

CULTIVAR AND PLANT DENSITY INFLUENCE ON THE QUANTITY AND QUALITY OF THE SWEET PEPPER YIELD OBTAINED IN ECOLOGICAL FARMING POLLYTUNNELS CONDITIONS

INFLUENȚA CULTIVARULUI ȘI A DENSITĂȚILOR DE PLANTARE ASUPRA CANTITĂȚII ȘI CALITĂȚII RECOLTEI DE ARDEI GRAS OBȚINUTE ÎN SOLAR, ÎN CONDIȚII ECOLOGICE

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Abstract. The aim of this paper is to establish the influence of the cultivar and plant densities on the quantity and quality of the yield (as an expression of the following indicators: solids content, soluble dry substance, reducing sugars, total protein and vitamin C) on a sweet pepper crop grown in polytunnels in organic farming conditions. Mainly, the results emphasize the influence of genotype on the yield quantity and of plant densities on the yield quality. The total yield varied between 37.07 t / ha (Bianca F1 x 45 cm) to 49.90 t / ha (F1 Brillante x 35 cm) and the dry matter content between 8.89% (Bianca F1 x 40 cm) to 16.67% (F1 Brillante x 45 cm). The others qualitative parameters recorded values comparable with those reported by the other authors.

Keywords: ecological sweet peppers, dry matter content, C vitamin content.

Rezumat. Scopul lucrării este de a stabili influența cultivarului și densității la cultura de ardei gras în solar, în condiții de agricultură ecologică, asupra cantității și calității recoltei (exprimată prin conținutului în: substanță uscată totală, substanță solubilă, zaharuri reducătoare, proteine totale și vitamina C). Rezultatele obținute reliefează, cu preponderență, influența genotipului asupra cantității recoltei și a densităților de plantare asupra calității acesteia. Producția totală a variat de la 37,07 t/ha (Bianca F1 x 45 cm) la 49,90 t/ha (Brillante F1 x 35 cm) iar conținutul în substanță uscată de la 8,89 % (Bianca F1 x 40 cm) la 16,67 % (Brillante F1 x 45 cm). Ceilalți indicatori calitativi au înregistrat valori în limitele raportate de literatura de specialitate.

Cuvinte cheie: ardei gras ecologic, conținutul de substanță uscată, conținutul de vitamina C.

INTRODUCTION

Accounted for vegetable with the highest intake of vitamin C in the human diet, pepper fruit provides important extra vitamins and minerals giving it the status of "medicinal vegetable" (Stoian, 2005).

The aim of this study is to determine the influence of cultivar and plant density on an ecological polytunnel sweet pepper crop on the quantity and quality of the crop (expressed as content of: solids, soluble dry substance, reducing sugars, total protein and vitamin C).

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MATERIAL AND METHOD

The researches were conducted during the 2012 year in the vegetable growing experimental field from "V. Adamachi" farm belonging to UASVM Iași, on a polytunnel sweet pepper culture with seedling produced at alveolar pallets with subculturing procedure.

The bifactorial experience (table 1) was organized in a subdivided plots device with three repetitions, each plot containing ten plants.

Table 1

Tehnological factors graduation

A factor (Cultivar)	B factor (Distance between plants / row)
a1 = Brillante F1	b1 = 33 cm (33.670 plants/ha)
a2 = Export	b2 = 40 cm (27.778 plants/ha)
a3 = Bianca F1	b3 = 50 cm (22.223 plants/ha)

Harvesting was conducted on the technological maturity of the fruit. For biochemical analyzes were taken three fruits / plant and were stored at -80°C. Afterwards they were mortar and on the mixture obtained were carried out following determinations:

- Dry matter content was determined by oven drying at 105 °C to constant weight;
- Soluble solids content - determined by ABBE refractometer and expressed in Brix degrees;
- Reducing sugar content - by the Miller method (1972) using the 3,5 - dinitrosalicylic acid (DNSA) reagent;
- Total protein content - was determined by the Bradford method;
- Vitamin C content - was estimated by titration with 2,6 - dichlorophenol indophenol reagent (Sadasivam and Manicke, 1992).

