MANAGEMENT OF PLANT PRODUCTION (NARCISSUS L.) THROUGH THE APPLICATION OF NON-STANDARD GROWING METHODS IN ORDER TO INCREASE THE FINANCIAL VALUE OF PRODUCTION

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ABSTRACT

Geophytes are plants of high biological diversity that depends to a great extent on the growing process. Based on what is stated, any new method of production of Narcissus L. has a decisive effect on its production. The aim of the study is to determine if it is possible to achieve better economic-agricultural results with a new method/form of plant growing (Narcissus L., Amaryllidaceae). Under the conditions of the Pannonian environment the production of two methods/forms of growing is compared. By measuring physical plant parameters (p=.00) the results show that the production is better using the standard method of growing. The realized value on the market is higher for the plants grown using the standard method of production (p<.05). The contribution of the author of the study is to indicate a new way of growing, which leads to a higher total value of production.

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Introduction

Narcissus L. is perennial geophytes those are narrowly distributed along the Mediterranean basin. Narcissus L. is a member of Amaryllidaceous a family comprising several horticulturally important plant genera. Decorative and sensory values (Hobson & Davies, 1977; Ehret, et all, 1990; Arroyo & Dafni, 1995; Arroyo & Barrett, 2000; Briggs & Christie, 2002; Folta & Maruhnich, 2007) Narcissus shows high horticultural potential. It is used as an ornamental bulb for growing in the ground, in containers or cut flowers (Kinoshita & Wada, 2000; Kinoshita, et al., 2001; Horton & Ruban, 2005; Loreto, et all, 2009; Lubbe, et all, 2009; Katalin, at all, 2020) then it is used to maintain biodiversity, as well as for plant breeding programs, Narcissus (Rudnicki & Nowak, 1976; Mathew, 2002; Sun, et all., 2005; Okazawa & Nishijima, 2007; Bjelica et all., 2017; Gul, et all., 2018; Safratová, et all., 2018; Zelenović et all., 2018; Bakmaz et all., 2020) it is also widely used in the pharmaceutical industry (alkaloids), to alleviate the symptoms of Alzheimer's disease.

Narcissus poetic's bulbs are also a source of narpoethane-a substance that stimulates the growth of cereals and cotton. The scent of Narcissus flower extract is used in the perfume industry, aromatherapy and hortitherapy. Due to the large application of narcissus and its reaction to growing conditions (Popović, et all., 2018).

Due to the large application of narcissus and its reaction to growing conditions agro-economic observation of plant growing is gaining in importance, particularly in case of plant growing where there is a requirement of making a visual impression on the observer.

The purpose of the research is to present possible agro-economic benefits of plants grown in previous years in public areas under a natural shade. The purpose of the study is to point to the specialists in the relevant field, as well as top management, particularly in public enterprises, to choose an optimum method of (*Narcissus* L.) plant growing.

This plant is one of the first spring types that enrich public parks. In addition to that, this is one of the rare studies showing that the economic value of the plant grown by applying two methods could be measured, and the methods employed are the standard one and the method of growing based on planting (*Narcissus* L.) bulbs grown in the previous three years under a pronounced natural shade in public park areas in the cities.

Numerous authors emphasize that there is a great number of heterogeneous factors that might have an impact on plant growing. Such production conditions often imply a shade, i.e. insufficient quantities of natural light, which has a significant impact on physical properties of the plants grown (Devlin, et all., 2007; Boanca, et all., 2014; Nowak, et all., 2016; Baráth, & Fertő, 2017).

For a comprehensive valuation of (*Narcissus* L.) plant growing, it is necessary to consider a great number of heterogeneous agronomic impacts on the plants. The authors of the study point out that it is necessary to take into account a very great number of heterogeneous economic factors when deciding on the production, as well as to employ a greater number of internal control factors in the respective enterprises.

Besides, in the operations of public utility companies which are essentially providing services to citizens it is of particular importance to take care of the value of production as such operations is funded by taxpayers.

