

Behaviour of some romanian genotypes of long peppers (*Capsicum
annuum* L., var. *longum* Irish) in protected cultureApostol D.F.^{1*}, Dinu Maria^{2*}, Giugea N²¹University of Craiova, Faculty of Horticulture, Doctoral School of Plant and Animal Resources Engineering, 13 A.I.Cuza Street, 200858, Craiova, Romania²University of Craiova, Faculty of Horticulture, Department of Horticulture and Food Science, 13 A.I.Cuza Street, 200858, Craiova, Romania

Abstract

The idea of this study started from the current growing practical need of truck farmers to grow long pepper varieties and hybrids in a protected and forced system. Varieties of foreign origin are generally used, in particular F1 hybrids, instead of Romanian autochthonous varieties. The assortment of peppers, var. *longum*, has improved substantially lately in our country, and a proof in this respect are the 6 varieties: Bogdan, Lung de Işalniţa, Lung românesc, Doljan, Cosmin and Fermier obtained at SCDL Işalniţa, SCDL Vidra and SC Mefim Agro SRL that are used in the present study. The observations and determinations showed that the Bogdan long pepper genotype, a semi-early variety, with large, yellowish green fruits at technical maturity, had a good behaviour in cold/unheated greenhouse culture, achieving a total production of 4.71 kg/pl. The late-maturing varieties also had a good behaviour such as Cosmin with 4.29 kg/pl and Fermier with 3.15 kg/pl. It was observed that the fruit length varied from 14.5 cm in Lung de Işalniţa to 18.7 cm in Lung Românesc and in terms of fruit diameter, this morphological characteristic varied from 3.6 cm in Lung Românesc to 7.2 cm in Fermier. Also, the Fermier genotype recorded an average number of fruits/plant of 18 while Lung Românesc recorded a number of 39 fruits/plant.

Introduction

The pepper is of great importance from an economic and food point of view due to the quality of its fruits, as well as the great diversity of cultivars and cultivated varieties, contributing to the consumption of fresh or preserved vegetables and also to crop rotation in vegetables. It is a species that fights well against diseases and pests in the biological system (Hoza et al., 2016; Caruso et al., 2016). The genetic variability is the most important condition in a horticultural plant cultivation program (Dinu et al., 2018). As a result, researching the genetic variation between genotypes is always very difficult, thorough and long-lasting. Due to the nutritional properties of this species, consumption has increased in recent decades and, therefore, researchers pay special attention to the creation of new varieties and hybrids. The studied 6 varieties are created in Romania, in the climatic conditions specific to our country, taking into account the consumer preferences. The present study aimed at observing their behaviour in the culture, in a cold greenhouse, focusing especially on the production characteristics due to the significant yield that can be obtained per unit area.

Material and method

Six genotypes of long pepper (*Capsicum annum* L.) var. *longum* originating in Romania were grown in a cold greenhouse in Şimnicu de Sus, Dolj County (south-western Romania) (44°24'23"N 23°48'09"E). These genotypes were cultivated in an experiment organized in randomized blocks, in three repetitions respecting the norms of the experimental technique (Săulescu et al., 1967; Ceapolu, 1968). The colour of the fruits as well as the earliness of the 6 genotypes of long peppers, i.e. Bogdan, Lung de Işalniţa, Lung Românesc, Doljan, Cosmin and Fermier are presented in table 1 and fig.1-6. The applied technology was the classical one for the pepper cultivation in greenhouses, the planting density being of 3-4 plants/m² (Indrea et al., 2007). During the vegetation period, observations and biometric determinations were made referring to fruit length, fruit diameter, average fruit weight and number of fruits per plant as well as to the total production, in order to establish the productive capacity of the studied genotypes. The recorded production data were statistically processed by analysis of variance and by the Duncan test, and the level of statistical significance was established using the limit difference (LD).