RESULTS AND DISCUSSIONS

Analyzing the interaction of the two factors influence on total production highlights three very significant positive variants (Brillante F1 x 35 cm, Brillante F1 x 40 cm and Export x 35 cm), whose production increases compared to the control were: + 6.73 t/ha, + 3.42 t/ha, respectively + 3.19 t/ha and three very significant negative variants (Bianca F1 x 45 cm, Bianca F1 x 40 cm and Export x 45 cm) with a lack of production to the control of 6,1 t/ha, -3.6 t/ha, respectively - 3.21 t/ha (see table 2).

At most species, the dry matter content increases with light intensity (Weston and Zandstra, 1989).

The dry matter is not significantly affected by planting distance, but increases progressively with culture maturation (Arteaga et al., 1999).

The cultivar x crop density interaction reveals two extreme variants within the ninth, respectively Bianca F1 x 40 cm (8.89%) and Brillante F1 x 45 cm (16.67%) (figure 1).

Table 2

Interaction of cultivar and culture density on total production of pepper

No.	Variant Specification	Total production		Difference over the control (t/ha)	Significance
		t /ha	%		
1.	Brillante F1 x 35 cm	49,90	115,59	6,73	***
2.	Brillante F1 x 40 cm	46,59	107,92	3,42	***
3.	Brillante F1 x 45 cm	42,39	98,19	-0,78	-
4.	Export x 35 cm	46,36	107,39	3,19	***
5.	Export x 40 cm	41,75	96,71	-1,42	o
6.	Export x 45 cm	39,96	92,56	-3,21	ooo
7.	Bianca F1 x 35 cm	44,93	104,08	1,76	**
8.	Bianca F1 x 40 cm	39,57	91,66	-3,6	ooo
9.	Bianca F1 x 45 cm	37,07	85,87	-6,1	ooo
10.	Media experienței (Mt)	43,17	100		

DL 5% = 1,10 t/ha

DL 1% = 1,51 t/ha

DL 0,1% = 2,08 t/ha

A general idea can be highlighted on the influence of planting density on the dry matter content analysis. Therefore, at all hybrids, the maximum dry matter was recorded at 50 cm between plants/row variants and the lowest at 40 cm between plants/row variants.

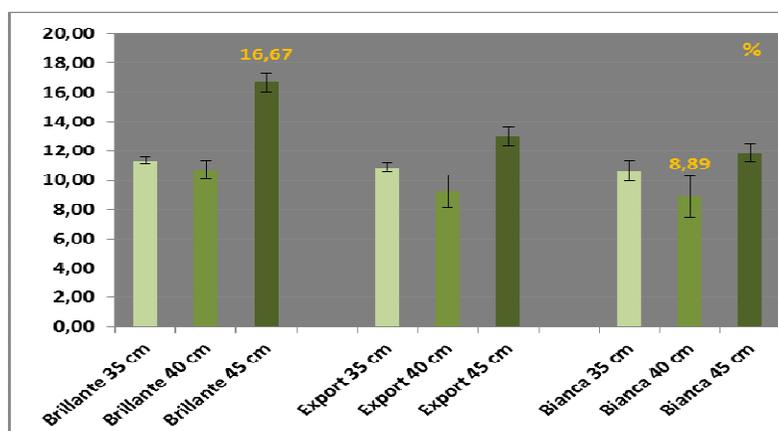


Fig. 1 - Dry matter content on sweet pepper

Production and fruit quality are in a directly proportional relation with all the fotoasimilants available during fruiting period. Photosynthesis efficiency is provided by the interaction of many factors, among which light is the most important. Studies have shown that there is a correlation between the amount of fotoasimilants and the number of light days during the growing period, resulting a decreased by 20% due to the climatic conditions in such countries (eg. England), with a similar decline of production (Cockshull et al. 1992).

