Scientific Papers. Series B, Horticulture. Vol. LXVIII, No. 2, 2024
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

YIELD AND QUALITY EVALUATION OF L 548, VITAMINA, THE NEW TOMATO VARIETY OBTAINED AT BRGV BUZĂU

Costel VÎNĂTORU[1], Bianca MUȘAT[1], Adrian PETICILĂ[2], Matilda POPESCU[1], Geanina NEGOȘANU[1], Camelia BRATU[1]

[1]Plant Genetic Resources Bank - for Vegetables, Floricultural, Aromatic and Medicinal Plants Buzău, Romania
[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd, District 1, Bucharest, Romania

Corresponding author email: zamfir_b@yahoo.com

Abstract

The researchers of BRGV Buzau had the preservation and breeding of local old autochthonous varieties and landraces as their purpose. In 2022, through repeated individual selection, the variety for fresh consumption with indeterminate growth registered at ISTIS with the provisional name of Vitamina was obtained. The strong distinguishing character of the variety is given by the fruit color. It is yellow, slightly orange. The fruits are large, round, slightly ribbed, with a weight that varies between 96-315 g. In addition to the high production potential, the variety presents an added quality given by the fruits taste and aroma and their richness in beneficial and healthy substances, leading the authors to propose the name Vitamina. It has the U gene, which express medium green cap immature fruit, but also specific taste and aroma given by the SGLK2 gene complex. The variety shows main pathogens attack high resistance and also has the nematode repellence mi gene. The market tests carried out so far with more than 1000 growers, have been favourable to the variety, and it enjoys a lot of appreciation.

Key words*: aroma, autochthonous, expressiveness, local landrace, repellence.*

INTRODUCTION

Spanish conquistadors were the first to record seeing tomatoes being cultivated for food in Mexico in the 16th century. Tomato seeds were then dispersed to the Philippines, the Caribbean, Italy, and Spain and from there to the rest of continental Europe and Southeast Asia (Bland, 2005).

Over time, although it is a crop introduced relatively recently in Romania, in the nineteenth century, tomatoes have gained popularity among growers and consumers, thus writing history in the cultivation and use of this species (Vînătoru et al., 2019). If at the beginning were cultivated trans-generational preserved local populations that were inherited from family-to-family, after 1990, concomitantly with the development of research in crop plant breeding, high-performance varieties and later top hybrids were created. Heirloom vegetables are nonhybrid varieties that have been preserved from generation to generation as seeds (Coolong 2009). Over time, these organic creations have replaced the traditional classic tomato due to their superior production and quality characteristics. Heirloom tomatoes are defined as varieties, which have been passed down through multiple generations of a family (Rowland, 2019).

One of the main problems of modern vegetable farming is the creation of new economically efficient varieties with complex valuable characters adapted to different growing conditions (Mihnea N., 2011).

A wide diversity of traditional varieties, modern cultivars, crop wild relatives and other wild-plant species. They are the basis for food security, as their loss results in reduced crop genetic diversity or genetic erosion, increasing the vulnerability of the future food supply (Harlan, 1992).

Consumers demonstrated their positive reception of heirloom tomatoes, especially when they were cultivated in the open-field and near their area of selection where they express their full potential in the nutrient synthesis and sensory properties (Lázaro A., 2018).

The term landrace has received numerous definitions and several synonyms refer to the

same concept, including local variety, local population, traditional cultivar, farmer variety and farmer population (Zeven, 1998) or traditional variety and primitive variety (Negri et al., 2009).

MATERIALS AND METHODS

The genetic material that was used for intensive breeding works comes from a local population identified in Jilava, Ilfov County, in 1986. It bore the code name L 548.

Four lines from the tomato variety for fresh consumption were studied from the phenotypic, biochemical, production and quality point of view: L 28, L 532, L 548 and L 80. Through repeated individual selection works, stabilization in descent of the genotype L 548. The comparative crops were established in the greenhouse, on an area of 300 m^2 in palisade system. Both years, the tomatoes were planted in high tunnels 1 month earlier and harvested 3 weeks earlier than the field.

