

The Influence of some Technological Factors upon the Yield of Cucumbers, Cultivated in Polyethylene Tunnels in Ecological System

**Alexandru Silviu APAHIDEAN¹⁾, Mariana BEI²⁾, Mihai CĂRBURAR²⁾,
Maria APAHIDEAN¹⁾, Alexandru Ioan APAHIDEAN¹⁾, Eniko LACZI¹⁾**

¹⁾University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture, 3-5 Mănăştur Street, Cluj-Napoca, 400372, România; sapahidean@gmail.com

²⁾University of Oradea, Universităţii Street, No. 1, Oradea, România

Abstract. Lately can be observed that the organic agricultural system is more and more developed not only in our country, but all over the world, having a continuous ascending, in parallel with the formation of a specific market. In some countries, this organic (biological or ecological) agricultural system, had known a considerable growth of more than 20% in only one year (in USA, France and Japan). From farmers point of view the organic production represents a better way of capitalization, while the vegetables obtained using this system are more and more consumed raw or slightly processed, and have a high attraction for a specific segment of consumers which is becoming more and more consolidated. The experimental factors of this research were: the planting density (64.4 thousand plants/ha, 44.4 thousand plants/ha and 33.3 thousand plants/ha) and the hybrid (Szatmar, Crispina, Pasalimo and Mirabelle). The research was conducted in the west part of our country, respectively in Husasău de Tinca locality, during 2007-2009.

Keywords: cucumbers, polyethylene tunnels, organic culture system, planting density, variety.

INTRODUCTION

Cucumber is one of those vegetable plants which is cultivated all year round, in greenhouses, polyethylene tunnels and in open field to, because of the high request of the consumers and also because a large part of the production is used mostly for preservation. Unlike other vegetables, cucumber has a lower nutritive value (19 calories in 100 g fresh matter of cucumber), with a low content of dry matter, only 4-6% (Ciofu *et al.* 2004; Pošta and Berar, 2008,). It can be consumed fresh or pickled, having some favorable effects in treating of some diseases or even in prevention of those, it can be used in cosmetics or in the pharmaceutical industry (Valnet, 1986).

Regarding vegetables growing, in the last few years, it can be observed the farmers orientation to less polluting technologies, respectively to organic cultures, which allows the obtaining of more healthy products due to elimination of the synthetic products from the culture technique.

Because vegetables are consumed mostly raw, some special measures are required in prevention and control of the pollution (Tuzel, *et al.*, 2005; Indrea *et al.*, 2007). In organic cultures, soil mulching with polyethylene film or straw, has a favorable effect upon the quantity and quality of the yield (Kirnak and Demirtas, 2006). A limitative factor of cucumber production is represented by ensuring an adequate quantity of water during the growing season of this vegetable (Nimah, 2007). Thereby, Jenny *et al.*, 2007, had noticed that in drought years, even in the wet climates, fertilization with nitrogen, gave favorable results only in case of irrigated cultures.

MATERIALS AND METHODS

The research took place during 2007-2009, in Husasău de Tinca locality from Bihor County, in a private farm.

The main purpose of the experiment was represented by the introduction in the culture technology of some new intensification elements, which would allow the obtaining of some profitable productions from economical point of view. The objectives were the determination of plants growth and fructification (stem length, number and length of stems of first and second order, number of formed fruits, harvesting dynamics and the quantitative and qualitative yield).

A bifactorial experiment was organized, which involved the following factors:

- Factor A – plants density (distance between plants on row), with 3 graduations – 64.4 thousand plants/ha (20 cm), 44.4 thousand plants/ha (30 cm) and 33.3 thousand plants/ha (40 cm).
- Factor B – the hybrid, with 4 graduations: hybrids Szatmar, Crispina, Pasalimo and Mirabelle.

By these factors combination 12 experimental variants resulted, which were placed according to the experimental technique, in an autumn culture (due to the higher demand for cornichon cucumbers in this period).

