

RESULTS CONCERNING THE EFFECT OF FOLIAR FERTILIZERS AND GROWTH PROMOTERS TREATMENTS ON PRODUCTION AND QUALITY OF TOMATO FRUITS

Jeni Gianina VOICU (SIMION)

University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Marasti Avenue, postcode 011464, Bucharest, Romania

Corresponding author email: gianina.simion@yahoo.com

Abstract

The work presents results obtained in protected culture of tomatoes under different treatments with foliar fertilizers (Folimax, Agriphyte) and ecological growth promoter P& R. It was taken in experience hybrid Balkan F₁ and variety Ghittia. The foliar fertilizers and growth promoters treatments has good influence on production and quality of tomato fruits. If the best at production was the hybrid Balkan F₁, the variety Ghittia was the best at quality. The biggest production was obtained by the hybrid Balkan F₁ treated with Agriphyte (69.626 t/ha) and the smallest one it was the variety Ghittia untreated – control (48.865 t/ha). The biggest content of vitamin C was registered at Ghittia variety in the case of P& R treatment (21.52 mg/100g and the biggest content of lycopene was registered at hybrid Balkan F₁ for Agriphyte treatment (69.39 ppm). The content of soluble carbohydrates was almost constant and has slightly varied at around 4.8%.

Key words: Agriphyte, Folimax, P&R, quality, production.

INTRODUCTION

Because of the big request for consumption, tomatoes are the most cultivated vegetable species on protected crops from Romania.

The benefits of this culture system are: possibility to obtain of sorts of vegetables according to the request of the market; earliness; good prices; possibility to obtain tomatoes almost all year; big productions/ha (Voican and Lacatus, 2002).

For obtaining good productions with maximum economic efficiency it needs to practice some technologies in which stimulating of growth and development of plants, fertilization and pest control are the most important works.

In the production technologies can be used different fertilizers, growth promoters and foliar fertilizers.

Researches on use of fertilizers in protected crops shows that use of foliar fertilizers has very good effects in vegetable crops in all growth and development phases (Davidescu and Davidescu, 2000; Lacatus, et al., 2005).

Foliar fertilization is very used in vegetable protected crops and it has some advantages like: use of reduced concentration of mineral elements, easier application simultaneously

with pesticides and rapid correction of nutritional deficiency (Voican and Lacatus, 2002).

Between foliar fertilizers, the literature mentions foliar fertilizers type F (231; 141; 411), the product Cropmax (Ciofu, et al., 2004), liquid foliar fertilizer Folimax (Lacatus, 2006).

The growth promoters are used for the regulation of the processes of growth and development of plants especially when the microclimate conditions are not favorable.

Many authors recommended that the treatments must be applied when the flowers are completely opened with a solution of Tomatset, Tomafix, Duraset, or Tomato-stim.

The paper presents partial results regarding the influence of the treatments with growth promoters and foliar fertilizers on growth, development and production of tomatoes for protected crops.

MATERIALS AND METHODS

The main objective of the research has been determining the optimal variant of stimulation and foliar fertilization of tomatoes in protected crops in order to obtain early production of

good quality fruits. Experience has been carried out in 2012 in Poiana, Ialomita county in high tunnel of 1000 m².

The experiment has been carried out in random blocks in three repetitions and experimental variants consist of three products: two foliar fertilizers and one growth promoter, which were compared with the control (Table 1).

Table 1. Experimental variants – variety Ghittia /hybrid Balkan-2012

Variants/ treatments	Specification
V1 Control (untreated)	-
V2 Folimax- 0.3%	Foliar fertilizer with microelements; ensure steady growth, disease resistance, increase the number of fruits and production.
V3 Agriphyte- 0.3%	Foliar fertilizer with 33% phosphorus, and 28% potassium; secondary has systemic fungicide properties.
V4 P& R- 0.5%	Organic product with role of protection and recovery of the plants from damage caused by extreme temperatures or diseases; help to a better use of the nutrients in different types of soils; increase the assimilation of some nutrients (Fe, Zn, Mn, B, Cu); may be used together with protective agents for plants (herbicides, insecticides, fungicides).

Biological material has been represented by variety Ghittia and hybrid Balkan F₁.

Ghittia: late tomatoes indefinite, the plants are vigorous, fruits are round flattened with 4-6 seeds lodge, uniform, of 250-300g weight and 4-5 fruit in a cluster, fruits are resistant to cracking, with good firmness. Recommended for cultivation in plastic tunnels and field.