Greenhouse soil was prepared with great care as it follows: the removal of previous crop debris, disinfection of the soil in the greenhouses being the most effective method of disease and pest prevention was done chemically. Before the crop was established, organic fertilizers were applied to the soil (80-100 t/ha).

Planting was done by hand at 70 cm between rows and 30 cm between plants per row and 120 cm between strips. The crop planting plan is the same as previously used. Immediately after planting the gaps were filled in. Soluble chemical fertilizers were used for fertilization, which were administered with irrigation water through the drip irrigation system. The special works used were the staking of the plants with string to the greenhouse support system at 200 cm, the pruning of the plants, the removal of the leaves below the first inflorescence, the shearing of the inflorescences when required.

The biochemical analyses carried out were: determination of the dry matter by oven weighing method, acidity, content of soluble substances (sugar, °Brix) and lycopene content.

The phenotypic and production observations were carried out according to the UPOV and IPGRI international descriptors.

The statistical analysis was performed in the SPSS statistical program, using analysis of variance, Anova followed by Duncan's post hoc test.

RESULTS AND DISCUSSIONS

The main parameters were chosen to follow the evolution of plant growth and development as follows: plant height (cm), leaf length (cm), fruit weight (g), number of fruits/plant (pcs), fruit height (cm), fruit diameter (cm) (Table 1) (Figure 1).

Figure 1. Vitamina variety: plant, fruit detail, fruit section

Table 1. Average data on the main plant growth parameters

Accession / Parameter	Plant height (cm)	Leaf lenght (cm)	Fruit weight (g)	Number of fruits/plant (pcs)	Fruit height (cm)	Fruit diameter (cm)
L 28 S	215±1.17 [a]	36±3.58 [a]	221±4.65 [a]	26.4±3.20 [a]	11.4±2.50 [a]	5.82±1.93 [a]
L 2000 S	196±52.8 [a]	39±4.58 [a]	485.2±328.6 [a]	12±3.74 [a]	6.8±1.65 [a]	7.2±1.46 [a]
L 80 S	220.4±14.7 [a]	36.22±4.98 [a]	18.84±2.36 [a]	317.6±93 [a]	3.64±0.56 [a]	2.12±0.8 [a]
L 532 S	164.6±42.7	33.16±6.08	75.64±5.4	43.4±10.57	7.28±1.31 [a]	2.74±0.63 [a]

*Letters represent Duncan test results with confidence interval of 95% and $p<0.05$

The measurable characteristics of L 548 are clearly superior to the other lines in the tomatoes assortment for fresh consumption, average values were recorded in terms of fruit weight of 385 g, reaching a maximum of 500 g.
In terms of fruit production per plant, they are significantly reduced than the other lines, but considering their size, the production remains significantly high, recording an average of 9.2 kg of fruit per plant in greenhouse.
The biochemical analyses carried out revealed the nutritional and medicinal importance of this line, being obvious that the line meets essential biochemical characteristics for human body health but also a chemical composition that gives it a special taste and aroma. Regarding the total dry substance, it has a rather low value, recording an average of 5.6% S.U.T., which indicates that the line is intended for fresh consumption and for salads.
Regarding the ratio between sugar and acidity, it is perfectly balanced, a very important characteristic in the case of tomatoes, a characteristic that supports the taste and aroma specific to the Romanian tomato.
The lycopene content reaches the highest values in the case of line 548, of 7.5 mg/100 g, which indicates exceptional antioxidant properties (Table 2).

