Volume 22(1), 58- 62, 2018
JOURNAL of Horticulture, Forestry and Biotechnology
www.journal-hfb.usab-tm.ro

Technological aspects concerning growing of some Romanian tomato lines in greenhouse

Doltu Mădălina[1*], Sora D.[1], Nescșu M.[1]

[1]Research and Development Institute for Processing and Marketing of Horticultural Products - Horting Bucharest

*Corresponding authors. E-mails: doltu_mada@yahoo.com

Abstract The research watched establishing the technological flow for growing of a Romanian tomato line collection for cultivation in greenhouse in the south of Romania. The research has been conducted between 2015 and 2017 in the Laboratory of Horticultural Cultures in Protected Spaces of the Horting Institute Bucharest. The laboratory have greenhouses specialized in producing vegetable seedlings (plastic professional greenhouse) and for vegetable cultivation (glass greenhouse). The biological material used has been composed from Romanian tomato creations (*Lycopersicon esculentum* lines: L_{26C}, L_{28}, L_{80}, L_{548} and L_{2000A}) from the germplasm bank of Research and Development Station for Vegetable Growing Buzău (V.R.D.S. Buzău). The L_{26C} and L_{80} are two tomato lines of red cherry type, with average weight per fruit between 22.5 g and 12.5 g. The L_{28}, L_{548} and L_{2000A} are three tomato lines with different shapes and colors (red and yellow-orange) and average weight per fruit than 150 g. The ecological and technological requirements of this specie have been respected for to achieve this objective. The technology for growing of these tomato lines has been a specific growing for protected spaces from the south of Romania.

Key words

Lycopersicon esculentum, protected space, Romania, technology

Tomato (*Solanum lycopersicum* L.) is one of the most popular used vegetable crops in the world. By degree of use it occupies the second place in the world, being surpassed only by potatoes. Tomato fruits are notable for their taste, dietetic and medicinal properties, as well for divers use [9, 5, 1]. The tomato is a commercially important crop throughout the world. At northern latitudes tomato are grown in greenhouses: planted in mid-winter and harvested until late autumn [2]. The tomato varieties cultivated today in whole the regions in the world, have the genesis in the wild species of the *Lycopersicum* sort. The transition from the wild form to the cultivated ones was possible in time [15].

The carbohydrate (2.9 – 7 %), vitamins (A, B, B2, B6, C), salts of important mineral elements (K, P, Fe, Ca, I, Mg) and organic acids (0.5 – 1.5 %) content from tomato fruits is very important [8]. It is an important condiment in most diets and a very cheap source of vitamins. It also contains a large quantity of water, calcium and niacin all of which are of great importance in the metabolic activities of man. Tomato is a good source of vitamins A, C and E and minerals that are very good for body and protect the body against diseases [10,14].

Tomatoes (*L. esculentum* Mill.) are widely consumed either fresh or processed. Tomatoes are known as health stimulating fruit because of the antioxidant properties of their main compounds. Tomatoes are usually consumed at their maximum organoleptic quality, which takes place when they reach the full red color stage but before excessive softening [12].

Hybrid tomato varieties have many advantages compared to open-pollinated varieties. Hybrids usually produce higher yields. They generally mature earlier and more uniformly. Many hybrids have better fruit quality and disease resistance. With all of these advantages, many farmers prefer to sow hybrid seeds in spite of the higher seed costs [11]. Intercrossing different varieties of plants frequently produces hybrid offspring with superior vigor and increased yields, in a poorly understood phenomenon known as heterosis [7].

The Romanians have classic options concerning taste of vegetables, they appreciate and choose tomatoes with superior organoleptic qualities, the taste of "Romanian tomato". In Romania, the aim is multiplication and cultivation of Romanian tomato F_1 hybrids and varieties specially designed for cultivation in protected space because they are adapted to the climatic conditions from country and for to meet the consumer demands. The cultivar (variety or F_1 hybrid) and the cultivation technology influence the qualitative characteristics of the tomato fruits [4]. The evolution of this species was determined by the human intervention , which, through the selection and amelioration work succeeded to improve the production qualities .

V.R.D.S. Buzău has an over 50 years tradition in tomato amelioration [15], V.R.D.S. Buzău is well known in tomato breeding. Here we present, for the first time in Romania, commercial hybrid seeds [17].

The nutritional value of Romanian vegetable species, favorable environmental conditions and the experience that we have are safe premises for success. At the moment, there are Romanian varieties and hybrids which are appreciated by Romanian consumer [6].