In the experimental field was applied the specific technology for organic cultures, therefore for the main fertilization was applied manure, 70 t/ha, 15 days after plants emergence, a new fertilization was made with Agriful, 4 l/ha, which was repeated at 30 days respectively at 45 days after plants rising. At the beginning of flowering poultry manure maceration was administrated (which was decomposed in water, for 5 weeks, the used dilution being 1:9). This fertilization was repeated after 3 weeks. Other 6 fertilizations were made with Tecamin-Max, from 15 to 15 days, first being made at the beginning of flowering.

For plants protection prevention methods were used, so repeated treatments were made every 10 days, with nettle and horsetail maceration, alternatively. When the aphids appeared, in the second half of August, also their natural predators, ants and ladybugs had appeared and kept the aphids population under control, until the end of vegetation period, when a new treatment (with maceration of tomato scion) was made.

The harvesting started in the second decade of July and lasted until the beginning of October.

RESULTS AND DISCUSSION

During 2007-2009, the total yield of cucumber cultivated in polyethylene tunnels, in organic system, was influenced by the studied factors.

The planting density is one of the factors which have an influence upon the total yield of cucumbers. Thereby from data presented in table 1 it can be observed that the production was higher at variants with a density of 33.3 thousand plants/ha (4.51 kg/m²), followed by that with 44.4 thousand plants/ha (4.23 kg/m²). In case of organic system, the increase of plants density was not in favour of a higher production per unit surface, while at summer production this increase had a favourable effect on yield.

At maximum density of 64.4 thousand plants/ha a very significant negative difference of yield compared to the witness variant was registered (Fig. 1).

Tab. 1

Unilateral influence of plants density upon total yield at polyethylene tunnel cucumbers
Husasău-Tinca, 2007-2009

Variant Plants density	Yield		Diference (kg/m ²)	Significance
	kg/m ²	%		
33.3 thousand plants/ha – Control	4.51	100.0	0.00	-
64.4 thousand plants/ha	3.31	73.5	-1.20	000
44.4 thousand plants/ha	4.23	93.8	-0.28	0
LSD (p 5%)				0.18
LSD (p 1%)				0.29
LSD (p 0.1%)				0.56

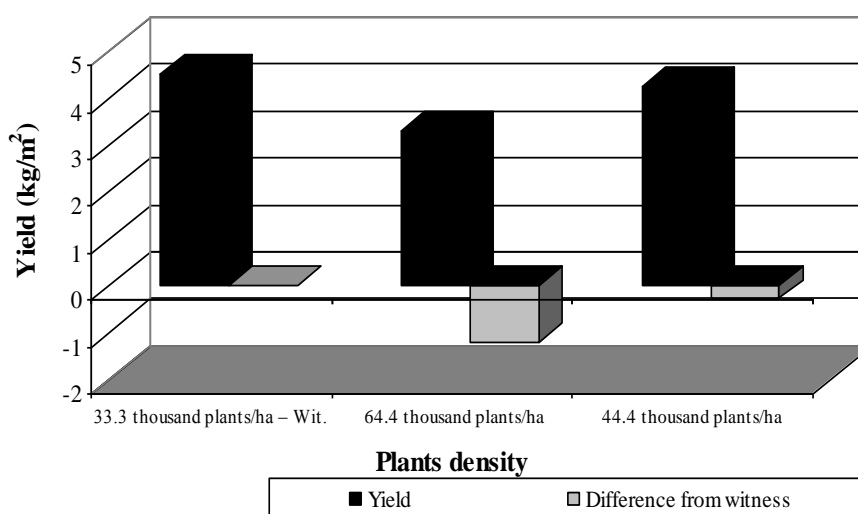


Fig. 1. Unilateral influence of plants density upon total yield at polyethylene tunnel cucumbers
Husasău-Tinca, 2007-2009

According to the used cultivar, total yield varied between 63 kg/m² and 4.33 kg/m² (Fig. 2). Yields were higher at Szatmar hybrid, followed by Mirabelle hybrid, the differences in production compared with Crispina being distinct significant positives (Tab. 2).