Table 2. Biochemical analysis of tomato assortment for fresh consumption

Accession	S.U.T. (%)	Acidity (as citric acid) (%)	Sugar (%)	Acidity/sugar ratio	Ascorbic acid, mg/100 g^{-1}	Lycopene, mg/100 g^{-1}
L28	4.5±1.1 ^{b}	0.3±0.2 ^{b}	3.9±0.8 ^{b}	13.1±5.8 ^{a}	7.7±0.8 ^{b}	4.6±1.1 ^{b}
L80	4.16±0.43 ^{b}	0.22±0.04 ^{b}	3.6±0.40 ^{b}	35.0±8.24 ^{a}	5.8±1.64 ^{b}	5.6±1.12 ^{a}
L548	5.6±1.06 ^{a}	0.5±0.07 ^{a}	2.6±1.06 ^{b}	10.5±1.89 ^{b}	8.2±2.13 ^{a}	7.5±1.06 ^{b}
L532	6.3±0.7 ^{a}	0.4±0.1 ^{a}	4.3±0.5 ^{a}	17.1±4.6 ^{a}	7.3±1.5 ^{a}	3.4±1.5 ^{a}

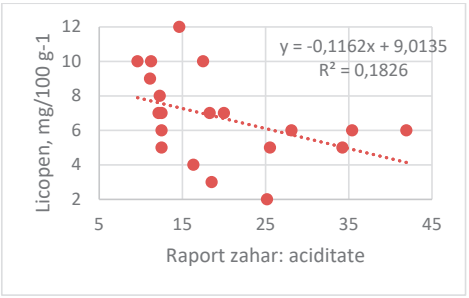
*Letters represent Duncan test results with confidence interval of 95% and p<0.05.

In order to establish a correlation between the characteristics determined by laboratory analysis, the Pearson correlation test was performed, and the correlation matrix was created that reveals the relationships between these parameters and their positive or negative influence (Table 3).

Table 3. Correlation coefficients of the analyzed biochemical composition

Features	s.u.t. %	A	Z	Z/A	Aasc	L
s.u.t. %	1					
Acidity (as citric acid) (%) - A	0.394	1				
Sugar total (%) - Z	-0.027	-0.028	1			
Sugar-acidity ratio - Z/A	-0.147	**-0.530**	**0.839**	1		
Ascorbic acid, mg/100 g-1-Aasc	**0.589**	**0.453**	0.099	-0.290	1	
Lycopene, mg/100 g-1-L	**0.503**	**0.486**	-0.258	-0.427	0.420	1

According to the matrix above, you can see the negative values colored in red and the positive values colored in green.
The two trends, both negative and positive, are of major interest for breeders because they can determine the relationship between the measurable parameters.
The ratio between lycopene and the sugar/acidity ratio is -0.427, which indicates that the lower the lycopene content, the lower the sugar/acidity ratio. Also, a major influence is observed between the vitamin C content and the total dry matter content, this being 0.589, from which we can conclude that as the vitamin C content increases, the total dry matter content also increases.
These trends can be seen in Figure 2.
The four lines were harvested staggered. Thus, the harvests were carried out in the greenhouse starting from June 15 to October 15 (Table 4).
The crops were planted and treated as a prolonged cycle to highlight the production capacity of the lines chosen for the study (Figure 3).
For each harvest, quality I (STAS I), quality II (STAS II) and SUBSTAS (non-compliant fruits) were calculated. Also, for each line in the two years of study, 2022 and 2023, the early production was calculated.
For a more detailed and easy exemplification, a histogram was made showing the peak moments of the maximum quantities harvested throughout the harvesting period, for each individual line, in the two years of the study, as well as the average of these harvests per year (Figure 4).