Materials and methods

Conducting an Experiment

The realization of the experiment took place on a park area in the City of Novi Sad (latitude 45° 20; longitude 19° 51'). It is a continuation of the previous three-year experiment, the results of which were published in and which included standard planting of plants (Narcissus L.) with the application of a new method of planting the same plant species.

In the standard cultivation of the mentioned plant species on the park areas of cities in the conditions of cultivation where there was a pronounced shade (1000 lx during the day) after three years the plants were destroyed. This was done because the plants had significantly lower growth, i.e. their visual effect on visitors to city parks was much weaker.

The paper gives an innovative or new approach to production, which meant that plants were not destroyed but replanted in park areas in cities where there is a normal amount of daylight. A three-year experiment was done that included both ways-forms of production.

The obtained results of 8 physical parameters of cultivated plants in both forms-forms of production are economically observed path of economic value that this plant has on the retail market in the year of production, but also during the duration of the experiment.

The purpose of the experiment was to find a new way to improve the economy in the production of these plants. Therefore, measurements of the economic effects of both modes of production were made in order to obtain valid answers that would be useful for some future production. The aim of the author was to discover the possible economic justification of the new way-form of plant cultivation, especially since their production is done with the money of local government taxpayers.

Interval and Course of the Experiment

The interval of the experiment was in the period 11/01/2017, until 03/30/2019. The experimental area is characterized by an average annual temperature of 10.9 ° C, average precipitation of about 578 mm and an altitude of 86 m.

The authors measured 8 selected plant parameters that were observed in total in both production methods in order to determine the achieved results by comparison. The experiment began with the planting of bulbs on the city park area, i.e. on land mechanically cleared of weeds, which had standard conditions of natural light during the day. Planting was done on two plots close to each other (about 40 m).

The first plot was planted with bulbs from plants that were grown as standard and the second plot was planted with bulbs from plants that had been grown in the previous three years in conditions of extreme natural shade (1000 lx during the day).

Objectives of Experimental Research

First goal of the study was to discover the existence of differences in both methods of cultivation through morphological changes, i.e. by monitoring 8 physical values of selected parameters of cultivated plants.

The second goal was to determine the existence of differences in the amount of direct economic investments in both methods of production.

The third goal was to determine whether the realized value of plant production is the same in both methods of production by years of observation.

The fourth goal was to determine whether the total realized value of plant production was the same for both methods of production in the entire observation period.

The fifth goal was to determine whether the same total difference in value for the entire observation period is achieved with both methods-forms of production.

Hypotheses

Taking into account the previously stated views, the authors of the study developed the following hypotheses.

H: 1 Plants (Narcissus L.) produced from plants grown in natural light conditions in Parks of Cities (hereinafter the first method of production) in the first year of production after planting achieve the same production results measured over 8 physical parameters as plants that originate from plants that have been grown in the shade for the previous three years (1000 lx; hereinafter another method of production).

H: 2 Plants (Narcissus L.) grown in the first method of production in the second year of production after planting achieve the same production results measured over 8 physical parameters as plants grown in the second method of production.

H: 3 Plants (Narcissus L.) grown in the first method of production in the third year of production after planting achieve the same production results measured over 8 physical parameters as plants grown in the second - an innovative method of production.

H: 4 Plants (Narcissus L.) produced in the first year of cultivation require the same direct economic investment in production in both production methods.

H: 5 Plants (Narcissus L.) produced in the second year of cultivation require the same direct economic investment in production in both production methods.

H: 6 Plants (Narcissus L.) produced in the third year of cultivation require the same direct economic investment in production in both production methods.

H: 7 Plants (Narcissus L.) produced in the first year of cultivation achieve the same market value in both production methods.

H: 8 Plants (Narcissus L.) produced in the second year of cultivation achieve the same market value in both production methods.

H: 9 Plants (Narcissus L.) produced in the third year of cultivation achieve the same market value in both production methods.

