

THE PHYSIOLOGICAL AND BIOCHEMICAL BEHAVIOUR OF FIVE CULTIVARS OF *LYCOPERSICON ESCULENTUM* DURING THE RIPENING PROCESS IN TWO DIFFERENT CULTURE CYCLES

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INTRODUCTION

This paper presents the variation of some physiological and biochemical parameters during the ripening process. Fruit quality and consumer acceptability in tomatoes are strongly related to the concentration of soluble solids content in the ripened fruits. Flesh color represents another important feature regarding fruits quality assessment. In this research paper, we discuss the physiological and biochemical changes during the maturation process and the increasing or decreasing manner of the content in total soluble dry matter, lycopene, and titratable acidity. We also discuss about the report between total soluble dry matter and titratable acidity.

MATERIAL AND METHODS

The experiments were conducted in the summer of 2004, 2005 and 2006 using five Dutch Origin cultivars of tomatoes. The cultivars are known for their good productivity and our study follows physiological and biochemical changes during the maturation, because of the importance in tomatoes quality. The tomatoes plants were grown under greenhouse ordinary conditions, at the Pipera greenhouses farm in Bucharest area. The experiments were carried out in two different culture cycles as we can see in table 1. The tomato seedlings were planted in the greenhouse soil.

Table 1 Specifications about culture cycle

Specifications	Culture cycle	
	First	Second
Sow Period	20 Nov	10 Jun
Plant Period	10 Jan	10 Jul
Give Out Period	20 Jun	15 Dec
Seedling	50 Days	30 Days

All investigations were performed during the ripening process. The physiological and biochemical changes concerned the content in soluble dry matter, pigments, and titratable acidity.

We analyzed these parameters because of their importance in tomato quality. The soluble dry matter content was determined using refractometer method, and then, expressed in percents.

Titratable acidity was determined using titration method and than is expressed in mg/100g citric acid. The most important pigment in tomato flesh, responsible for the red color (lycopene), was extracted in petrol ether and determined at spectrometer at $\lambda=472$ nm. Content of lycopene is expressed in mg/100g.

RESULTS AND DISCUSSIONS

As we can see in figure 1 the content in soluble dry matter is enlarged during the ripening process.

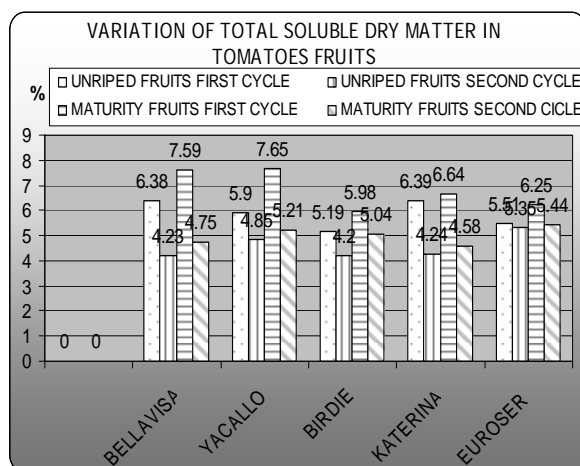


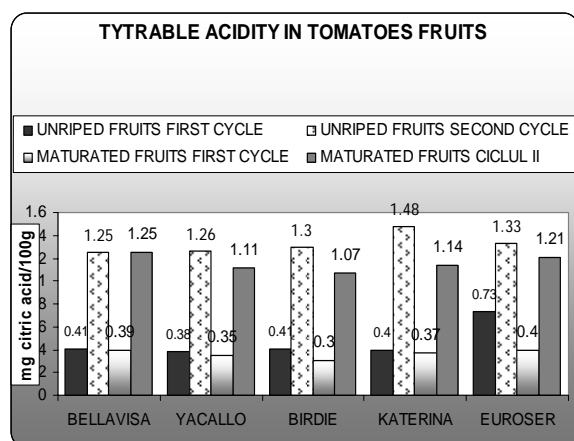
Fig. 1. Variation of total soluble dry matter in tomato fruits during the ripening process

At first determination in the first culture cycle, the average was 5.08%. We observed an increase of 1.23 times at the second determination. The best results for this parameter were obtained at Yacallo cultivar, 7%. In case of the second culture cycle the average was 3.84% and the increase was 1.18 times at the second determination, when the fruit were fully matured. Euroser obtained the biggest rate of this parameter, 5.90%. Regarding the comparison between the first and the second culture cycle, as we can see in

fig. 1, in all cases the cultivars obtain best results in the first cycle.

