EARLY AND TOTAL YIELD OF GREENHOUSE CYCLE I TOMATO HYBRIDS IN SOILLESS CULTURE

PRODUCȚIA TIMPURIE ŞI TOTALĂ A HIBRIZILOR DE SERĂ CICLUL I CULTIVAȚI ÎN SISTEME FĂRĂ SOL

CENARIU DIANA, APAHIDEAN AL.S., APAHIDEAN MARIA, SIMA RODICA
University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca

Abstract. *Tomatoes are the main vegetable crop cultivated in greenhouses as a result of the continuous demand that exists on the market for consuming both fresh and processed tomatoes all over the year. Besides from cultivating them in the greenhouse soil, tomatoes are being cultivated in soilless systems. The cultivation system of tomatoes in polyethylene bags started some years ago, in 1989 in the greenhouses belonging to USAMV and was prooved to be superior to the old cultivation system (directly in the greenhouse soil). This soilless system was improoved all over the years: different substrate's composition and volume, plant density and hybrids used. Early and total yield for the year 2007 varies from 9.16 kg/m^2 to 12.88 kg/m^2 both for the two culture systems and the fertilization method used.*

Rezumat. *Tomatele se situează pe primul loc între plantele legumicole cultivate în sere, datorită cerințelor permanente existente atât pentru consumul în stare proaspătă cât şi prelucrate industrial (pastă, ketchup, bulion, etc) pe parcursul întregului an. Pe lângă cultivarea acestora direct în solul serei, a fost implementat şi noul sistem de cultivare în culturi fără sol. Sistemul de cultură pe substrat organic al tomatelor de seră în pungi din folie de polietilenă a fost experimentat şi în serele USAMV din 1989 şi dovedindu-se a fi un sistem de cultură superior celui în solul serei a fost practicat an de an până în prezent. Pe parcursul acestor ani, acest sistem de cultură a fost permanent îmbunătățit, atât în ceea ce priveşte compoziția şi volumul substratului, a densității plantelor cât şi a hibrizilor folosiți. Producțiile timpurii şi totale obținute variază în funcție de sistemul de cultură şi de tipul de fertilizare aplicat de la 9.16 kg/m^2 până la 12.88 kg/m^2.*

Tomatoes are the main vegetable crop cultivated in greenhouses, being highly requested all around the year. The producers try to find ways of satisfying this need by starting an early harvest, from April until late autumn.

The present research offers an alternative by cultivating the tomato plants in polyethylene bags, on organic substratum instead of directly in the greenhouse soil by using a special mixture: peat 80%+ long duration follow soil and well-decomposed manure 20% at least 8 l substrate/plant.

The development, fructification and yield of the tomatoes were registered periodically from April until July when the tomato culture ended. Foliar and root fertilizations (Ferticare NPK 10:5:26, each 10 days) were applied and all the specific maintenance works were performed on a regular basis in order for the culture to be successful and the tomato plants free from diseases and pests.

MATERIAL AND METHOD

The experimental field was set up in the greenhouse of the vegetable growing sector of the Faculty of Horticulture. The experiment is poly-factorial with four experimental factors, each with two graduations:

F1: the hybrid — a. Cronos F_1; b. Menhir F_1

F2: the culture system — a. in the greenhouse soil; b. in polyethylene bags on organic substratum

F3: the basic fertilization — a. simple doses; b. double doses

F4: the supplementary fertilization — a. root; b. root + foliar

From the combination of the four factors a number of 16 experimental variants resulted, placed in 3 repetitions. The tomato seedlings were planted in 10.02.07 at the density of 80/40 cm with 31.200 plants/ha in experimental variants of 9 m^2 each.

The tomato fruits were harvested starting with 23.04.07 until 15.07.07. The early yield was calculated from 23.04.07 to 31.05.07, while the total yield was considered until 15.07.07 when the final crop was ingathered.

RESULTS AND DISCUSSIONS

The results obtained are presented both for the early and total yield. The influence of the different factors as well as their combined influence had been studied.

Comparing the two culture systems: in the greenhouse soil and in polyethylene bags, the outcome is very favorable for the plants grown in PE peat bags, which had registered a much better production: 4.87 Kg/m^2 in PE bags for early yield and 12.32 Kg/m^2 for total yield, compared to 3.35 Kg/m^2 and 10.07 Kg/m^2 for soil culture (Table 1).

Table 1

The influence of the culture system on early and total yield

The culture system	Early Yield				Total yield			
	Kg/m^2	%	Differ.	Signific.	Kg/m^2	%	Differ.	Signific.
soil	3.35	100	+ 0.00	-	10.07	100	+0.00	-
PE bags	4.87	145.3	+ 1.52	xx	12.32	122.4	+2.25	x

DL (p 5%)	+ 0,63	DL (p 5%)	+ 0,99
DL (p 1%)	+ 1.45	DL (p 1%)	+ 0,29
DL (p 0,1%)	+ 4.63	DL (p 0,1%)	+ 7.30

Comparing the behavior of the two hybrids with the control (Cronos cultivated in the greenhouse soil), the differences are significant positive for the variants cultivated in the PE bags, both for early and total yield (Table 2).