Glucides content of fruit is most easily assessed by measuring soluble solids content, expressed in Brix degrees. Although fruits contain a whole range of soluble compounds, such as vitamins, minerals, organic acids and so on, the majority of them (80-85%) is represented by the soluble glucides.

Soluble solids content decreased with plant densities within Brillante F1 and Export cultivars. In contrast, at Bianca F1, the highest value was recorded at 45 cm between plants/row variant (1.27 degrees Brix) (figure 2.).

Limit variants were Bianca F1 x 40 cm (one Brix degree) and Brillante F1 x 35 cm (2.02 Brix degrees).

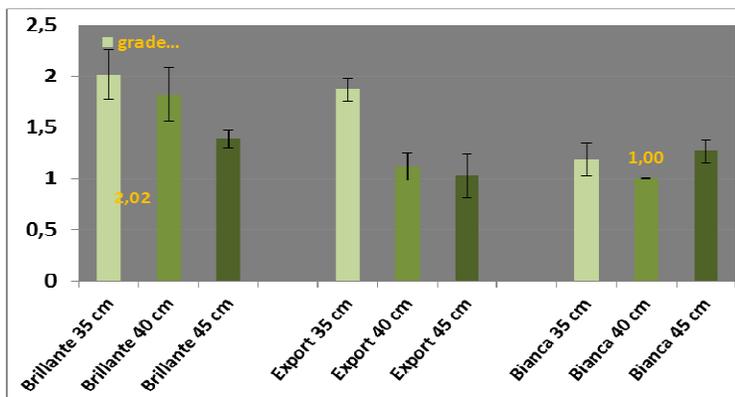


Fig. 2 - Soluble solids content at sweet pepper

The importance of cultivar on the reducing sugars content has been shown to be predominant, unlike the content of dry matter or total protein. Supporting this assertion are the reducing sugars levels achieved by the deficient hybrid (Bianca F1 – 2,86 mg/100 g f.s.) and by superior hybrid (Brillante F1 – 4,48 mg/100 g f.s.) (figure 3.).

The cultivar x crop density interaction highlights Export x 40 cm (2.72 mg/100 g f.s.) as minimum variant and Brillante F1 x 35 cm (4.48 mg / 100 g f.s.) as upper variant.

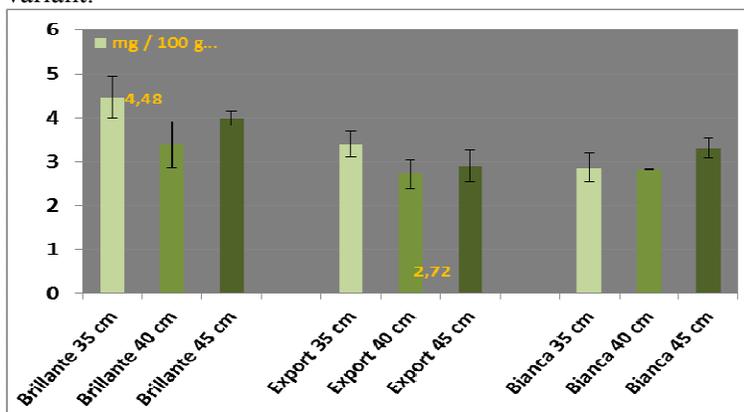


Fig. 3 - Reducing sugars content at sweet pepper

The analyzes concluded that the genotype influence on total protein content is insignificant, the average difference between the minimum variant (Bianca F1) and the maximum one (Brillante F1) being of only 0,73 mg/g f.s.

The influence of planting distances provides ambiguous information, even contradictory. Thus, at two of the three cultivars (Export and Bianca F1), the maximum total protein content was achieved at 40 cm between plants/row variants, while at the other hybrid the 40 cm variant reported the lowest concentration of total protein (figure 4.).

