chemistry proceedings

MDPI

Proceeding Paper

Assessment of Eggplant (*Solanum melongena* L.) Genotypes and Selection of Parameters for Better Yield †

Jelena Damnjanović [1], Zdenka Girek [1], Jelena Milojević [2], Veselinka Zečević [1], Tomislav Živanović [3], Milan Ugrinović [1] and Suzana Pavlović [1,*]

[1] Institute for Vegetable Crops, 11420 Smederevska Palanka, Serbia; jdamnjanovic@institut-palanka.rs (J.D.); zgirek@institut-palanka.rs (Z.G.); vzecevic@institut-palanka.rs (V.Z.); mugrinovic@institut-palanka.rs (M.U.)
[2] Institute for Biological Research Siniša Stanković, 11000 Belgrade, Serbia; jecamil_84@yahoo.com
[3] Faculty of Agriculture, University of Belgrade, 11080 Belgrade, Serbia; tomislav@agrif.bg.ac.rs
* Correspondence: spavlovic@institut-palanka.rs; Tel.: +38-164-883-4621
† Presented at the 1st International Online Conference on Agriculture-Advances in Agricultural Science and Technology, 10–25 February 2022; Available online: https://iocag2022.sciforum.net/.

Abstract: One of the goals in eggplant breeding (*Solanum melongena* L.) is higher yield. This study included 20 different genotypes that are part of the collection of the Institute for Vegetable Crops Smederevska Palanka. Sixteen genotypes originated from Serbia, two originated from the Netherlands, one originated from Italy, and one originated from Israel. The experiment was conducted at Vranovo (44°36′6.35″ N, 20°59′55.47″ E, altitude 87 m) using a randomized complete block design and three replications. The yield parameters (earliness, plant height/centimeter, number of fruits per plant, fruit weight/gram, fruit length and width/centimeter, and fruit yield per genotype/kilogram) were examined to study the relationships among traits and their effects on eggplant yield. The number of fruits per plant had a positive and significant correlation with yield (r = 0.685 **). Additionally, the results showed positive correlations between plant height and fruit length (r = 0.812 **), between plant height and fruit weight (r = 0.147), and between fruit width and fruit weight (r = 0.523 *). These characteristics had direct or indirect positive effects on yield, so they can be used as selection criteria to increase the final yield of eggplant. Because there is genetic variability between the tested genotypes, progress in breeding will depend on this variation. Earliness had a negative correlation with yield (r = −0.044) and with all other parameters.

Keywords: eggplant; genotypes; fruit; yield; earliness

Citation: Damnjanović, J.; Girek, Z.; Milojević, J.; Zečević, V.; Živanović, T.; Ugrinović, M.; Pavlović, S. Assessment of Eggplant (*Solanum melongena* L.) Genotypes and Selection of Parameters for Better Yield. *Chem. Proc.* **2022**, *10*, 31. https://doi.org/10.3390/IOCAG2022-12309

Academic Editor: Daniel Tan

Published: 21 February 2022

1. Introduction

Eggplant (*Solanum melongena* L.) is an agronomically and economically important member of the *Solanaceae* family. It is important as a source of various nutritional compounds and as a raw material for the pharmaceutical industry [1]. In 2018, the world production of eggplants was 54 million tonnes on more than 1.8 million ha, led by China, with 63% of the total, and India, with 24% of the total [2].

The presence of good fiber, and various vitamins and minerals in fruits (rich source of iron and manganese) is of great benefit to human health. Eggplant also contains high phenolic contents that act as antioxidants [3,4]. The color of purple-skin cultivars is due to the anthocyanin nasunin [5]. The browning of eggplant flesh results from the oxidation of polyphenols, such as the most abundant phenolic compound in this fruit, chlorogenic acid [6].

Foods that contain antioxidants may help prevent a variety of diseases. Various studies have shown that eggplant extracts have superb healing effects on different disorders such as burns, warts, inflammatory infections, gastritis, stomatitis, and arthritis [7]. Chlorogenic acid has anticarcinogenic functions by promoting apoptosis in many human cancer cells, such as leukemia and lung cancer cells [8].

Some of the goals of eggplant breeding are to obtain a higher yield and better-quality fruits as well as to improve adaptation to various environments [9]. Many varietes are created in response to adaptation to environmental conditions. Variability is observed even within the same variety in terms of plant height, fruit size, and yield depending on the climate, exposure, and place and method of cultivation [10].

The aim of this study was to examine the relationships among yield parameters (earliness, plant height/centimeter, number of fruits per plant, fruit weight/gram, fruit length and width/centimeter, and fruit yield per genotype/kilogram) and their effects on eggplant yield.