Tab. 2

Unilateral influence of the cultivar upon the total yield at polyethylene tunnel cucumbers
Husasău-Tinca, 2007-2009

Variant Hybrid	Yield		Difference (kg/m ²)	Significance
	kg/m ²	%		
Crispina – Control	3.63	100.0	0.00	-
Szatmar	4.33	119.3	0.70	**
Pasalimo	3.80	104.7	0.17	-
Mirabelle	4.32	119.2	0.69	**
LSD (p 5%)				0.18
LSD (p 1%)				0.34
LSD (p 0.1%)				0.71

From the data presented in table 3, it can be noticed that the total yield of cucumbers cultivated in polyethylene tunnels varied from one hybrid to other, but it depended on plants density on surface unit. At maximum density of 64.4 thousand plants/ha, the realised

production of the 4 hybrids varied between 3.16 kg/m² and 3.56 kg/m², at the density of 44.4 thousand plants/ha the obtained yield ranged from 3.21 to 4.89 kg/m², while at the density of 33.3 thousand plants/ha from 4.29 and 4.76 kg/m². The highest production, between the four hybrids, was obtained at the following hybrids, Mirabelle and Szatmar, especially at the density of 44.4 thousand plants/ha.

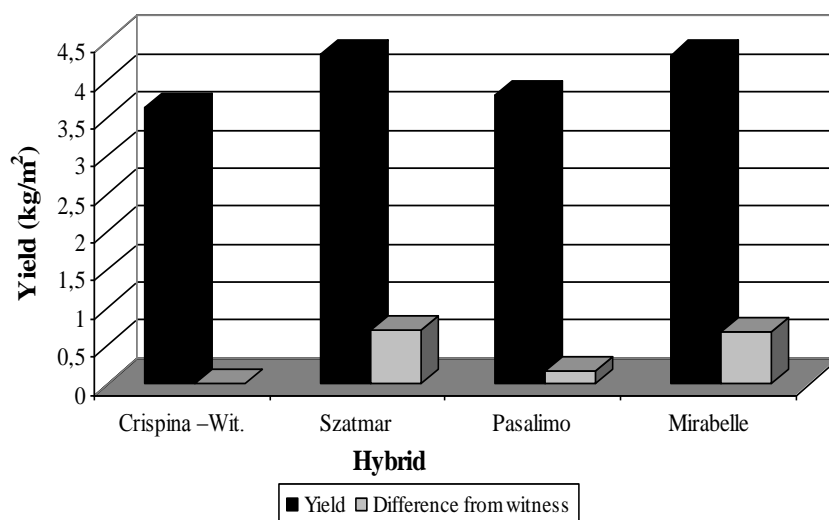


Fig. 2. Unilateral influence of the cultivar upon the total yield at polyethylene tunnel cucumbers Husasău-Tinca, 2007-2009

Tab. 3

Combined influence of hybrid and plants density upon the total yield at polyethylene tunnel cucumbers – Husasău-Tinca, 2007-2009

Variant		Yield		Difference(kg /m ²)	Significance
Hybrid	Plants density (thousand plants/ha)	kg/m ²	%		
Crispina	64.4 control	3.19	100.0	0.00	-
Szatmar	64.4	3.56	111.6	0.37	*
Pasalimo	64.4	3.16	99.1	-0.03	-
Mirabelle	64.4	3.34	104.6	0.15	-
Crispina	44.4 control	3.21	100.0	0.00	-
Szatmar	44.4	4.89	152.2	1.68	***
Pasalimo	44.4	3.95	122.8	0.73	**
Mirabelle	44.4	4.87	151.7	1.66	***
Crispina	33.3 control	4.47	100.0	0.00	-
Szatmar	33.3	4.52	101.1	0.05	-
Pasalimo	33.3	4.29	95.8	-0.19	-
Mirabelle	33.3	4.76	106.3	0.28	*
LSD (p 5%)				0.22	
LSD (p 1%)				0.41	
LSD (p 0.1%)				0.74	