Titrateable acidity in tomato fruit and content in soluble dry matter are very important parameters for taste. During the ripening period in the first culture cycle, because of the higher temperature the average of titrateable acidity was lower compared with the second culture cycle.

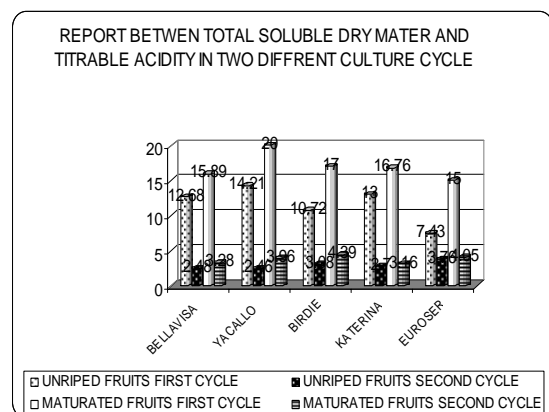
Fig. 2. Titrateable acidity in tomato fruit - mg citric acid / 100 g



Regarding titrateable acidity, we observed a decrease during the ripening process. The lowest value was obtained in the first culture cycle when the fruit accumulated the biggest soluble dry matter. In the case of the mature fruits the average for titrateable acidity in first culture cycle was 0.36 mg citric acid/100g and 1.16 mg citric acid/100g for second culture cycle.

We obtained the biggest value for titrateable acidity in our first determination in the second culture cycle. The average was 1.32 mg acid citric/100 g for fruits not completed matured. Because of the low temperatures in the growth and ripening period this value decreased just 1.14 times in the maturity period. In this case biodegradation of organic acids was inhibited.

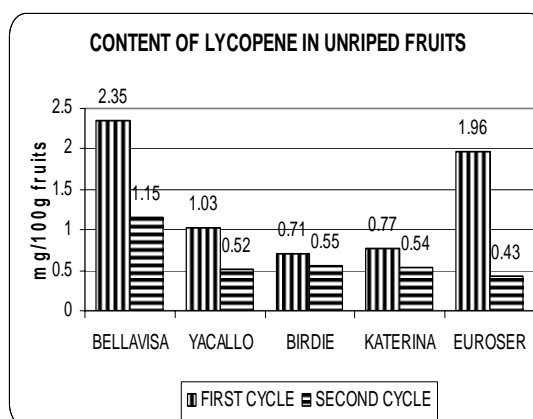
Fig. 3. Report between total soluble dry matter and titrateable acidity



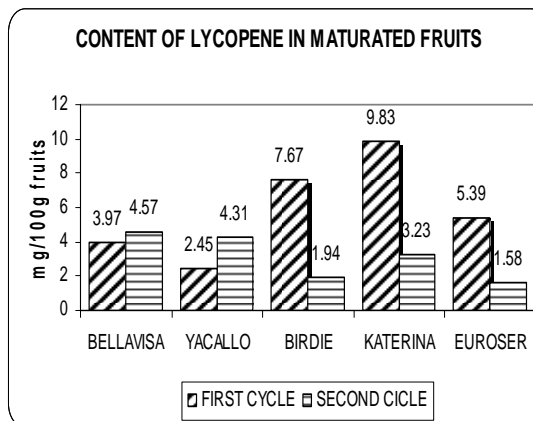
The ratio between solid dry matter and titrateable acidity can be an indicator for the quality taste of tomatoes. We registered the biggest value in fruit of the first culture cycle. This fact indicates a more balanced taste, a higher content in sugars, and a lower content in citric acid. Matured fruits from the first culture cycle registered a 4.49 times ratio by comparison with fruits from the second culture cycle. Low values of solid dry matter and titrateable acidity in the second culture cycle (3.16 – 4.39) indicate inappropriate taste, a high value of citric acid and a low content in sugars.

