

## COMPARATIVE RESEARCH ON NEW TOMATO HYBRIDS FOR SPRING CULTURE IN SOLARIUM

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### Abstract

The research was made with a tomato spring culture, in solarium, in 2016 and 2017, in Fierbintii de Jos village, Ialomitia county, on an area of 2000 m<sup>2</sup>. Four new tomato hybrids were used respectively Zadurella F1, Matissimo F1, Yigido F1 and SV 4224 TH F1. The tips of the main stems were removed at four inflorescences and the layout of the experiment was made in randomized blocks with three repetitions. The tomatoes were cultivated on a soil with neutral pH, with an optimal content of ammonium nitrate and average content of nitric nitrogen, phosphorus, organic matter, calcium, sodium and soluble salts, with very low content of potassium and very high of magnesium. The main fertilization was made through applying 30t/ha of organic fertilizers while preparing the soil. During the vegetation period the fertilization was phasal with products from the Tecamin brand, appropriate for each phenophase in part. The results obtained proved that all hybrids used were highly productive, the commercial production per each plant being between 2.48 kg and 3.62 kg. The commercial production per m<sup>2</sup> varied between 9.42 kg and 13.76 kg. The average fruit weight was between 167 and 214 g. All hybrids produced large, firm fruits, with a content of dry soluble substance of roughly 5%, the titratable acidity between 0.22% for Yigido F1 and 0.43 % for Zadurella F1. The fruits had a C vitamin content between 14.42 mg/100 g at Yigido F1 and 23.00 mg/100 g at Zadurella F1.

**Key words:** biochemical composition, vegetative growth, protected culture, production.

### INTRODUCTION

Tomatoes (*Solanum lycopersicon* L.) pertain to the *Solanaceae* family and are perennial plants in their original cultivation area, however in some regions they are cultivated as annual plants (Kalloo, 1993). They are cultivated all over the world on a surface of over 4.7 mil ha with a production of over 177 mil tones (FAO, 2016). Tomatoes have a very high capacity of adapting to various culture systems. It is the species with the highest expansion form all vegetable species because they are highly productive, the production can be echeloned throughout the whole year and is capitalized in various ways (Hoza et Hoza, 2013). Moreover the fruits are very rich in vitamins, mineral salts, lycopene and other elements highly beneficial for human health (Coyago-Cruz et al., 2017; Dinu et al., 2017). Currently this species is very much studied by researchers around the world in order to improve the

culture technology. Although it is cultivated in culture systems, new solutions are researched to increase plant productiveness. The focus is to ameliorate the culture assortment by using hybrids with undetermined growth, especially for protected cultures or the ones conducted in greenhouses (Benalfew et al., 2016; Soarea et al., 2015). Grafting tomatoes on other botanically related species increases the resistance to various stressors, increases its production and quality (Bogoescu et al., 2008, Huang et al., 2015). The use of complex fertilizers with a very high degree of solubility and absorption by plants increases the yield of the crop (Apahidean et al., 2002; Sima et al., 2007; Becherescu et al., 2015). The management of tomato plants with several stems reduces the number of plants per sqm, and increases production (Hoza 2013) and cultivation on different crop substrates gives the possibility of monoculture (Apahidean et al., 2008). Due to the existence of a high

number of tomato hybrids with superior features the necessity emerged to study the response of some hybrids in specific conditions of each country or each grower in order to recommend an optimal assortment structure for each hybrid destination. The present paper aimed to investigate the above mentioned matter. Undoubtedly, more researches will be conducted in Romania in order to understand the hybrid responses and to choose the best ones for culture.

## MATERIALS AND METHODS

The seedlings were transplanted in pots of 200 ml when the first pair of real leaves emerged, the substratum used was the same as the one for seeding. During the process of seedling production the following works have been conducted: airing the space in order to regulate temperature, humidity and oxygen, repeated irrigations to maintain a moist soil as to avoid hydric stress, three phasal fertilizations with Tecamin Raiz, one before transplanting with concentration of 0.2% and two after transplanting with concentration of 0.3% and phytosanitary treatments with Previcur Energy 0.1% and Dithane M45 0.2%. Ten days before planting the temperature dropped gradually to 12C<sup>0</sup>-15C<sup>0</sup> in order to harden plants and increase their resistance to the lower temperatures of the planting area.