Results and discussions

- The observations and biometric determinations conducted in this study highlighted the main morphological characteristics of the fruits of the 6 Romanian long pepper genotypes studied in cold greenhouse cultivation conditions as well as the obtained production. The length of the fruit recorded high values in all 6 genotypes of the studied long pepper, average values of 14.5 cm being recorded in Lung de Işalniţa and 18.7 cm in Lung românesc, the Bogdan and Fermier varieties recording high values of 17.7 cm. It should be noted that this long pepper crop benefited from the classic cultivation technology, the authors wanting to highlight the good behaviour as well as the production obtained in this cropping system.
- The diameter of the fruit, measured at the base of the fruit, recorded average values ranging between 3.6 cm in the Lung de Işalniţa genotype and 7.2 cm in the Fermier genotype, a large diameter of the fruit, 5.5 cm, was also recorded in the Cosmin genotype.
- The shape index (SI = L/D) represented by the ratio between the length of the fruit and its diameter, had values ranging between 2.46 in the Fermier genotype and 4.16 in the Lung Românesc genotype. The very large diameter of the Fermier genotype and the value of the shape index of 2.46 indicate that this variety has a moderately triangular fruit in longitudinal section, while the value of the shape index of 4.16 in the Lung românesc genotype indicates the fact that the shape of the fruit in longitudinal section is narrowly triangular.
- The average weight of the fruit and the number of fruits per plant are characteristics that define the productive biological potential of a genotype.
- The average weight of the fruit, expressed in grams, recorded medium values in the Lung de Işalniţa (68 g), Lung românesc (72 g) and Doljan (73 g) genotypes and high values in the Cosmin (118 g), Bogdan (170 g) and Fermier (177 g) genotypes. These values demonstrate the stability of these genotypes in terms of this morphological element of the fruit. The applied technology as well as the environmental conditions did not greatly influence this characteristic given that the study was conducted in a greenhouse culture. The cited and presented results confirm that the climatic conditions strongly affect the morphological parameters of fruits in open field cultivation.
- The average number of fruits harvested per plant recorded high values, given that the genotypes of the studied long peppers recorded an indeterminate increase and the plants had 3 arms. The lowest average number of fruits per plant was recorded in the Fermier genotype (18), but it compensates with the high weight of the fruit, 177 g. The Lung românesc genotype recorded the highest number of fruits per plant, 39, but with an average weight of fruit of only 72 g (Table 1). There is a direct correlation between the average weight of the fruit and the average number of fruits per plant. Also, the average number of fruits / plant was very much influenced by the number of remaining arms/plant. Three arms for this cropping system are many because the plants grow a lot in height and provide shade, thus causing the premature fruit drop.

Table 1
The main morphological characteristics of
long pepper fruits (average values)

Genotype	The length of the fruit (cm)	Fruit diameter (cm)	SI (L/D)	Fruit weight (g)	Number of fruits / plant
Bogdan	17.7	4.8	3.69	170	28
Lung de Işalniţa	14.5	3.6	4.03	68	33
Lung Românesc	18.7	4.5	4.16	72	39
Doljan	17.5	4.3	4.07	73	27
Cosmin	16.6	5.5	3.02	118	38
Fermier	17.7	7.2	2.46	177	18

- The statistical analysis of production data highlights the biological potential of long pepper genotypes studied in cold greenhouse conditions (Table 2). The comparison of the average productions was done according to the average number of the variants. The calculation and expression of the absolute average production was done in kg / plant.
- The absolute average yields recorded in the studied long pepper genotypes were between 1.97 kg/plant in Doljan and 4.71 kg/plant in Bogdan. The Cosmin genotype recorded a total average production above the average number of the variants (4.29 kg / plant). The difference of the total average productions of the two cultivars compared to the average number of the variants is quite large, of +1.56 kg/plant in Bogdan and +1.14 kg/plant in Cosmin. The differences are statistically significant, being positive. The production from the Fermier genotype is below the average number of the variants (3.15 kg/plant), the difference being very small, of -0.04 kg/plant, which is not statistically significant. It turns out that the best results were recorded by the Bogdan genotype, a semi-early variety and by the Cosmin genotype, which is a late variety.
- The analysis of multiple comparisons (Duncan test) of long pepper genotypes shows that there are significant differences between most genotypes (Table 3). The best genotypes are Bogdan and Cosmin, with the most significant differences.

Table 2 - The total average production of long pepper varieties

No.	GENOTYPE	X	THE DIFFERENCE FROM THE VARIANT ON THE POSITION
			2 3 4 5 6
1.	BOGDAN	4.71	0.42* 1.56* 1.92* 2.5* 2.74*
2.	COSMIN	4.29	- 1.14* 1.58* 2.08* 2.32*
3.	FERMIER	3.15	- - 0.36* 0.94* 1.18*
4.	LUNG ROMÂNESC	2.79	- - - 0.58* 0.82*
5.	LUNG DE IŞALNIŢA	2.21	- - - - 0.24
6.	DOLJAN	1.97	- - - - -

Table 3 - The multiple comparisons (Duncan test) of total average yields recorded by the long pepper varieties

Genotype	Total average production	The average difference (± kg / pl)	Significance of differences
	Absolute (kg/pl)	Relative (%)	
BOGDAN	4.71	147.6	***
COSMIN	4.29	134.5	***
FERMIER	3.15	100	-
LUNG ROMÂNESC	3.15	98.7	-0.04
LUNG DE IŞALNIŢA	2.79	87.5	-0.4
DOLJAN	2.21	69.3	-0.98
	1.97	61.8	-1.22

Conclusions

The comparative study of some Romanian long pepper genotypes, grown in protected culture in cold greenhouse, highlighted the suitability of some of them for this culture system. In terms of the average weight of the fruit, the Cosmin genotypes recorded 118 g/fruit, Bogdan recorded 170 g/fruit and Fermier recorded 177 g/fruit. The total production per plant recorded high values in the Fermier varieties with 3.15 kg/pl, in Cosmin with 4.29 kg/pl and in Bogdan with 4.71 kg/pl. It should be noted that the Bogdan genotype is semi-early and the green-yellow colour of the fruit at technological maturity, is an asset for this culture system. Also, the tradition of the Romanian people to preserve the long pepper by pickling recommends the studied genotypes for this use as well. Our study on the assortment of long peppers grown in cold greenhouse in the climatic conditions of our country presents the selection of the most valuable genotypes suitable for different uses and commercialization.