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PRELIMINARY STUDY RELATED ON YIELD AND QUALITY POTENTIAL OF TWO NEW SWEET PEPPERS VARIETIES OBTAINED AT V.R.D.S BUZĂU

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Abstract

Sweet pepper is an important vegetable used in Romania and it holds a significant area crop. At present, there are a lot of new varieties of sweet peppers in Romania, but, unfortunately, most of them comes from worldwide seed producers. Being demand for autochthonous competitive varieties, suitable for growing in greenhouse, Vegetable Research-Development Station Buzău has been preoccupied with obtaining of new varieties of sweet peppers. This study was conducted to investigate the qualitative and quantitative potential of two new varieties, 'Ideal' and 'Carmin'. As the study shown, 'Ideal' variety has a higher yield potential, while 'Carmin' variety has a higher content of vitamin C. Dry matter content and soluble substances it has higher values in 'Ideal' variety. New bred varieties have demonstrated downstream genetic stability in the phenotypic expressiveness of the main characters and have also recorded high-quality yield production, thereby contribute to the enrichment of the inland assortment suitable to be cultivated in greenhouses.

Key words*: breeding, Capsicum annuum L., Carmin, Ideal, Romania.*

INTRODUCTION

Capsicum annuum L. var. *grossum* Sendt also known as bell pepper, sweet pepper and green pepper is one of the well known and productive species from *Solanaceae* family and holds significant crop areas in Romania. An important part of Romanian varieties of *Capsicum* spp. are not suitable for growing in the greenhouse, that is why one of the main objectives of Vegetable Research-Development Station (V.R.D.S.) Buzău, was to obtain valuable genotypes. V.R.D.S. Buzău owns a diverse germplasm collection of different kind of peppers. Recently, two varieties of peppers, 'Ideal' and 'Carmin', have been patented and the aim of this study was to research their quantity and quality potential. Among the characteristics of the bell pepper fruits, the length and the diameter stand out and these characteristics have been considered extremely important for commercialization (Blat et al., 2007). These characteristics are still important in defining the shape of these fruits and it's fundamental to determine the group to which they belong whether conical, rectangular or square (Ramos et al., 2017). 'Carmin' fruits belong to the square group and 'Ideal' has fruit with conical shape both of them are from *Capsicum annuum* var. *grossum*. It is well known that pepper fruits are very used and appreciated by their high content of ascorbic acid (AsA) and antioxidant activities (carotene and flavonoids) (Burzo, 2015). AsA, the anti-scorbutic factor, is a required human nutrient, and its biological functions are centred on its antioxidant properties in biological systems, preventing common degenerative processes (Padayatty et al., 2003). Of course, the values are influenced by variety, crop technology and harvest time. That is why, in this study, for biochemical analysis fruits were harvested in two different times: green stage and red stage. Their attractive red colour is due to the profuse

synthesis of various carotenoid pigments during ripening. These include oxygenated carotenoids such as capsanthin, capsorubin and crypto-capsin, which are exclusive to this genus and have been shown to be effective free radical scavengers (Matsufuji, Nakamuro, Chino, Takeda, 1998). Also results of Kim et al. (2016) shows that intake of sweet pepper might be helpful for lowering the risk of diseases caused by oxidative stress. The aim of this study was to evaluate the yield and quality potential of those two new *Capsicum* varieties, ˈIdealˈ and ˈCarminˈ.

MATERIALS AND METHODS

To assess the morphological characteristics, agronomic performance and biochemical compounds, varieties were grown under protected environment within V.R.D.S. Buzau site during spring-autumn of 2017. During summer, from June to end of August, the greenhouse was covered with shading net with a shading degree of 40%.

The seeds were sown on 07.03.2017 and transplanted in the greenhouse at the beginning of May, on 03.05.2017. Planting was made in strips in the following formula 70 cm x 35 cm and 1.2 m between the strips.

The experiment was organized in randomized blocks, in two rehearsals and the observations were made on 100 plants for each variety. Both varieties have received standard cultural practices, a special care was made to handle the bell pepper shoots and to remove of the first floral button.

During vegetation period, there have been recorded some agronomic traits like: earliness, number of fruits/plant, weight of fruits, weight of receptacle, weight of fruit pulp, the thickness of pulp.

To highlight the variability of the two varieties, a morphological characterization was performed using the DUS test, according to European Union - Community Plant Variety Office (2007) (CPVO-TP/076/2).

The characteristics of fruits analyzed were as follows: unripe colour fruit, cross-section fruit, number of locules, fruit shape at blossom end, fruit shape at pedicel attachment and thickness of the pulp.