The plantation of seedlings was conducted manually in the first decade of March, at 90cm/40cm/40 cm, resulting a culture density of 38461 plants/ha.

The culture was set up on a soil with neutral pH, an optimum content of ammonium nitrate and average content of nitric nitrogen, phosphorus, organic matter, calcium, sodium and soluble salts. The soil had a very low content of potassium and a very high one of magnesium. In order to ensure a balanced nutrition the organic fertilization, 30t/ha, was applied when preparing the soil and afterwards the phasal fertilization was applied during the vegetation period, for each phase in part. In culture the actions taken were the following: the airing of the space to regulate temperature was made gradually though the opening of the doors and lateral walls, the irrigation was

conducted daily through the drip system to maintain the moisture of the soil, plants were supported on strings, totally pruned, the removal of the main stem tip was made after the 4th inflorescence, phytosanitary treatments were done alternatively with Bravo 500 SC 0.4 %; Switch 0.1 % and Topsin 70 WDG 0.1 % and foliar fertilizations were managed as per the fertilization planning.

The foliar fertilization plan matched the vegetation phenophase and the products used were from the Tecamin brand as it follows: 2 weeks after planting in order to rebuilt the radicular system Tecamin Max 0.2 % and Tecnokel Amino mix 0.2 % were applied; During the vegetative growth was used Tecamin Max 0.2 %; before efflorescing Tecnokel Amino Mix 0.2%; fruit formation from first inflorescence Tecamin Max 0.2%; fruit growth Tecamin Brix 0.2% + Tecnokel CaB 0.2%; beginning of harvest Tecnokel CaB 0.2%; until culture end Tecnokel Amino Mix 0.2%, Tecamin Brix 0.2% and Tecnokel CaB 0.2%.

Measurements were made to note plant growth and the number of flowers and fruits in inflorescences, the fruit formation percentage, the production per plant, production and m<sup>2</sup> and biochemical tests for fruits. It was quantified: the content of C vitamin through titration with potassium iodate, the titratable acidity through titration with sodium hydroxide with phenolphthalein as indicator, the firmness of fruits using the penetrometer and the dry soluble substance using the refractometer.

The statistical calculation was done through the variant analysis.

## RESULTS AND DISCUSSIONS

Analysing the results obtained from the point of view of the vegetative growth of studied hybrids it was noticed that the hybrid had a slight impact on the growth process (Table 1). Thus, plant height up to the fourth inflorescence – after which the tip of the main stem was removed – was under 1 m at Zadurella F1 and it was also correlated with the smaller distance between inflorescences. Hybrids Yigido F1 and SV 4224 TH F1 were more vigorous, the plant height being of 124 cm and the average distance between inflorescences of 31.0 cm.

Table 1. Biometrical features of hybrid tomato

| Variant             | Plants height (cm) | Average distance between:         |                    |      |      | Average (cm) |
|---------------------|--------------------|-----------------------------------|--------------------|------|------|--------------|
|                     |                    | Soil and first inflorescence (cm) | Inflorescence (cm) |      |      |              |
|                     |                    |                                   | 1-2                | 2-3  | 3-4  |              |
| V1(Mt)–Zadurella F1 | 95.1               | 34.1                              | 19.5               | 21.4 | 20.0 | 23.8         |
| V2-Matissimo F1     | 110.6***           | 37.4                              | 28.6               | 23.0 | 21.6 | 27.7***      |
| V3-Yigido F1        | 124.2***           | 41.0                              | 33.1               | 26.8 | 23.1 | 31.0***      |
| V4-SV 4224 TH F1    | 124.6***           | 40.4                              | 32.0               | 25.1 | 27.0 | 31.1***      |
| Average             | 113.63             |                                   |                    |      |      | 28.32        |
| LSD 5%              | 0.43               |                                   |                    |      |      | 0.71         |
| LSD 1%              | 0.66               |                                   |                    |      |      | 1.07         |
| LSD 0.1%            | 1.05               |                                   |                    |      |      | 1.71         |