Materials and Methods

The research has been conducted in the Laboratory of Horticultural Cultures in Protected Spaces of the Horting Institute Bucharest.

The laboratory have greenhouses specialized in producing vegetable seedlings (plastic professional greenhouse) and for vegetable cultivation (glass greenhouse).

The biological material used was represented by five tomato genotypes (*L. esculentum* Mill.), L_{26C}, L_{80}, L_{28}, L_{548} and L_{2000A}, selections obtained from the biological creation patrimony of the V.R.D.S. Buzău, Romania.

The L_{26C} and L_{80} are two tomato lines of red cherry type, with average weight per fruit between 22.5 g and 12.5 g (Fig. 1 and Fig. 2).

The L_{28}, L_{548} and L_{2000A} are three tomato lines with different shapes and colors (red and yellow-orange) and average weight per fruit than 150 g (Fig. 3, Fig. 4 and Fig. 5).

Fig. 1. The L_{26C} tomatoes (cherry type)

Fig. 2. The L_{80} tomatoes (cherry type)

Fig. 3. The L_{28} tomatoes

Fig. 4. The L_{548} tomatoes

Fig. 5. L_{2000A} tomatoes

The ecological and technological requirements of this specie have been respected for to achieve this objective.

The technology for growing of these tomato lines has been according the specific technology of tomato growing in protected spaces (glass and plastic

greenhouse).

Results

The results described in this paper are about the researches carried out between 2015 and 2017 at the Research and Development Institute for Processing and Marketing of Horticultural Products – Horting Bucharest.

This research aimed to establish the technology for obtaining of some Romanian tomato genotypes used in amelioration works in the greenhouse conditions from south Romania.

The tomato seedlings have been produced between the end of February to the end of April, in a 1450 m^2 professional plastic greenhouse (double plastic film), in 70 alveolar trays with a capacity of 50 mL per alveolus, using as substrate a peat with a grain size of 0 – 10 mm, 1 kg m^{-3} content in NPK, microelements B, Mg, Cu, Mn, Zn, Fe and S (0.050 kg m^{-3}), limestone (4 – 7 kg m^{-3}), pH 6 and humidification agent 100 ml m^{-3}. The control treatments of the soil borne disease (*Pythium debaryanum, Phythophtora parasitica and Rhizoctonia solanii*) were made with fungicides (fosetil 310 g L^{-1} + propamocarb 530 g L^{-1}; 0.15 % in three treatments).

The culture was founded at the end of April in a glass greenhouse, without heating systems. At all tomato lines plants was a planting density of 27000 plants ha^{-1}.

A soil insecticide (clorpirifos 7.5 %; 300 kg ha^{-1}) was administered in the day of planting for protection against of the *Gryllotalpa gryllotalpa* pest.

During the vegetation time have been applied specific works for tomato culture in protected areas.

The watering has been made through dropping (soil humidity has been 80% from total water potential of field).

The fertilization program is presented in the table 1.

Table 1

Fertilization program for tomato crop in greenhouse (kg ha^{-1}) [16]

Moment	Ammonium nitrate (34% N)	Concentrated superphosphate (40% P_2O_5)	Complex 16:48:0	Potassium sulphate (45% K_2O)	Magnesium sulphate (16% MgO)
A	100-200	0-300	-	200-400	100-200
B 10–20*	100	-	-	-	-
21–50*	300	-	100	-	-
51–80*	200	-	-	200	50
81–110*	100	-	-	200	50

A – basic; B – in vegetation; * – days after planting

In Romania, the most important pathogens of tomato crops [3] are both soil borne pathogens as *Fusarium oxysporum* f.sp. *lycopersici* (Fusarium wilt) respectively *Verticillium dahliae* (Verticillium wilt) and pathogens which attack the aerial part of the plants (leaves, stems, fruits) as *Alternaria porri* f.sp. *solani* (early blight), *Botrytis cinerea* (grey mold), *Fulvia fulva* (leaf mold), *Erysiphe* sp. (powdery mildew), *Phytophthora infestans* (late blight) etc. [13].