Physico-chemical analysis

Researches have been carried out in the Research Center for Studies of Food Quality and Agricultural Products from University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania. Physico-chemical analyses were performed on unripe fruit (green stage) at the beginning of August and on ripe fruits (red) in September.

For each variety were harvested an increase number of sampling so that the confidence interval of the sample to get wider. Each analysis was an average sample of several fruits.

Ascorbic acid content was determined with HPLC - Aqilent Technologies 1200 Series equipment. Ascorbic acid was determined by using methods described by Jones and Hughes (1983), Deepa et al. (2006), Topuz et al. (2007), Ghasemnezhad et al. (2011) with slight modification. From average sample of fresh fruits were taken 1 g and mixed with a pinch of quartz sand.

The mixed sample was homogenized with 10 mL of metaphosphoric acid. The samples were kept in the dark for 45 minutes at 4°C. The extract has been centrifuged for 1 minute at 1000 rotation/minute.

The supernatant was filtered through a filter Agilent RC 0.2 μm and then it was injected in HPLC. The samples were analysed in duplicate for each varieties and were expressed in mg/100 g.

Total soluble solids (TSS) and titratable acidity (TA). TSS is an index of soluble sugar content in fruit. Soluble solids were determined from bell pepper juice using refractometer Kruss (% Brix).

Titratable acidity (TA) was determined using 10 g of ground bell pepper diluted in 50 ml of distilled water. The titratable acidity of peppers was determined by titration with 0.1N NaOH to pH 8.1 (Sadler and Murphy, 2010; Serrano et. al, 2010).

For titration was used automatic titrator TitroLine easy. The results were expressed in milligrams citric acid/100g.

The ***dry matter*** was determined by drying stove for 15 hours at 105°C, until the samples reach constant weight.

RESULTS AND DISCUSSIONS

Vegetable Research-Development Station Buzău had undertaken research under the breeding program which aimed primarily in obtaining new varieties of bell pepper suitable for greenhouse growing, adapted to pedo-climate conditions of Romania and meet the requirements of farmers and consumers.
The new varieties obtained, 'Ideal' and 'Carmin', were morphologically analyzed according to DUS test and the result obtained are shown in the Tabel 1.

Tabel 1. Main fruit characteristics

Variety	'Ideal'	'Carmin'
Fruit: colour before maturity	3 (green)	3 (green)
Fruit: colour at maturity	8 (red)	8 (red)
Fruit: shape in cross section (at level of placenta)	3 (circular)	3 (circular)
Fruit: number of locules	2 (predominantly two)	4 (equally three and four)
Fruit: depth of stalk cavity	5 (medium)	7 (deep)
Fruit: shape of apex	2 (moderately acute)	4 (moderately depressed)
Fruit: thickness of flesh (mm)	7 (thick)	6 (medium)

'Ideal' variety had been characterized by earliness, 12 days earlier than 'Carmin' variety and with a high average yield of 3.5 kg/plant compared to 'Carmin' variety 2.59 kg/plant average yield. Although 'Carmin' has less fruit, the fruit average weight is higher.
'Ideal' variety (Figure 1) has a vigorous plant growth habit, with a height over 1 m, strongly branched, with a high percentage of fruit set even at high temperatures during hot days in the summer.

Figure 1. Crop view 'Ideal' variety

The average number of fruits per plant has been 26 fruits. Fruits are slightly conical with two locules, light green before maturity and red when ripe.
The average weight of the fruits is 135.2 g and the thickness of the flesh is on average 6.8 mm. The average weight of the receptacle has been 19.3 g and the average pulp weight 115.9 g.
The low temperature during summer nights causes the fruits to form a pointed end at the apex of the fruit.
'Carmin' variety (Figure 2) has a compact bush, with a height over 90 cm, very well branched. The fruit set percentage is medium in the hot summer days and high during autumn, September-October period.

Figure 2. Crop view 'Carmin' variety

There has been, in average, a number of 16 fruits/plant. Fruits have a pleasant commercial appearance, slightly waxed, with three of four lobes. The fruits have light green colour when unripe and red when they reach physiological maturity. The average of fruit weight has a value of 152.3 g, and the average of pulp thickness has a value of 5.78 mm. The average of receptacle has weighted 22.4 g and the pulp had 129.9 g.
In Figure 3 can be seen fruits of 'Ideal' and 'Carmin' variety in different colours during ripening period.

Figure 3. Different colour of fruits during ripening

In this study, the fruit quality of the sweet peppers variety was assessed by: ascorbic acid

content, dry matter, total soluble solids and titratable acidity. The quality indicators were different in both ripening stages: green and red.
The amount of ascorbic acid was higher in 'Carmin' variety, in both stages green and red, as seen in Figure 4, values vary from 164.31 mg/100 g when green stage and 189.27 mg/100 g when ripe.
'Ideal' variety records a value of 79.29 mg/100 g when fruits are unripe and green and an increased value of 122.5 mg/ 100 g when fruits have reached physiological maturity.