The capacity of fructification of studied hybrids was quite uniform due to the genetic characteristics of the hybrids and the culture technology applied. The similarities between hybrids was highlighted by the number of flowers per plant which varied between 26.6 at Matissimo F1 and 27.9 la Zadurella F1, statistically assured, with negative values, which reached numbers lower that the control hybrid. The number of fruits formed was very

significantly positive at Yigido and SV 4224 TH and insignificant at the hybrid Matissimo, the values being between 17.5 at Zadurella F1 and 20.3 la Yigido F1. Hybrids shown differences at fruit formation per plant. The top value was obtained by Yigido F1 (75.2 %) and the lowest by Zadurella F1 (62.7 %). The other hybrids had mediate values and the differences between hybrids in comparison to the control were highly significantly positive (Table 2).

Table 2. Number of flowers, fruits and fruit formation percentage for the hybrid tomato plants studied

| Variant           | Number of flowers/plant | Number of fruits/plant | % of fruit formation/ plant |
|-------------------|-------------------------|------------------------|-----------------------------|
| V1-Zadurella (Mt) | 27.9                    | 17.5                   | 62.7                        |
| V2-Matissimo      | 26.6 <sup>ooo</sup>     | 18.0 n                 | 67.7***                     |
| V3-Yigido         | 27.0 <sup>ooo</sup>     | 20.3***                | 75.2***                     |
| V4-SV 4224 TH     | 27.5 <sup>ooo</sup>     | 19.3***                | 70.2***                     |
| Average           | 27.23                   | 18.78                  | 68.95                       |
| LSD 5%            | 0.25                    | 0.68                   | 0.47                        |
| LSD 1%            | 0.39                    | 1.03                   | 0.71                        |
| LSD 0.1%          | 0.62                    | 1.64                   | 1.14                        |

The average weight of fruits was registered with differences between hybrids (Table 3). The smallest fruits were obtained at Zadurella F1 which also presented a lower vigour of plants in comparison to the other hybrids, respectively 167 g, while Matissimo F1 had the biggest fruits, respectively 214 g. By calculating the total production per plant it was observed that the highest production was obtained by Yigido F1, 4.02 kg/pl, followed by Matissimo F1 with 3.85 kg/pl. The control had 2.92 kg/pl. From the total production of fruits per plant roughly 10-15% from all fruits had quality parameters under the standard ones

agreed for tomatoes. The commercial production was over 3 kg/pl for all hybrids except for Zadurella, which produced 2.48 kg/pl. The total production of tomatoes per m<sup>2</sup> showed the same tendency as the production per plant and it had values between 13.34 kg/m<sup>2</sup> and 14.63 kg/m<sup>2</sup> in comparison to the control which had 11.01 kg/m<sup>2</sup>. The commercial production was over 13 kg/m<sup>2</sup> at hybrids Yigido and Matissimo, 11.59 kg/m<sup>2</sup> at hybrid SV4224 TH and 9.42 kg/m<sup>2</sup> at hybrid Zadurella, all these results being assured statistically.

