

RESEARCH ON THE INFLUENCE OF MODERN CULTURE TECHNOLOGIES ON MORPHOMETRIC AND BIOCHEMICAL CHARACTERIZATIONS OF EGGPLANT VARIETIES

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Abstract

Solanum melongena L. is a species originating in Southeast Asia which is cultivated in many regions of the globe. In recent years, for the areas cultivated with this species, an upward trend has also been observed in our country. This growing trend of cultivated areas requires a deepening of research into the use of higher quality fruit cultivars and the improvement of cultivation technologies for this species. The paper shows the behavior of four eggplant varieties Mirval F1, Bibo F1, Black Pearl F1, Rania F1 on new cultivation technologies applied in solar. The novelty in the cultivation technology is the use of the "Leguma" (Viano) fertilizer applied at a dose of 150 g/m² during planting and twice during vegetation in fertilized variants and the use of natural predators (Spidex and Swirskii mite) to limit the pests'. The first harvest determinations show clearly the efficacy of using fertilizer at planting. The best results in average fruit weight are recorded in the Bibo F1 hybrid (507.8 g/fruit). The biochemical analyzes reveal the qualities of this hybrid, the firmness of the fruits being 8.077 kg/cm², the soluble dry substance the (total soluble solids) 4.16% and the titratable acidity of 0.226%.

Key words: eggplant, novelty technology, harvest determinations, biochemical analyses.

INTRODUCTION

Solanum melongena L. is a species originating in Southeast Asia (India, Burma), where it is still found in the spontaneous flora (Tsao and Lo, 2006; Doijode, 2001; Săvulescu, 2016). The caravans brought the eggplant first to North Africa from where the Arabs brought it to Spain (Weese and Bohs, 2010). In the Middle Ages eggplants were considered decorative plants and were not consumed because they were believed to cause a range of diseases (Lagunovski and Vinatoru, 2016).

Originally the fruit of this plant was round and green in color, but during its cultivation there were changes in shape, size, color and taste (Bratu et al., 2018; Bratu et al., 2017; Vânătoru et al., 2013).

The importance of eating eggplants is mainly given by their chemical composition: ascorbic acid - vitamin C (5 mg / 100 g), nicotinamide - vitamin PP (0.60 mg / 100 g), pantothenic acid - vitamin B5 (0.23 mg / vitamin B6 (0.09 mg / 100g), riboflavin - vitamin B2 (0.05 mg / 100g), thiamin - vitamin B1 (0.03 mg / 100g),

folic acid - 100 g) and tocopherol - vitamin E (0.03 mg / 100 g), (Souci et al., 1981). In Romania, this species has been grown since the 18th century. At first they were cultivated near the monastery courtyards, and then spread more widely after the First World War. Recent research in the country is about finding a suitable range of cultivars for field crops and protected areas, as well as introducing modern technological links such as mulching, composting, organic seed treatment, the use of natural predators in combating diseases and pests. (Catana et al., 2012, Sima et al., 2010a, 2010b, Drăghici et al., 2010). Due to the species' claims on the environmental factors, plant cultivation has been adapted to protected systems, because better results are achieved in terms of fruit quality and production (Ciuciuc, 2014). However, their cultivation is increasingly difficult due to the large number of diseases and pests that have developed increased resistance to conventional pesticides (Rodino et al., 2017). Excessive use of chemical fertilizers and production factors have led to the degradation of soil fertility, erosion,

water contamination, pesticide poisoning, lowering groundwater levels, water exploitation and biodiversity depletion (Caruso et al., 2017; Sivasangari et al., 2015).

All these issues related to environmental contamination and as well consumer demand for pesticide residue reduction in food, has determined vegetable growers to adopt new crop strategies using the latest and most modern fertilization, irrigation and pest control technologies. (Buzatu et al., 2018; Dinu et al., 2018; Doltu et al., 2017; Călin et al., 2017; Sönmez et al., 2016; Becherescu et al., 2016; Hoza, 2014; Sima et al., 2010).

MATERIALS AND METHODS

The experience has been achieved in a 100 m² plastic tunnel in the commune of Cochirleanca in Buzau County. The establishment of the crop was carried out by seedling produced in the multiplying greenhouse. The sowing took place on 27 January 2018 in alveolar trays, and the planting was done on April 28th, 2018 at a distance of 80 cm between the ranges of plants and 40 cm between the plants per row.

The variants studied are presented in Table 1.