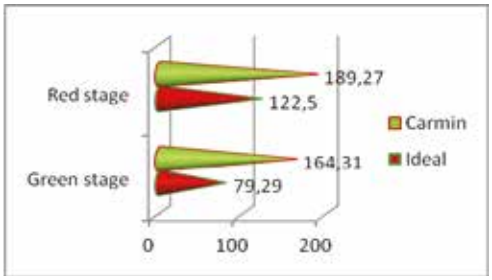

Figure 4. Variation of ascorbic acid during ripening period

As fruit ripens, an increase in ascorbic acid content was observed, these results have been in assent with previous studies (Howard et al, 1994; Deepa et al., 2006; Osuna et al., 1998; Marin et al., 2004). Smirnoff and Wheeler (2000) states that the role of ascorbate content as a photoprotector has been reported for leaves acclimated to high light, which have a higher ascorbate concentration than leaves grown at low intensity. The amount and intensity of light during the growing season have also been described to have a definite influence increasing the ascorbic acid formed. The light exposure could explain the increase in ascorbic acid content of red fruits as compared to the green ones (Lee, 2000).
To provide antioxidant protection, a Recommended Dietary Allowance (RDA) of vitamin C is 90 mg/day for adult men and 75 mg/day (Bendich A., 2001), individuals who smoke require 35 mg/day more. According to the results obtained for 'Carmin' and 'Ideal' variety, it was learned that it can provide the recommended dietary allowance and even more with just 100 g/day.

Physico-chemical analyses of total soluble solids (TSS), titratable acidity (TA) and dry matter values are presented in Table 2.

Table 2. Physico-chemical analyses

Stage	Analyse	'Ideal'	'Carmin'
Green	TA (citric acid) %	0.23 mg/100g	0.17 mg/100 g
	TSS °Brix	4.87	4.52
	Dry matter (g)	7.99	6.23
Red	TA (citric acid) %	0.28 mg/100g	0.29 mg/100 g
	TSS °Brix	7.25	6.75
	Dry matter (g)	9.43	9.01

As seen in Table 2, the quantity of titratable acidity increased with ripening of varieties. While the fruit ripens, the metabolic reactions increase, increasing the concentration of organic acids involved in the Krebs cycle. Apart from this, these acids make up the energetic reserves and the metabolic reactions that involve the synthesis of pigments, enzymes and other materials and the degradation of pectins and celluloses, which are essential for the ripening process. The organic acids are active substances during ripening in these alterations (Chitarra and Chitarra, 1990). For the totally green bell peppers, these organic acids are present in small quantities, as the ripening process has not yet started, presenting differences in relation to the other stages of ripening. The same behaviour was observed by Molinari et al. (1999) and by Ghasemnezhad et al. (2011).
Total soluble solids it is also increasing during ripening period on both sweet pepper varieties. As fruits starts ripening there is an increased of total soluble substance due to the degradation or biosynthesis of the polysaccharides and the accumulation of sugars. The metabolic processes related to the advance of ripening are directly influence by the level of TSS, where fruits in advance stages of ripening present the highest levels of TSS. These increases in soluble sugars and acidity have also been found during physiological ripening in many cultivars of both hot and sweet pepper, being correlated to colour changes (Lyon et al., 1992; Ghasemnezhad et al., 2011; Behera et al., 2004; Orowski et al., 2004; Tadesse et al., 2002, Serrano et al., 2010).
The amount of dry matter is an important quality attribute of bell pepper. High values of this parameter induce a better flavour and taste. It has been registered an increase in green stage on 'Ideal' variety from 4.87 g to 7.25 g in the

red stage and referring to 'Carmin' variety, the registered differences oscillated between 4.52 g to 6.75 g. Concluding, 'Ideal' variety has a stronger flavour and a more pleasant taste than 'Carmin' variety. Fruits who have reached physiological maturity have a higher amount of dry matter, which is probably due to high temperature during summer, which allows an increase nutrition and plant metabolism. Similar results were recorded by Amalfitano et al. (2017), in Naples, Italy.

CONCLUSIONS

The two new varieties obtained at Vegetable Research-Development Station Buzău, 'Ideal' and 'Carmin', have shown genetic stability in terms of phenotypic expressiveness of the main characters and have also recorded high quality yield, contributing to the enrichment of the local assortment suitable for greenhouse growing.

'Carmin' variety was highlighted by its high content of vitamin C, and the 'Ideal' variety by a higher yield and a high content of dry matter and total soluble substance.

This study can help promote and stimulate growing in the greenhouse of those two new varieties.

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