H: 10 Plants (Narcissus L.) produced in a three-year observation period achieve the same total market value in both production methods.

H: 11 Plants (Narcissus L.) produced in the three-year observation period achieve the same difference in value, taking into account direct investments in production and the realized value on the retail market in both production methods. centered.

Concluding remarks after the presentation in the study

In the study conducted by the authors, 5 main conclusions are given.

The first conclusion is that after measuring 8 physical parameters of the plants grown, the results obtained are better than in case of the first method/form of production in all three years of observation.

The second conclusion is that direct investments in production are significantly greater for the first method/form of production in the first year of production, whereas in the second and third year they are approximately the same.

The third conclusion is that the realized value of plant production in each of the three years under observation is greater in case of the first method/form of production than in the second.

The fourth conclusion is that the total realized value of plant production in all three years is greater in case of plants grown by the standard way of production than in case of plants grown by the new method/form of production ($p<.05$).

The fifth conclusion is that in the three-year period of observation the total difference in value in case of plants grown by the new method/form of production is greater, whereby the value of total direct investments in production and values on the retail market ($p<.05$) are taken into account.

Data processing

Statistical package SPSS IBM 22.0 was used for data processing. This was done in order to test the hypotheses. The authors used descriptive statistics with cross-tabulation, and from the statistical tests the t-test for independent samples and the t-test for independent samples with Bonferroni correction were used.

Results

The main objective of the paper is to present the results obtained in the production based on an experimental research of both methods of production, which would enable making an optimum decision on a possible production in the future.

The results are presented through 5 interconnected units that essentially complement each other and create a general picture of the importance of an innovative approach in the production of a plant species (*Narcissus* L., Amaryllidaceae) in urban production conditions.

Morphological characteristics of cultivated plants measured over 8 physical parameters in the cultivation of two forms of production

The authors measured 8 physical parameters, namely: flower diameter, stem length, stem diameter, leaf length, leaf width, mass of aboveground part, bulb diameter and bulb mass in both methods of plant production.

The results are presented by descriptive statistical processing for the period 2017-2019 for both forms of production, and they are strengthened by T-test of independent samples, Tables 1 and 2.

Table 1. Display of total measurement results of 8 physical parameters per year

Year of observation	Method of production	N	Mean	Std. Deviation	Std. Error Mean
2017	standard mode of production	100	**78.40**	3.216	.322
	new mode of production	100	**46.40**	3.216	.322
2018	standard mode of production	100	**69.80**	2.871	.287
	new mode of production	100	**52.80**	3.939	.394
2019	standard mode of production	100	**72.00**	.000	.000
	new mode of production	100	**64.40**	1.752	.175

Source: Author's research

Table 2. Results of t-test of physical parameters of plant production and production methods

Year of observation	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
2017	**70.356**	198	.000	32.000	.455	31.103	32.897
2018	34.878	198	.000	17.000	.487	16.039	17.961
2019	43.370	198	.000	7.600	.175	7.254	7.946

Source: Author's research

Direct economic investments and the form of organization of production

The authors made a gradation of direct economic investments taking into account three levels of gradation, namely: small level, medium and high level of investment. The presentation of the obtained results is given in Table 3 in the three observed years (2017-2019) in which the research was conducted, Table 3.

Table 3. Representation of the gradation of direct economic investments in relation to the form of production

Year of observation	Direct economic investment in production	Form of production	
		Standard mode of production	New mode of production
		Column N (%)	Column N (%)
2017	Little level	0.0%	80.0%
	Middle level	0.0%	20.0%
	High level	100.0%	0.0%
2018	Little level	80.0%	80.0%
	Middle level	20.0%	20.0%
	High level	0.0%	0.0%
2019	Little level	100.0%	100.0%
	Middle level	0.0%	0.0%
	High level	0.0%	0.0%

Source: Author's research

Realized value on the retail market in relation to the form of production by years of observation

The authors performed measurements of the realized value in the retail market in relation to the form of production by years in which the experiment was performed, which is reinforced by the presentation given in Table 4, after the Bonferroni coefficient t-test.