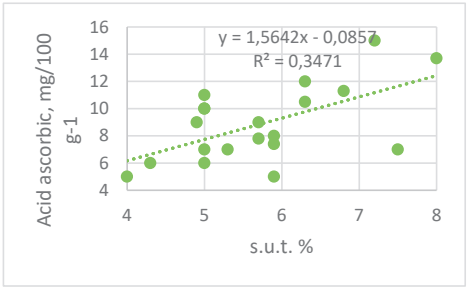


Figure 2. Lycopene/sugar/acidity ratio; ascorbic acid/s.u.t.% ratio

Figure 3. Fruit details on plant and immature/mature fruits

Table 4. Harvest dynamics (g/plant)

Line	I'st harvest (15.06)	II'nd harvest (30.06)	III'rd harvest (15.07)	IV'th harvest (30.07)	V'th harvest (15.08)	VI'th harvest (30.08)	VII'th harvest (15.09)	VIII'th harvest (30.09)	IX'th harvest (15.10)	TOTAL	Early yield
L28 average	174.6	814.8	1164	1571.4	756.6	582	291	232.8	174.6	5820	989.4
L28-2022	186	868	1240	1674	806	620	310	248	186	6200	1054
L28-2023	163.2	761.6	1088	1468.8	707.2	544	272	217.6	163.2	5440	924.8
L548 average	233.2	524.7	1574.1	1457.5	757.9	583	349.8	233.2	116.6	5830	757.9
L548 -2022	157.6	354.6	1063.8	985	512.2	394	236.4	157.6	78.8	3940	512.2
L548 -2023	308.8	694.8	2084.4	1930	1003.6	772	463.2	308.8	154.4	7720	1003.6
L80 average	181.65	847.7	1211	1634.85	787.15	605.5	302.75	242.2	181.65	6055	1029.35
L80-2022	132.3	617.4	882	1190.7	573.3	441	220.5	176.4	132.3	4410	749.7
L80-2023	231	1078	1540	2079	1001	770	385	308	231	7700	1309
L532 average	331	628.9	595.8	496.5	397.2	331	297.9	132.4	99.3	3310	959.9
L532-2022	265	503.5	477	397.5	318	265	238.5	106	79.5	2650	768.5
L532-2023	397	754.3	714.6	595.5	476.4	397	357.3	158.8	119.1	3970	1151.3

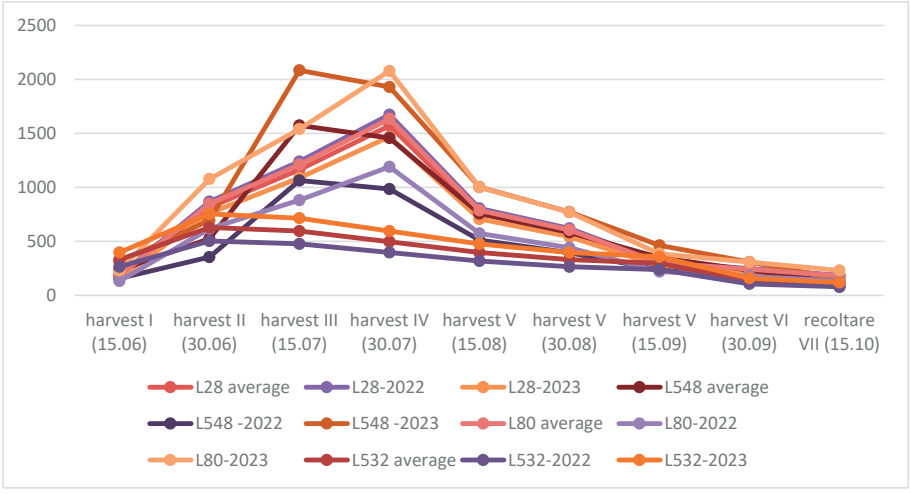


Figure 4. Yield recorded during the harvest period of the greenhouse crop

Regarding the dynamics of harvesting in the greenhouse, they were staggered over a longer period of time, the greenhouse being the one who allows this. Thus, harvesting began on June 15 and continued until October 15, which in the open field is not possible due to the arrival of early frost or frost.

The peak moments quantified in high production were registered by most of the lines in the months of June-July. L 548 is a semi-early line but which can record significantly high productions.

As a result of the studies and research carried out, L 548 has been genetically stabilized and is undergoing annual DUS testing at ISTIS to be approved and patented under the name of Vitamina.