Table 2

The combined influence of the culture system and of the hybrid on yield

Culture system	Hybrid	Early yield				Total yield			
		Kg/m^2	%	D	S	Kg/m^2	%	D	S
soil	Cronos	3.13	100	+ 0.00	-	9.57	100	+ 0.00	C
PE bags	Cronos	4.57	145	+ 1.44	x	12.02	125	+ 2.46	x
soil	Menhir	3.57	114	+ 0.44	-	10.57	110	+ 1.00	-
PE bags	Menhir	5.18	165	+ 2.05	xx	12.61	131	+ 3.04	x

DL (p 5%)	+ 0.89	DL (p 5%)	+ 1.41
DL (p 1%)	+ 2.05	DL (p 1%)	+ 3.25
DL (p 0,1%)	+ 6.54	DL (p 0,1%)	+ 10.33

D= difference
S= significance
C= control

In the next table (Table 3) a significant positive difference can be noticed for the plants grown in soiless culture, with an increase up to 1.86 kg/m^2 for early yield and 2.43 kg/m^2 for total yield, after using the two supplementary fertilization methods (root and root + foliar), among which the best results are those of the tomato plants grown in PE bags.

Table 3

The combined influence of the culture system and of the supplementary fertilization on yield

Culture system	Supplem. fertilization	Early yield				Total yield			
		Kg/m^2	%	D	S	Kg/m^2	%	D	S
soil	root	3.18	100.0	+ 0.00	-	9.67	100.0	+0.00	C
PE bags	root	4.71	147.8	+ 1.52	xx	12.10	125.2	+2.43	xx
soil	root+foliar	3.52	110.7	+ 0.34	-	10.47	108.3	+ 0.8	-
PE bags	root+foliar	5.04	158.5	+ 1.86	xx	11.80	122	+ 2.13	xx

DL (p 5%)	+ 0.67	DL (p 5%)	+ 1.00
DL (p 1%)	+ 1.38	DL (p 1%)	+ 2.12
DL (p 0,1%)	+ 3.90	DL (p 0,1%)	+ 6.91

D= difference
S= significance
C= control

Analyzing the combined influence of the three factors (culture system, hybrid and supplementary fertilization) on the tomato yield (Table 4), a positive significant difference is registered for the two hybrids when cultivated in polyethylene bags with 4.40 Kg/m^2 for early yields and 11.86 Kg/m^2 for total yields in contrast with soil crops of 2.97 Kg/m^2 (early) and 9.16 Kg/m^2 (total yield). It can be concluded that the main influence on the total yield is conferred by the culture system, especially the soiless culture.

Compared to the controlled variant: Cronos cultivated in soil and root fertilized, all the others variants registered higher yields, as a result of being grown in PE bags, both root and foliar fertilized, especially Menhir with 5.35 Kg/m^2 for early yield and 12.88 Kg/m^2 for total yield (Table 4).

Table 4

The combined influence of the culture system, hybrid and supplementary fertilization on yield

Culture system	Hybrid	Suppl. fertiliz.	Early yield				Total yield			
			Kg/m^2	%	D	S	Kg/m^2	%	D	S
soil	Cronos	root	2.97	100.0	+ 0.00	-	9.16	100.0	+0.00	C
PE bag	Cronos	root+foliar	4.40	148.2	+ 1.37	x	11.86	123.1	+2.24	x
soil	Cronos	root	3.29	110.8	+ 0.32	-	9.97	108.8	+0.81	-
PE bag	Cronos	root+foliar	4.74	159.6	+ 1.77	x	12.19	133	+ 3.03	x
soil	Menhir	root	3.40	114.5	+ 0.43	-	10.17	111	+ 1.01	-
PE bag	Menhir	root+foliar	5.01	169	+ 2.04	xx	12.34	134.7	+ 3.19	xx
soil	Menhir	root	3.75	126.3	+ 0.78	-	10.96	119.6	+ 1.80	x
PE bag	Menhir	root+foliar	5.35	180.1	+ 2.38	xx	12.88	140.6	+ 3.72	xx

DL (p 5%)	+ 0.95	DL (p 5%)	+ 1.42
DL (p 1%)	+ 1.95	DL (p 1%)	+ 3.17
DL (p 0,1%)	+ 5.51	DL (p 0,1%)	+ 9.77

D= difference
S= significance
C= control

CONCLUSIONS

1. Analyzing the two culture systems: in the greenhouse soil and in polyethylene bags on organic substratum, it can be concluded that the best yields were obtained at the tomatoes grown in soiless culture.

2. Both hybrids (Cronos and Menhir) had the best behavior when cultivated in polyethylene bags, on organic substratum and root + foliar fertilized, with early yields up to 5.35 Kg/m^2 and total yields of 12.88 Kg/m^2.

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