Table 3. Production of tomatoes

| Variant           | Average weight of fruit (g) | Total production |                   | Commercial production |                   |
|-------------------|-----------------------------|------------------|-------------------|-----------------------|-------------------|
|                   |                             | kg/pl            | kg/m <sup>2</sup> | kg/pl                 | kg/m <sup>2</sup> |
| V1-Zadurella (Mt) | 167                         | 2.92             | 11.01             | 2.48                  | 9.42              |
| V2-Matissimo      | 214***                      | 3.85***          | 14.63             | 3.47***               | 13.19             |
| V3-Yigido         | 194***                      | 4.02***          | 15.28             | 3.62***               | 13.76             |
| V4-SV 4224 TH     | 182***                      | 3.51***          | 13.34             | 3.05***               | 11.59             |
| Average           | 189.25                      | 3.57             |                   | 3.15                  |                   |
| LSD 5%            | 4.93                        | 0.12             |                   | 0.13                  |                   |
| LSD 1%            | 7.46                        | 0.19             |                   | 0.19                  |                   |
| LSD 0.1%          | 11.88                       | 0.30             |                   | 0.31                  |                   |

Taking into consideration the biochemical composition of fruits differences were registered between hybrids (Table 4). Thus, for hybrids with a higher production the content of C vitamin was lower, 14.42 mg/100 g at Yigido F1 and 17.83 mg/100 g at Matissimo F1. For hybrids with a lower production the content of C vitamin was higher 23.00 mg/100 g at Zadurella F1 and 20.11 mg/100 g at SV 424 TH F1. The results obtained were similar to the ones from professional literature (Chattopadhyay et al., 2013; Dinu et al., 2017).

Titrateable acidity was quite different between hybrids and had values of 0.22 % at Yigido F1 and 0.43 % at Zadurella F1 matching the research of Caliman (Bogoescu et al., 2008). All hybrids presented a good firmness, however Yigido F1 had the lowest value. The total content of soluble dry substance did not have very different values between hybrids, all values were insignificant proving all hybrids are from the same category from the consumption point of view as shown by the professional literature as well (Kalloo, 1993).

Table 4. Some quality features of tomato fruits

| Variant           | Vitamin C (mg/100 g) | Acidity (%) | Pulp firmness (kg/cm <sup>2</sup> ) | Dry soluble substance (%) |
|-------------------|----------------------|-------------|-------------------------------------|---------------------------|
| V1-Zadurella (Mt) | 23.00                | 0.43        | 1.15                                | 5.08                      |
| V2 – Matissimo    | 17.83 <sup>ooo</sup> | 0.35        | 1.06                                | 5.00 N                    |
| V3 – Yigido       | 14.42 <sup>ooo</sup> | 0.22        | 0.98                                | 5.20 N                    |
| V4 – SV 4224 TH   | 20.11 <sup>ooo</sup> | 0.30        | 1.13                                | 4.98 N                    |
| Average           | 18.84                | 0.32        | 1.08                                | 5.06                      |
| LSD 5%            | 0.88                 |             |                                     | 0.15                      |
| LSD 1%            | 1.33                 |             |                                     | 0.23                      |
| LSD 0,1%          | 2.13                 |             |                                     | 0.36                      |

## CONCLUSIONS

For the research conducted on some hybrid tomato in spring culture the following conclusions can be withdrawn:

The studied hybrids had a very good vegetative growth and manifested a high tolerance at diseases and pests. The total number of flowers per plant was uniform between hybrids, reaching values of 26.6 at Matissimo F1 and 27.9 la Zadurella F1. The number of fruits formed was smaller than the number of flowers and was influenced by the hybrid used, reaching values between 17.5 at Zadurella F1 and 20.3 la Yigido F1. The commercial production exceeded 3 kg/pl at 3 hybrids; only

Zadurella had 2.48 kg/pl. The commercial production per m<sup>2</sup> had a similar tendency with the total one, highlighting Yigido F1 as the best hybrid with 13.76 kg/m<sup>2</sup>. The control hybrid Zadurella F1 produced 9.42 kg/m<sup>2</sup>. The content of C vitamin was in inverse proportion with the production obtained, higher for hybrids with smaller production and lower for hybrids with high production. Fruits had different acidity from one hybrid to the other which could contribute to the diversification of the tomato assortment and to satisfying all consumer taste. The firmness of fruits was registered between 0.98 kg/cm<sup>2</sup> at Yigido F1 and 1.15 kg/cm<sup>2</sup> at Zadurella F1.

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