The soil borne and plant aerial part pathogens have been controlled by chemical treatments (preventive and control), thus:

- *V. dahliae*, chemical treatments on soil with tiofanat metil 70% (0.05 – 0.1 %; 0.5 L of solution $plant^{-1}$),
- *A. porri,* chemical treatments with clorotalonil 500 g/L (1.5 L ha^{-1}),
- *B. cinerea* and *F. fulva*, chemical treatments clorotalonil 500 g/L (1.5 L ha^{-1}), azoxistrobin 250 g L^{-1} (0.075 %; 0,75 L ha^{-1}) and fludioxonil 25% + cyprodinil 37,5 % (0.08 – 0.1 %; 0.8 – 1 kg ha^{-1}),
- *P. infestans,* chemical treatments mefenoxam 4% + mancozeb 68 % (0.25 %; 2.5 kg ha^{-1}) and clorotalonil 500 g L^{-1} (1.5 L ha^{-1}).

In this research, the important pests of tomato crops have been controlled by preventive and control chemical treatments, thus:

- *Trialeurodes vaporariorum, Liriomyza trifolii, Thrips tabaci and Frankliniella occidentalis, Helicoverpa armigera, Macrosiphon euforbiae,* chemical treatments with imidacloprid 75 g L^{-1} + deltametrin 10 g L^{-1} (0.08 – 0.13 %) and thiametoxam 25% (0.02 %),
- *Tutta absoluta*, chemical treatments with emamectin benzoat 9,5 g kg^{-1} (1.5 kg ha^{-1}),
- *Tetranichus urticae* chemical treatments with abamectin 18 g L^{-1} (60–80 mL ha^{-1}), hexitiazol 10 % (0.4 kg ha^{-1}).

The harvests have made from mid-June to September.

The results obtained on the L_{26C}, L_{28}, L_{80}, L_{548} and L_{2000} tomatoes are in the table 2.

Table 2

Determinations on L_{26C}, L_{28}, L_{80}, L_{548} and L_{2000} tomatoes [4]

a) in the first decade June

Specification	L_{26C}	L_{28}	L_{80}	L_{548}	L_{2000}
Total inflorescences (no. plant^{-1})	1-2	1-2	2	1	0-1
Total fruits (no. plant^{-1})	0-3	0-2	0	0-1	0-1

b) in mid-July

Total inflorescences (no. plant^{-1})	3	3	5	5	5
Total fruits (no. plant^{-1})	7-10	3-4	5-15	4-6	10-12

c) in mid-July – 1st harvest

Total fruits (no. plant^{-1})	1-3	1-2	3-5	2-3	1

d) production evaluation

Weight (g fruit^{-1})	22.5	140	12.5	112	180
Shape index on fruit (cm)	1.2	1.8	1.4	1.1	1.2
Total seminal lodges (no. fruit^{-1})	2	2	2	3	6
Mature fruit color	red	red, green cap	red, green cap	orange	red, green cap
Total inflorescences (no. plant^{-1})	5 – 6	6 – 7	5 – 6	6 – 7	6 – 7
Total yield (kg plant^{-1})	3	4.2	3	5.1	4.7

The tomatoes differ by the important fruit characters.

The weight (g fruit^{-1}) was been between 12.5 g (L_{80}) and 22.5 g (L_{26C}) at the tomato lines of red cherry type and 112 g (L_{548}) to 180 g (L_{2000}) at other tomato lines.

The total yield (kg plant^{-1}) has varied, thus: 3 kg at the cherry tomatoes and between 4.2 kg (L_{28}) to 5.1 kg (L_{548}) at other tomatoes.

The shape index on fruit (cm) of these tomatoes shows that the fruits are spherical and spherical – elongated.

The total seminal lodges (no. fruit^{-1}) has varied, thus: 2 (L_{26C}, L_{28} and L_{80}), 3 (L_{548}) and 6 (L_{2000}).

This Romanian tomato line collection have the red or yellow–orange mature fruit color, with or without green cap.

The varieties differ by the important fruit characters as well as mass (large and medium), shape (round, at-round and cylindrical), the number of lodge (2-3 and above), pericarp thickness (medium and large) and mesocarp thickness (medium, large and extra large) [9].

Conclusions

Some technological aspects concerning growing of the L_{26C}, L_{28}, L_{80}, L_{548} and L_{2000} Romanian tomato lines in extended cycle of greenhouse have been established; these are about seedling production and tomato plant cultivation.

During the last years, more and more, our consumer is looking for Romanian vegetables. The shape, color and size are traditional features and they are more suited to our specific environmental conditions [6].

Theses tomato lines are appreciated for the weight, shape, color and ”Romanian taste” of the fruits.