Table 1. Variants studied

Variants	Cultivars	Specification
V1	Mirval F1	unfertilized
V2		2 fertilizations with Viano – 150g/m ²
V3	Bibo F1	unfertilized
V4		2 fertilizations with Viano – 150g/m ²
V5	Rania F1	unfertilized
V6		2 fertilizations with Viano – 150g/m ²
V7	Black Pearl F1	unfertilized
V8		2 fertilizations with Viano – 150g/m ²

Biological material presentation

Mirval F1 is an extra-early hybrid with large semi-long fruits. The fruit is firm, shiny black color, with a long-lasting quality and long shelf life. Mirval F1 is resistant to high temperatures, have short internodes, and the foliage is aereated. Fruit weight ranging from 400 to 450 g.

Bibo F1 is the most widely used white eggplant hybrid in Romania. It has an early maturity, 60 days from planting with an average fruit weight of 300 grams. The fruit has a white, oval shape with a length of 18-20 cm and a width of

8-10 cm. It is resistant to Tomato Mosaic Virus and Fusarium (Figure 1).



Figure 1 - Bibo F1

Rania F1 is a special hybrid, due to its distinctive exterior appearance. It is suitable for open-field cultures and as well for protected areas. The fruit has an oval-long shape, and on the outside it is purple colored with cream stripes. The length is about 20 cm and the weight is 520 - 550 g (Figure 2).



Figure 2 Rania F1

Black Pearl F1, is a mid-early eggplant hybrid, with semi-long fruits recommended for crops in protected areas or open field. The fruits are dark, very glossy, the quality is excellent. They are firm, resistant during

transport. Shape and size are uniform. They have the advantage of not forming thorns. Prior to planting, a soil analysis was done in the plastic tunnel (Table 2).

Table 2 Substrate analysis

Soil sample			ppm Content						
pH	H %	Soluble salts %	N- NH ₄ ⁺	N- NO ₃ ⁻	ΣN	P	K	Ca	Mg
6.7	2.7	0.060	11.8	118.7	130.6	26.6	48.0	22	19

The soil has a medium content of humus, very high nitrogen, medium phosphorus, medium supplied with potassium, and the pH of the soil analyzed is favorable for eggplant culture. Ca²⁺ and Mg²⁺ have a normal content. However, culture must be kept an eye on in order to avoid deficiencies due to repeated irrigation (Davidescu and Davidescu, 1992).

After planting, specific care work was carried out: filling the seedbeds with the same age seedling where needed. Irrigation was with a drip irrigation system, 3 days irrigation with 15 minutes in the early morning. Fertilization was done with organic fertilizer VIANO Leguma 150 g / m² granules at planting and during the growing period. Bumble bees were used for pollination, 1 hive of bumble bees per 100 sqm. For the pests encountered in culture were applied the predator mite: *Amblyseius swirskii*, SWIRSKI-Mite, with controlling role in white fly larvae and thrips. The predator mite: *Phytoseiulus persimilis* - Spidex, with a role in combating different mites species (Kolleret al., 2016). The quality analysis (fruit length, diameter, weight, firmness, total soluble solids, titratable acidity) of matured fruits were carried out in the laboratories of the Research Center for Studies of Food and Agricultural Products Quality, University of Agronomic Sciences and Veterinary Medicine of Bucharest.

The firmness of eggplant fruits was measured with a 53200 fruit penetrometer.

Total soluble solids (TSS) content was determined by refractometric method, using Digital Handheld Refractometer Kruss DR301-95, the results were expressed in percentage (%) according with (UE) No. 974/2014 Regulation.

The titratable acidity was determined after Esteban et al., (1992) and Saad et al., (2014) as follows: 10 g of sample was diluted with 50 ml distilled water. The sample was homogenised and titrated with 0.1N NaOH until to 8.1 pH, using Titro Line easy device. The results were expressed as percentages of malic acid content. All the analysis were performed in triplicate.

RESULTS AND DISCUSSIONS

For the morphometric measurements, 5 plants of each variant were measured during the vegetation period.



Figure 3. Eggplant harvested at full maturity

The first measurements were carried out on seedlings before their planting in the plastic tunnel (Table 3).

Table 3. Measurements of eggplant seedlings

Cultivar	Seedling length (cm)	Stem length (cm)	Stem weight (g)	Root weight (g)	Number of leaves
Mirval F1	24.3	20.3	4.0	2.7	6.2
Bibo F1	22.3	16.7	4.1	2.3	7.1
Rania F1	13.7	9.0	3.3	1.7	6.3
Black Pearl F1	24.3	19.7	4.7	3.3	6.0

The data in Table 3 shows that the seedling length was the highest in Mirval F1 of 24.3 cm and the lowest was at Rania F1 13.7 cm; the stem weight of the vegetative part was the highest at the Black Pearl F1 of 4.7 g, and the lowest was Rania F1 3.3 g, the weight of the root was higher at 3.3 g Pearl F1 and the lowest at Rania F1 1.7 g, and the number of leaves was higher at Bibo F1 of 7.1 and Black Pearl F1 6.0 leaves.