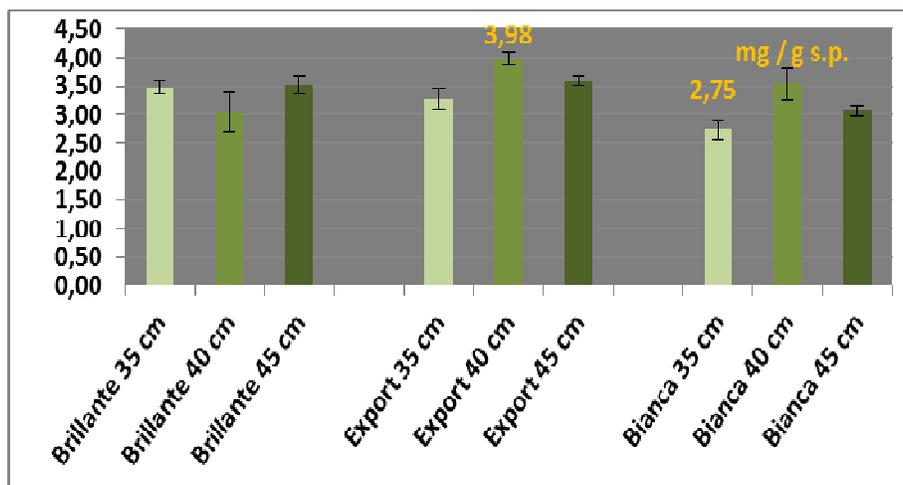


Fig. 4 - Total protein content at sweet pepper

L-ascorbic acid (C vitamin) is an essential compound to human health but has also a special role as an antioxidant and modulator of hormonal signaling pathways in plant tissues. Biosynthesis of this compound is closely related to the primary carbon metabolism: the main pathway ("Smirnoff-Wheeler") of ascorbic acid biosynthesis has the L-galactono-1,4-lactone (L-GL) as the immediate precursor and other intermediate phosphorylated and nephosphorylated monosaccharides (Obaet al., 1995 Gatzek et al., 2002).

Mahendran și Bandara (2000), citați de R. Vijitha și S. Mahendran (2010) relatează că stresul de umiditate reduce conținutul de vitamina C din fructele de ardei.

Mahendran and Bandara (2000), cited by Vijitha and Mahendran (2010) reported that stress moisture reduces the C vitamin content of fruit pepper.

The cultivar x crop density interaction reveals two minimum variants (Brilliant F1 x 40 cm and Bianca F1 x 45 cm) with 121 mg / 100 g f.s. and one variant with the most pronounced ascorbic acid content - Export x 40 cm (152.67 mg / 100 g f.s.) (figure 5.)

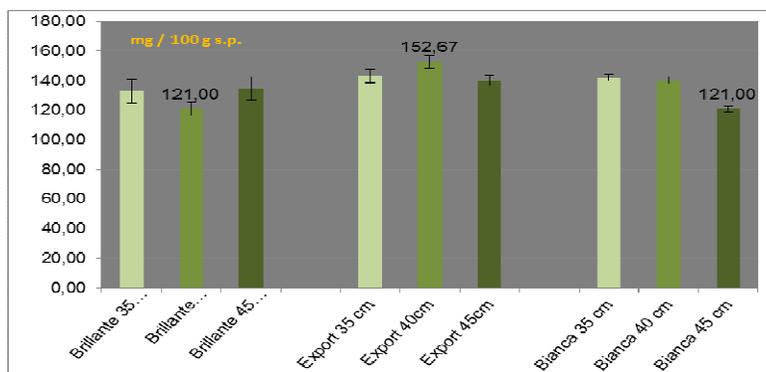


Fig. 5 - C vitamin content at sweet pepper

CONCLUSIONS

1. In general, the high content of protein is given by an increased activation of metabolic reactions and mechanisms for adaptation to different environmental conditions. From this perspective, we can consider that the distance of 40 cm is optimal for adaptation of pepper plant to polytunnel culture conditions.

2. Primarily, C vitamin content depends on the genotype, the planting distances having an secondary effect. The only qualitative indicators that allow the shaping of plant densities influence are the dry matter content and soluble solids content.

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