According to the UPOV and IPGRI international descriptors, the variety has the following characteristics: plants with indeterminate growth, immature fruits with a medium green cap, mature fruits of yellow-orange color, round, slightly ribbed, with a weight varying between 96-315 g. Inflorescences are dense, on average 8 and a height of over 2 m of the plant. In addition to the high production potential, the variety presents an added quality given by the taste and aroma of the fruits and their great richness in substances beneficial to health, leading the authors to propose the name Vitamina.

It has the *U* gene, which gives the immature fruit a medium green cap and the *SGLK2* gene complex that accentuates the specific taste and aroma.

The variety shows high resistance to the main pathogens attack and has the nematode repellence gene.

The foliage is rich, well balanced on the plant, it has an average number of 38 leaves/plant, up to a height of 200 cm, with a leaf length varying from 18 to 36 cm. The pistillate point is star-shaped, the number of seminal lobes in the cross section is 5, the thickness of the pericarp is 6 mm.

The fruits are juicy, they can also be used for processing, in obtaining tomato pasta or juice. However, their firmness is medium-weak, making them easily perishable.

CONCLUSIONS

An assortment of tomatoes for fresh consumption from the BRGV Buzau germplasm collection, which has over 4.200 tomato lines, was involved in the study.

Among these, 4 lines were chosen for in-depth research, being characterized phenotypically, biochemically and from the point of view of production quality.

Thus, emphasis was placed on Line 548, originating from a traditional local population, which was genetically stabilized through repeated individual selection and improvement works.

Line 548 presents valuable distinctive characteristics, having large, yellow-orange fruits, indeterminate growth and genetic resistance to the attack of pathogens.

Also, following the biochemical analyses, they indicated the nutritional value of the studied line, relevant to an exceptional chemical composition, a balance in terms of the sugar/acidity ratio, as well as a net content superior to the other lines in terms of the percentage of lycopene, an important and primary antioxidant for the species *Solanum lycopersicum*.

Following this study, line 548 was registered for the purpose of homologation and patenting, meeting the characteristics of the DUS test, distinctiveness, uniformity and stability in descent.

It has the provisional name of Vitamin, a name that indicates the superior nutritional quality of the variety intended for fresh consumption.

REFERENCES

Bland, S.E. (2005). Consumer Acceptability Of Heirloom Tomatoes, pp. 4-43

Coolong, T. (2009) Heirloom vegetables. Cooperative Extension Service, College of Agriculture, University of Kentucky. Accessed September 26, 2011.

Harlan JR (1992) *Crops and man*. Madison, USA: American Society of Agronomy, 248 pp.

Lázaro, A. (2018). Tomato landraces: an analysis of diversity and preferences. *Plant Genetic Resources*, 16(4), 315-324.

Mihnea, N. (2011). Genetic and breeding value of tomato varieties without geniculate joint of floral peduncle. *Oltenia - Studii si Comunicari Stiintele Naturii*, 27(2), 7-13.

Negri, V., Maxted, N., Veteläinen, M. (2009). European landrace conservation: an introduction. In: Veteläinen, M., Negri,V., Maxted, N. (Eds.), European Landraces: On-farm Conservation Management and Use, Biodiversity Technical Bulletin, 15. Bioversity International, Macaresse, pp. 1–22.

Rowland, S. D., Zumstein, K., Nakayama, H., Cheng, Z., Flores, A. M., Chitwood, D. H., … Sinha, N. R. (2019). Leaf shape is a predictor of fruit quality and cultivar performance in tomato. *New Phytologist.* doi:10.1111/nph.16403

Vînătoru C., Mușat Bianca, Bratu Camelia (2019). *Tratat de legumicultura speciala*, Editura Alpha MDN, Buzau.

Zeven, A.C. (1998). Landraces, a review of definitions and classifications. *Euphytica*, 104, 117–139.