Pigmentation is important for consumers. Red fruit are preferred in our country. We study more or less red fruits (depends of cultivar) at fully maturity. Concerning the flash color we observed the manner how the chlorophyll content drops gradually with a final rapid decline, coinciding with carotenes and lycopene synthesis and ripening process. β carotene and lycopene are the most important pigments, responsible for red pigmentation.

In the first culture cycle at the first determination the highest content of lycopene was registered at Bellavisa (2.35 mg/100g) and the lower at Birdie (0.71 mg/100g). The most pigmented fruits were Katerina's fruits with 9.83 mg/100g. In case of the first culture cycle the increasing rhythm was 4.80 times.



a



b

Fig. 4 a-b Variation of lycopene during fruit ripening



Photo 1. Variation of lycopene

The rhythm of increase was high in the second culture cycle, too. The average for the first determination was 0.64 mg/100g and the increase was 4.89 times (the last determination when the fruit where matured). In the second culture cycle the most pigmented fruit were Belavisa's, 4.57 mg/100g.



Photo 2. Culture aspects

CONCLUSIONS

1. Soluble dry matter rose during the maturation process, and reached the best results in the first culture cycle.
2. The content in citric acid has decreased during the ripening process, and reached the optimum results in first culture cycle.
3. The differences between the quality of the tomato fruits cultivated in two different periods can be explained thanks to the higher temperature during the growth and ripening process in the first culture cycle (May - June) when the temperatures and light intensity registered better parameters compared with November and December, the period of ripening and maturation for the second culture cycle.

4. Lower temperatures and low light intensity during growing and maturation process in second culture cycle November – December led us to an inappropriate taste of tomatoes (carbohydrate synthesis and metabolism of organic acids was stimulated). The fruits had a lower quality in the second cycle culture comparing first cycle.
5. Regarding lycopene content we observed pigmentation to be more pronounced in first culture cycle – average was 5.86 mg/100g, comparing second culture cycle when medium content was 3.13 mg/100g.
6. The content of lycopene rose during maturation process.
7. Tomatoes cultivated in the first period registered better taste qualities.

ABSTRACT

Tomatoes *Lycopersicon esculentum* Mill are included in the Solanaceae family. The maturity and quality of tomato fruits are evaluated from different point of views by producers, merchandises and consumers. The last ones appreciate usually the taste, form, weigh and color. The dry soluble mater (SUS) is the most accessible quality indicator – it consists of: soluble glucides (glucose, fructose and sucrose), organic acids, amino acids and mineral substances.

The titratable acidity (At) of tomato fruits has a particular importance in taste qualities and this makes it a very important for consumers in establishing tomato quality. The value of the ratio SUS/At is also important.

Carotene and lycopene are the most important pigments in tomato flesh. Because of them the fruits become colored. The accumulation of this pigment is important in establishing the right moment of ripening and the commercial quality of tomato fruits.

The paper presents the variation of the quality index during the ripening process in two different culture cycles.

REFERENCES

1. BURZO, I; Ș.A (2000) - Fiziologia plantelor de cultură, vol 1, vol. 4, Ed. Știința
2. BARTLEY, G.E., SCOLNIK P.A. 1994 - Molecular biology of carotenoid. biosynthesis in plants. Annu. Rev. Plant Physiol. Plant Mol. Biol. 45, 287 – 307
3. BODEA, C. (1984) – Tratat de biochimie vegetală. Editura Academiei R.S.R., București
4. BREZEANU PETRE MARIAN, AMBĂRUȘ SILVICA, BREZEANU CREOLA, 2005 – The study, in comparative crops, of a range of tomatoes hybrids F1 in order to establish the most adapted genotypes that can be cultivated in the greenhouses from Romania.- Lucrări științifice anul XLVIII vol I (48) Ed. Ion Ionescu de la Brad Iași

5. BREZEANU, P. M., 2009 - The accumulations of pigments in the tomatoes fruits. Lucrări științifice USAMVseria B, vol LIII, 50-52
6. SEYMOUR G.B., TAYLOR J.E., TUCKER G.A. 1993 Biochemistry of Fruit Ripening, Chapman and Hall

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