Table 4. Values obtained after Bonferroni t-test by correction by years of observation

Year of observation	Form of production	
	Standard mode of production	New mode of production
	Mean	Mean
2017	10_a	6_b
2018	9_a	7_b
2019	9_a	8_b

Source: Author's research

Realized total value of production in relation to the form of production

After the research and the Bonferroni correction t-test, the authors presented the results of the total realized value of plant production in relation to the form of production for the observation period 2017-2020, Table 5.

Table 5. Values obtained after Bonferroni t-test by correction by years of observation

Period of research by years of observation	Form of production	
	Standard mode of production	New mode of production
	Mean	Mean
2017-2019	9_a	7_b

Source: Author's research

The realized total difference in the value of production arose on the basis of the ratio of direct investments and the realized value on the retail market

Table 6. Overview of the total realized value difference taking the ratio of direct economic investments and the realized value on the retail market after Bonferroni t-test by correction

Period of research by years of observation	Form of production	
	Standard mode of production	New mode of production
	Mean	Mean
2017-2019	6_a	7_b

Source: Author's research

The authors present (Table 5) the realized total difference in the value of production obtained by the ratio of direct investments and the realized value in the retail market in both methods of production for the observation period 2017-2020.

The first conclusion would be that plants that were previously grown in conditions of normal natural light in all three years achieve better results measured over 8 physical parameters than plants derived from previously grown plants in conditions of extremely low natural light (1000 lx), (Table 1). This was confirmed by conducting statistical significance by t-test for independent samples, at the level of significance p = .00 (Table 2).

The second conclusion is that direct economic investments in production in the first year of cultivation are significantly higher with the standard method of production than with the new form of production, while in the next two years direct economic investments are equal (Table 3).

The third conclusion is that plants derived from standard-grown plants achieved higher value in the retail market compared to plants planted from previously grown plants with pronounced shade during the entire observation period (p <.05), (Table 4).

The fourth conclusion is that in the entire observation period standard grown plants have a total significantly higher value compared to plants grown with a new form of production in the entire observation period (p <.05), (Table 5).

The fifth conclusion is that the plants grown in the new way-form of production achieved a greater total difference in value, taking into account direct economic investments in production and the realized value in the retail market (p <.05), (Table 6).

Discussion

As compromises between the appearance of a product and its value are increasingly sought it is necessary to innovate the production process, particularly taking into account the total economic cost relating to the resulting production (Barlev & Haddad, 2003; Brown & Szimayer, 2008; Aczel, 2015; Novaković, et all., 2018; Popović, D, et all., 2018; Wang, 2019; Murphy, 2019). This research is conducted having in mind that the plant in question is among the first early spring plants, particularly in city parks, improving the visual impression of the area. In addition to this visual impression

of visitors, plants grown in public areas are subject to other evaluations and they predominantly refer to economic costs of maintenance of public areas in cities as such maintenance is funded with the money of taxpayers (Sun, et all., 2005; Rodriguez, et all., 2019; Rajičić, et all., 2020; Radović, et all., 2021; Ugrenović, et all., 2021; Vitomir, et all., 2021; Popović, 2021). Due to that, public enterprises set up internal control aimed at reduction of production costs (Cantino, 2009; Popović, 2014; Popović, et all., 2014; Wynen & Verhoest, 2016).

With due regard to all published views, the authors, by making working assumptions, wanted to discover actual possibilities of innovating the method/form of production of (*Narcissus* L.) plant. To accomplish that, they used the results of a previous three-year research (*Narcissus* L.). They made a comparison of a standard plant growing method and the new method of growing. The innovated method the authors employed meant they used bulbs grown in the previous three years under conditions of a reduced natural light (1000 lx) during daytime instead destroying them and planted them. The authors measured the results obtained in the plant growing that way in the following three-year period.