During the vegetation period, measurements were made on the height of the eggplants in the plastic tunnel (Table 4).

Table 4. Dynamics of eggplants growth in the plastic tunnel

	12 May	26 May	9 June	7 July	4 August
V1. Mirval F1- u	30,2	37,6	96,4	132	161,4
V2. Mirval F1-f	32,2	45,6	96,38	142,6	156,2
V3. Bibo F1-u	29,2	44,1	95,16	133	169,6
V4. Bibo F1f	31,2	43,6	92,6	126,6	178,8
V5. Rania F1- u	22,4	33,9	61	114	156,8
V6. Rania F1- f	23,8	36,7	66,72	114,2	154,2
V7. Black Pearl F1-u	31,6	40,44	75,8	123,6	159,2
V8. Black Pearl F1-f	32,8	37,62	75,8	110,6	157,2

u-unfertilized; f- fertilization

From the table data, it was observed that at the first measurement, the highest height was recorded by the cultivar Black Pearl F1fertilized - 32.8 cm, and the lowest height was at the Rania F1, unfertilized cultivar - 22.4 cm. On 26 June, the highest height was 45.6 cm at Mirval F1 - fertilized, and the lowest height was 33.9 cm at Rania F1 - unfertilized. Toward the end of the fruiting period, topping the plant (removing the growing terminal) was the last measurement carried out on 04.08 when it was observed that the highest height was 178.8 cm at Bibo F1-fertilized and the smallest height was 154.2 cm at Rania F1-fertilized.

Table 5. Average number of flowers and viable fruits and % viable fruits by variants

Variants	Number of flowers / variant	Average fruit number/ variant	Fecund flowers %
V1. Mirval F1- u	52,6	30,4	57
V2. Mirval F1-f	54,3	36,2	66
V3. Bibo F1-u	55,1	34,4	62
V4. Bibo F1f	57,2	36,2	63
V5. Rania F1- u	50,0	36,5	73
V6. Rania F1- f	49,1	37,3	75
V7. Black Pearl F1-u	49,0	32,4	66
V8. Black Pearl F1-f	51,5	35,5	68

The average number of flowers and fruits linked to the variants were followed until the end of the harvests. According to Koundinya et al., (2019), the Genotype × Environment Interaction effects was 95.72% for number of fruits per plant for eggplants. That explain a slightly increase of average fruit number per fertilized variants.

The data from Table 5 shows that the fertilized variant of Bibo hybrid had the largest number

of flowers with a number of 57.2 flowers per variant. However, the highest percentage of fecund flowers is represented by the fertilized variant of the Black Pearl hybrid with 75 fecund flowers.

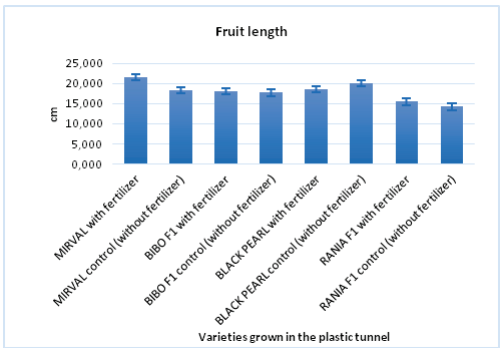


Figure 4. Comparison between eggplant varieties regarding fruit length measurements

The Mirval and Black Pearl varieties exhibit the highest fruit length (21.7 ± 0.43 cm and 20.17 ± 0.47 cm) compared to Bibo F1 and Rania F1 varieties (Figure 4).

As well as in fruit length Mirval and Black Pearl varieties follow the same trend, having the highest diameter (83.83 ± 2.97 mm and 89.35 ± 2.92 mm) compared to Bibo F1 and Rania F1 varieties (Figure 5).

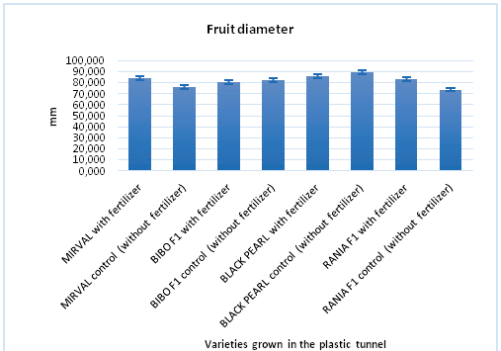


Figure 5. Comparison between eggplant varieties regarding fruit diameter

The results are comparable with those obtained by Bratu et al. (2017; 2018) for morphemetrically measurements.