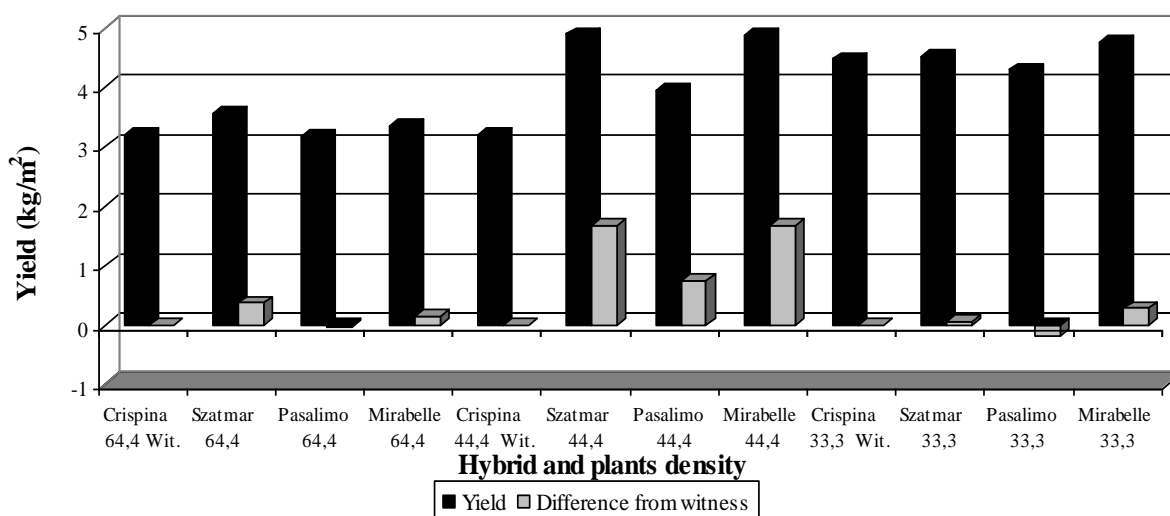


Fig. 3. Combined influence of hybrid and plants density upon the total yield at polyethylene tunnel cucumbers – Husasău-Tinca, 2007-2009

Regarding the combined influence of planting density and hybrid, it can be noticed from data presented in table 4, that the total yield was higher at the density of 33.3 thousand plants/ha (Crispina and Pasalimo) respectively at 44.4 thousand plants/ha (Szatmar and Mirabelle) (Fig. 4). The increasing of plants density to 64.4 thousand plants/ha, leads until the end of harvesting period, to a significant decrease of yield at all hybrids, the difference being very significant negative.

Tab. 4

Combined influence of planting density and hybrid upon the total yield at polyethylene tunnel cucumbers - Husasău-Tinca, 2007-2009

Variant		Yield		Difference (kg/m ²)	Significance
Plants density thousand plants/ha	Hybrid	kg/m ²	%		
33.	Szatmar - control	4.52	100.0	0.00	-
64.4	Szatmar	3.56	78.8	-0.96	000
44.4	Szatma	4.89	108.1	0.37	*
33.3	Crispina - control	4.47	100.0	0.00	-
64.4	Crispina	3.19	71.4	-1.28	000
44.4	Crispina	3.21	71.8	-1.26	000
33.3	Pasalimo - control	4.29	100.0	0.00	-
64.4	Pasalimo	3.16	73.8	-1.12	000
44.4	Pasalimo	3.95	92.1	-0.39	0
33.3	Mirabelle - control	4.76	100.0	0.00	-
64.4	Mirabelle	3.34	70.2	-1.42	000
44.4	Mirabelle	4.87	102.5	0.12	-

LSD (p 5%)

LSD (p 1%)

LSD (p 0.1%)