The L_{26C}, L_{28}, L_{80}, L_{548} and L_{2000} tomatoes are recommended to be cultivated in greenhouse near Bucharest.

This research shows that the L_{26C}, L_{28}, L_{80}, L_{548} and L_{2000} tomato lines are a valuable germplasm collection of the V.R.D.S. Buzău. These Romanian tomato lines have a good potentially biological, differ by the important fruit characters (mass, shape, number of lodges, mature fruit color) and can be recommended in the amelioration works of the *L. esculentum* specie.

References

1.Avdeev Iu I. – 1982 – Tomato selection. Chisinau: Science 284.

2.Brazaitytė A., Duchovskis P., Urbonavičiūtė A., Samuolienė G., Jankauskienė J., Kazėnas V., Kasiulevičiūtė-Bonakėrė A., Bliznikas Z., Novičkovas A., Breivė K., Žukauskas A. – 2009 – After-effect of light-emitting diodes lighting on tomato growth and yield in greenhouse, SODININKYSTĖ IR DARŽININKYSTĖ 28(1), 115–126.

3.Costache M., Roman T., Costache C. – 2007 – Diseases and pests of vegetable crops. Editura Agris, București, 47-55.

4.Doltu Mădălina, Bogoescu M., Sora D. – 2017 – Biological potential of some Romanian tomato genotypes cultivated in greenhouse. Technologies for a Sustainable Future; Micro and Nano Technologies, Advances in Biotechnology 17, 541–548.

5.Ershova V. D. – 1978 – Cultivation of tomatoes in open field, Chisinau. Food and Agriculture Organisation of the United Nations 2009, 279.

6.Glăman, Gh., Lăcătuş, V., Scurtu, I., Vînătoru, C., Burnichi Floarea , Heitz Minerva , Diaconu Aurelia , Sbîrciog Gicuţa , Ambăruş Silvica , Cârstea Luminiţa Nicoleta – 2015 – Eating Romanian vegetables with Romanian taste. Supply with Romanian vegetable seeds in the period 2015-2020. Journal of Horticulture, Forestry and Biotechnology Timişoara 19(1), 166–175.

7.Krieger U., Lippman Z.B., Zamir D. – 2010 – The flowering gene SINGLE FLOWER TRUSS drives heterosis for yield in tomato. Nature genetics 42, 459-463.

8.Lagunovschi-Luchian Viorica, Vînătoru C. – 2016 – Legumicultură. Ed. ALPHA MDN.

9.Mihnea Nadejda, Botnari V., Lupaşcu Galina – 2016 – Tomato Varieties with High Indices of Productivity and Resistance to Environmental Factors. Journal of Crop Breeding and Genetics 2(1), 15–22.

10.Olaniyi J. O., Akanbi W. B., Adejumo T. A., Akande O. G. – 2010 – Growth, fruit yield and nutritional quality of tomato varieties. African Journal of Food Science 4(6), 398–402.

11.Opeña R.T., Chen J.T., Kalb T., Hanson P. – 2001 – Hybrid Seed Production in Tomato. International Cooperators Guide, AVRDC pub # 01-527.

12.Radzevičius A., Karklelienė R., Viškelis P., Bobinas Č., Bobinaitė R., Sakalauskienė S. – 2009 – Tomato (*Lycopersicon esculentum* Mill.) fruit quality and physiological parameters at different ripening stages of; Lithuanian cultivars, Agronomy Research 7(II), 712–718.

13.Şovărel Gabriela – 2015 – Behavior of Some Greenhouse Grown Tomato Hybrids on Pathogens Attack. Bulletin Horticulture Cluj-Napoca 72(1), 229–230.

14.Taylor J. H. – 1987 – Text of lectures delivered at the national workshop on fruit and vegetables seedlings production held at NIHORT, 9–13.

15.Vînătoru C., Neicu E. – 2010 – New and Perspective Tomato Lines with Determined Growing Obtained at V.R.D.S. Buzău. Bulletin UASVM Horticulture Cluj-Napoca 67(1), 511.

16.Voican V., Lăcătuş V. – 1998 – Cultura protejată a legumelor în sere şi solarii, Ed. Ceres, 169.

17.Zamfir Bianca, Hoza D., Vînătoru C., Bratu Camelia, Barcanu Elena – 2017 – New Tomato (*Solanum lycopersicum*) Hybrids Obtained at V .R.D.S. Buzău. Bulletin UASVM Horticulture Cluj-Napoca 74(2), 204–205.