In figure 6 Bibo F1 variety with 507.83 g and Black Pearl variety with 505.28g have the best results for fruit weight.

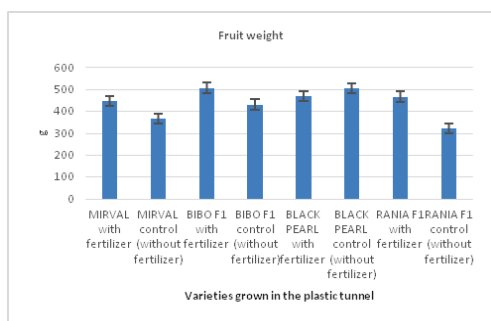


Figure 6. Comparison between eggplant varieties regarding fruit weight.

The fruit firmness varied between 6.88 Kg/cm² for Mirval variety and 8.82 Kg/cm² for Black Pearl variety (Figure 7), values greater than obtained by Valerga et al. (2019) for Monarca cv. harvested at the commercial stage. In non melting fruit, as eggplants, that are still undergoing extensive morphological modifications when harvested, the factors determining texture are far from being understood (Valerga et al., 2019).

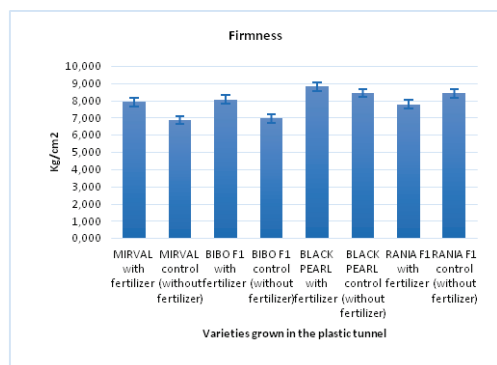


Figure 7. Comparison between eggplant varieties regarding fruit firmness

Figure 8 presents the total soluble solids content, that varied between 3.47% ± for Black Pearl variety and 4.20% ± for Rania F1 variety. The values obtained are slightly lower than those measured for Anamur Karası cv. (4.34% – 4.69%), as Colac et al. (2018) determined. The highest malic acid content was noted for Bibo F1 variety and Black Pearl variety (0.226 % ± 0.01). Mohawesh (2016), also found that the eggplant fruits acidity varied between 0.011% and 0.23 % (Figure 9).

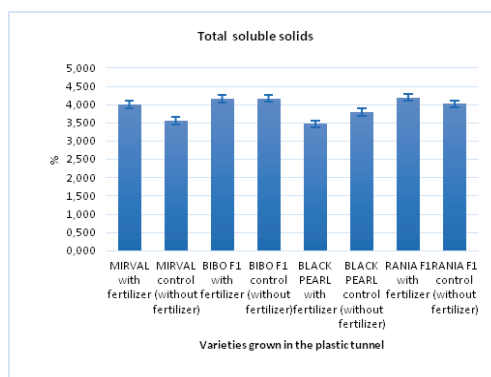


Figure 8. Total soluble solids content of four eggplant varieties

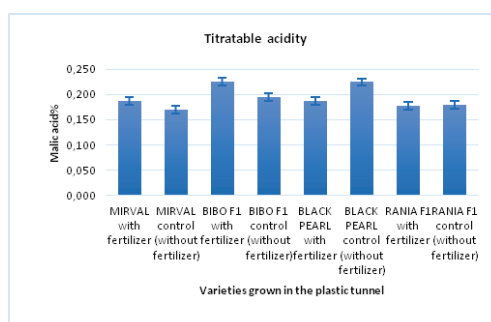


Figure 9 Titratable acidity of the eggplant varieties

CONCLUSIONS

Measurements made on eggplants lead to the conclusion that the most vigorous seedlings were recorded at Bibo F1 with the highest number of leaves (7.1) and the largest weight of vegetative part (4.1 g).

Increases in height were influenced by the hybrid but also by application of the fertilizer. At the end of the vegetation period, the highest heights were registered at the Bibo F1 in the fertilized variant (178.8 cm). Bibo F1 variety had also the highest fruit weight and malic acid content.

The best percentage of fecund flowers is recorded by the hybrid Black Pearl 75 % in the fertilized variant. It was noted that Black Pearl variety had the best results for fruit length, firmness and fruit diameter.

The results presented varied according to variety and variants from the experiment.

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