0.18

0.40

0.73

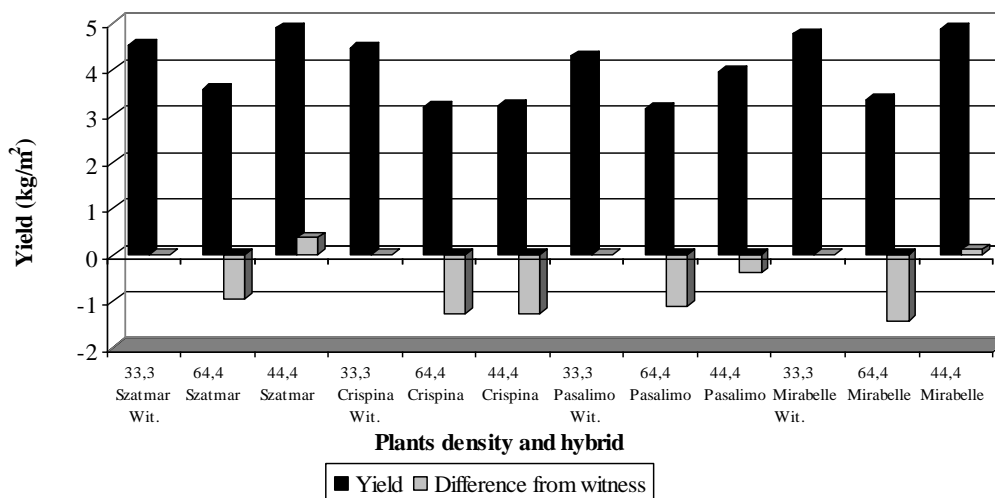


Fig.3. Combined influence of planting density and hybrid upon the total yield at polyethylene tunnel cucumbers - Husasău-Tinca, 2007-2009

CONCLUSIONS

In this organic culture, the harvest started in the second decade of July in all variants and in all three years of research, an exception being registered at Crispina hybrid at density of 64.4 thousand plants/ha, which for the harvest started in the third decade of the same month.

In all three experimental years (2007-2009), in organic culture, the maximum production was realized at variants cultivated at a density of 44.4 thousand plants/ha at Szatmar and Mirabelle hybrids. The highest yields in August and September in 2007, were obtained at Mirabelle hybrid, which was cultivated at a density of 33.3 thousand plants/ha, followed closely by Szatmar hybrid, cultivated at 44.4 thousand plants/ha, with a difference of only 0.01 kg/m², in 2008 by Szatmar and Mirabelle hybrids (at a density of 44.4 thousand plants/ha) and in 2009 by Szatmar hybrid, cultivated at a density of 44.4 thousand plants/ha, followed by hybrid Mirabelle.

The maximum volume of the production was realized at variants which were cultivated at a density of 44.4 thousand plants/ha, while the highest production from August and September was obtained at variants with 44.4 thousand plants/ha planting density and when Szatmar and Mirabelle hybrids were used.

The average dynamics of cucumber cultivation in polyethylene tunnel and organic system reveals the higher yield at Mirabelle and Szatmar hybrids, cultivated at a planting density of 44.4 thousand plants/ha.

REFERENCES

1. Ciofu, R., N. Stan, V. Popescu, C. Pelaghia., S. Apahidean, A. Horgos, V. Berar, K. F. Lauen and N. Atanasiu (2004). *Tratat de legumicultură*. Ed. Ceres. București.
2. Indrea, D., S. Apahidean, M. Apahidean, D. Măniuțiu and R. Sima (2007). *Cultura legumelor*. Ed. Ceres. București.
3. Kirnak, H. and M. N. Demirtas (2006). Effects of different irrigation regimes and mulches on yield and macronutrition levels of drip-irrigated cucumber under open field conditions. *Journal of Plant Nutrition*. 29(9):1675-1690.

4. Jenny, S., D. Rekika and K. A. Steward (2007). Yield, quality and revenue of pickling cucumbers with irrigation and supplemental N fertilizer under a humid climate. *Canadian Journal of Plant Science*. 87(3):571-580.
5. Nimah, M. N. (2007). Cucumber yield under regular deficit irrigation and mulching treatments. *Acta Horticulturae*. 731:189-194.
6. Poșta, G. and V. Berar (2008). *Legumicultură generală, Indrumător de lucrări practice*. Ed. Mirton. Timișoara.
7. Tuzel, Y., A. Gul, O. Tuncay, D. Anac, N. Madanlar, Z. Yoldas, M. Gumus, I. H. Tuzel and S. Enindeniz (2005). Organic cucumber production in the greenhouse: A case study from Turkey, *Renewable Agriculture and Food System*. 20(4):206-213.
8. Valnet, J. (1986). *Tratamentul bolilor prin legume, fructe și cereale*. Ed. Ceres. București.