Figure 1)



Graph. 1. Box - Whiskers diagrams of calculated parameters of decorative properties of the varieties

The key difference in the production of cascade chrysanthemums compared to previously produced potted multi-flowered chrysanthemums is that they do not have the possibility of genetic formation of cascade shape, but the preferred form of the cascade is produced by appropriate, strictly defined technology. This means that cascade chrysanthemums require a greater commitment of staff working on their production, as well as a number of operations. Despite that, numerous opportunities in the application, as well as decorative features of varieties, justify a more complex production.



Fig. 1. Cascade and multi-flowered chrysanthemums set in planters, Liberty Square, Novi Sad, November 2012.



Fig. 2. Cascading chrysanthemums on street lamps, Liberty Square, Novi Sad, November 2012.

CONCLUSION

Observing the values of all tested decorative components, it can be said that the *Armoricainte Tourly* variety emerged as the most suitable genotype for the formation of cascade shape, and that all four tested varieties have already met a catalogue selected standard of color and shape of flowers. Authors' recommendation for the next growing season is to start the production earlier. This way, with the extension of the period of production, and with a bigger number of completed pruning, longer, more dense and compact cascades would be produced.

In the development of horticultural production of the Republic of Serbia, increase of flower production and expansion of flower assortment for the greater competitiveness on both domestic and international markets is expected. Cascade production development would contribute to the efforts of the industry of our country. Conducted experiment shows that the production of cascade chrysanthemums is feasible, but it is necessary to conduct further research on the economic efficiency and profitability of the production.

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PROIZVODNJA KASKADNIH HRIZANTEMA U JAVNOM KOMUNALNOM PREDUZEĆU „GRADSKO ZELENILO“ NOVI SAD

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Izvod

Istraživanja su sprovedena u polukontrolisanim plasteničkim uslovima u rasadniku Javnog komunalnog preduzeća "Gradsko zelenilo" Novi Sad. U cilju proširenja asortimana saksijskih hrizantema, pored do sada proizvedenih multifloralnih, u proizvodnju se eksperimentalno uvode četiri nove sorte pogodne za dobijanje kaskadnih hrizantema, za čiju proizvodnju je bilo neophodno primeniti posebnu tehnologiju uzgoja. Ispitivanje dekorativnih svojstava obuhvatilo je merenje dužine kaskade kao i broja cvetova po dm² biljke, a parametri merenja prikazani su tabelarno i grafički. Postoje brojne mogućnosti u njihovoj primeni a neka od rešenja prikazana su na fotografijama.

Ključne reči: Hrizantema, kaskadna, proizvodnja.

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