2. Materials and Methods

This study included 20 different genotypes that are part of the collection of the Institute of Vegetables, Smederevska Palanka. Sixteen genotypes originated from Serbia, two originated from the Netherlands (K22 and K25), one originated from Italy (K19), and one originated from Israel (K38) (Table 1). The experiment was conducted at Vranovo (44°36′6.35″ N, 20°59′55.47″ E, altitude 87 m).

Table 1. The genotypes used and their origins.

Genotype	Genotype	Origin
K 1	K 19	Italy
K 3	K 20	Serbia
K 6	K 21	Serbia
K 7	K 22	The Netherlands
K 8/1	K 25	The Netherlands
K 10	K 34	Serbia
K 12	K 35	Serbia
K 13	K 36	Serbia
K 15	K 38	Israel
K 16	K 39	Serbia

Sowing was carried out in individual pots, 11 cm in diameter; filled with a sterile substrate; and kept in a protected area. The seedlings were maintained in a common manner, i.e., every 15 days fertilized with NPK 20:20:20 (25 g/10 L of water) and treated with pesticides as needed. Planting was carried out at the beginning of June. The area of the basic plot was 56 m^2. In each replication, 10 plants were placed in a row for each genotype. The length of the rows was 4 m, the distance between the rows was 0.70 m, and the distance between the plants in each row was 0.40 m.

The yield parameters (earliness, plant height/centimeter, number of fruits per plant, fruit weight/gram, fruit length and width/centimeter, and fruit yield per genotype/kilogram) were examined to study the relationships among the traits and their effects on eggplant yield. The trials were conducted with a randomized complete block design (RCBD) in three replicates. The correlations and path coefficients were studied using StatSoft Inc. (Tulsa, OK, USA) STATISTICA, version 8.0.

3. Results and Discussion

This study included 20 genotypes that differed in origin, color and shape of the fruit, and yield (Table 1 and Figure 1).

Figure 1. The genotypes used: differences in color and shape of the fruit.

The experiment was conducted in Vranovo during a year when the average air temperatures were higher than the ten-year average. During the period when the vegetative organs developed and the eggplant plants flowered, average temperatures were in the range of 21.0–27.8 °C. The total amount of precipitation at in Vranovo (139.6 mm) was lower compared with the multi-year average precipitation (Table 2).

Table 2. Total precipitation (mm) (A) and average monthly air temperature (°C) (B) in Vranovo for June–September 2015 and their ten-year averages (2000–2010).

		Month			
		June	**July**	**August**	**September**
A.	Precipitation (mm)	43.5	9.6	41.0	45.5
	Ten-year average precipitation (mm)	79.0	53.0	39.0	43.0
B.	Average Temperature (°C)	24.8	32.3	33.3	27.8
	Ten-year average temperature (°C)	17.9	21.2	19.8	18.7

Number of fruits per plant had a positive and significant correlation with yield (r = 0.68 *) (Table 3). The same results were obtained in a similar study [11]. Additionally, the results showed positive correlations between plant height and fruit length (r = 0.81 *), between plant height and fruit weight (r = 0.147), and between fruit width and fruit weight (r = 0.52 *). These characteristics had direct or indirect positive effects on yield, so they can be used as selection criteria to increase the final yield of eggplant. The correlation between fruit length and weight, and yield was positive but not significant. This is in line with the results of other groups of researchers [11–13]. Earliness had a negative correlation with yield (r = −0.044) and with all other parameters. Our results are in accordance with those of an earlier report [14] in which a negative correlation between days to flowering (earliness) and fruit yield was found.

Table 3. Correlation coefficients among the traits of different eggplant genotypes.

Traits	FYpG	L	W	FW	NFpP	PH	E
FYpG	1.00						
L	0.29	1.00					
W	0.11	−0.12	1.00				
FW	0.40	0.03	**0.52** *	1.00			
NFpP	**0.68** *	0.20	−0.14	−0.32	1.00		
PH	0.39	**0.81** *	−0.06	0.15	0.24	1.00	
E	−0.04	−0.27	−0.41	−0.21	0.11	−0.06	1.00

Marked correlations (*) are significant at $p < 0.05$. FYpG—fruit yield per genotype/kilogram; L—fruit length/centimeter; W—fruit width/centimeter; FW—fruit weight/gram; NFpP—number of fruits per plant; PH—plant height/centimeter; E—earliness.

4. Conclusions

All characteristics that had direct or indirect positive effects on yield can be used as selection criteria to increase the final yield of eggplant. Because there is a genetic variability between the tested genotypes, progress in breeding will depend on this variation.

Author Contributions: J.D., S.P. and Z.G. was involved in the study design, data collection, results analysis and interpretation, and manuscript writing and revisions. J.M. was involved in the study design and in the writing, drafting, and review of the manuscript. V.Z. was involved in the study design and data analysis. M.U. was involved in the data analysis. T.Ž. was involved in review of the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: The present work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant No. 451-03-68/2022-14/200216).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

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