Upon presentation of the obtained results (Table 1) hypotheses 1-3 can be rejected as morphological properties of the plants grown show that the standard method/form of growing yields better results in all three years of observation, which is also confirmed after the t-test is made for independent samples with the significance level p=.00 (Table 2).

The results presented show that direct economic investments in production (Table 3) in year one of growing are significantly higher in case of standard plant growing and therefore H:4 is rejected, whereas H:5 and H:6 are accepted as direct investments in year two and three are approximately the same.

The total value of production, when growing method is concerned, is significantly higher in case of the standard method grown plants in all three years, and H:7, H:8. H:9 are rejected, which is supported by the T-test with the Bonferroni correction (Table 4).

The obtained total value of production over the entire period of observation is higher in case of the standard growing than in case of the new method of production and therefore H:10 can be rejected with confidence as the obtained results are (Table 5), ($p<.05$).

The total difference in the production value presented in the ratio of direct investments to the value realized on the retail market is higher in case of the new method/form of production and H:11 can be rejected with confidence (Table 6), ($p<.05$).

During the preparation of this work, the authors used already published works in which there are notes that during the new organization of economic activities it is desirable to use all the economic benefits that arose on the basis of a different (innovative) economic activity (Soltani, 2009; Williams, 2010; Anwar & Sun, 2015; Chen, et al., 2017). In addition to what has been stated, the authors have also taken into account the views that include the factors of production organization and the existence of specific conditions that can affect the entire organization of production, such as the factors of the existence of the needs of residents within the existence of local self-government units, on which they are

pointed out by the authors (Alibegović, et al., 2018). Respecting all the previously stated views of the authors, the authors of this paper essentially continued with the previously started and published works (Popović, et all., 2015) as a basis for that research to innovate with new research which essentially had a multidisciplinary approach.

The results presented in the paper indicate that this research could be upgraded in some future efforts by introducing other types of plants in the research and conducting new experiments. In addition to a new research, it is possible to conduct subsequent ones by introducing new parameters in observation relating to economic investments in production, use of machines, labour etc. The primary goal of a possible future research would be imposed by taxpayers themselves as they would ask detailed explanations as to the investments made relative to their requirements. The authors believe that in the years to come there will be a greater number of papers on multidisciplinary monitoring of plant production, as well as agricultural production in general.

Conclusions

The importance of this work is reflected in pointing out the importance of applying a multidisciplinary approach in which the authors combined agronomic, ecological, psychological and economic observations. In addition, this work clearly indicates the importance of making the most optimal decision about the way/form of growing plants (Narcissus L.). It is of great importance in the organization of agricultural production. Such a way of organizing production should enable the satisfaction of the needs of taxpayers in local self-governments. The authors pointed to the realization of possible benefits if a new way of organizing production is implemented. The main authors pointed out the importance of managing the processes of agronomic production by means of a non-standard organization of agricultural production of the mentioned plant species.

Based on the review of this paper, the existence of three basic conclusions can be observed (the existence of possible benefits) if a new (innovative) approach is applied in the organization of a plant species (Narcissus L.) in urban conditions.

The first conclusion would be that the real existence of optimal plant production can be based on the improvement of the required morphological properties of cultivated plants (significance level p=.00; table 2), with the simultaneous existence of economic benefits in the production (table 3) of the mentioned plant species, especially in in the first year of production if the new and shown production method is applied.

Another conclusion would be that optimal plant production should also include an analysis of the total realized value of production by methods (ways) of growing plants.

The third conclusion would be that optimal plant production should include the results of the analysis of the total economic difference in the value of production in both methods/forms of production (table 5).

The above three conclusions derived from the obtained results of this work, in the author's opinion, represent a realistically applicable model in the production of a plant

species (Narcissus L.) in urban conditions. At the same time, such an approach in the application of plant production is also possible with other plant species, which can be a realistic upgrade of this approach to production in the next multidisciplinary researches in the field of organization of plant production.

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Conflict of Interests

The authors declare no conflicts of interest.

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