Balkan: early tomatoes, semi-determined growth. The fruits are rounded, uniform, of 100-120g weight, 6 fruit in a cluster. Recommended for cultivation in plastic tunnels and field.

The technology used in the experiences was selected from the literature for tomatoes (Ciofu et al., 2004).

Under climatic conditions of the year 2012, the culture has been established by planting of seedling on 25 of the April. The seedling was by 53 days old, 20-22 cm height, 4-5 mm thickness of stem, 5-6 leaves and it has first inflorescence. The density used was 36.000 plants/ha. Care work consisted in watering, hoeing, weeding, removing of early shoots whenever is necessary, sustaining plants on

strings, wire tapping for stimulation of pollination, pest and diseases control. It has been applied fertilization with different fertilizers (Folimax, Agriphyte) and growth promoter (P& R), depending on experimental variants, at two weeks and one month from planting.

Harvesting was done from the second decade of the July, by variants.

During the experimentation period has been carried out observations, measurements and determinations, which were used specific working methods namely:

Phenological determinations: sowing date, date of emerging, date of planting, date of flowering and date of harvest.

Production potential was determined by recording the number of fruits/plant, average mass of fruits and by calculation of the average production/plant and ha, for each variant studied. The fruits were harvested by quality classes according to the average weight of fruits as follows:

-extra-greater than 80 g;

-I-60-80 g;

-II-40-60 g;

-understas-less than 40 g.

The results were interpreted statistically by analysis of variance-Student test (Ardelean, et al., 2007).

Laboratory analysis at tomato fruits:

-biochemical analysis: vitamin C content (mg/100 fresh product), soluble carbohydrates (%), acidity (%), lycopene (ppm). Were harvested fruit samples for biochemical analysis of three different harvests and results are average of these samples.

RESULTS AND DISCUSSIONS

From the analysis of the results it can be observed that, regardless of treatment, the productions were superior to the untreated control (Table 2, Figure 1 and 2). Regardless of the variety the greatest production was obtained when applying foliar fertilization with Agriphyte (66.957 t/ha for Ghittia variety, respectively Balkan F₁ hybrid 69.626 t/ha). The largest share of total production was at quality I. It can also notice a higher share of quality extra in the case of Ghittia variety for Agriphyte treatment (40%).

Table 2. The production obtained at tomato experiment and the distribution on qualities Poiana, Ialomita county, 2012

HYBRID / VARIETY	VARIANT	QUALITY										TOTAL t/ha
		EXTRA		I		II		TOTAL STAS		UNDERSTAS		
		t/ha	%	t/ha	%	t/ha	%	t/ha	%	t/ha	%	
GHITTIA	Control	18.000	37	19.965	41	9.000	18	46.965	96	1.900	4	48.865
	Folimax	23.900	37	27.900	43	9.850	15	61.650	96	2.560	4	64.210
	Agriphyte	26.900	40	27.400	41	10.500	16	64.800	97	2.157	3	66.957
	P & R	22.350	38	23.920	41	10.100	17	56.370	95	2.650	5	59.020
BALKAN F ₁	Control	18.570	34	18.471	34	16.005	29	53.046	96	1.955	4	55.001
	Folimax	21.924	33	25.932	39	15.920	24	63.776	96	2.600	4	66.376
	Agriphyte	23.410	34	26.920	39	17.015	24	67.345	97	2.281	3	69.626
	P & R	20.499	32	22.943	36	17.284	27	60.726	96	2.775	4	63.501

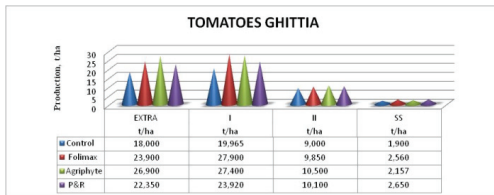


Figure 1. The production obtained at Ghittia variety and the distribution of it on qualities

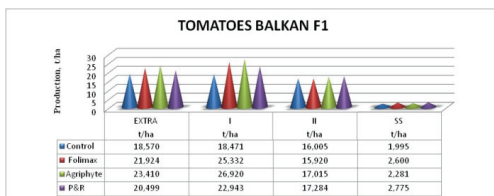


Figure 2. The production obtained at hybrid Balkan F₁ and the distribution of it on qualities

Taking into account the influence of variety/hybrid on the production of tomato (Table 3) it can be seen that the hybrid Balkan F₁ has made a significantly distinct difference production (3.863 t/ha) than Ghittia variety.

Table 3. The influence of variety on tomatoes production

Variant (variety/hybrid)	Average production, (t/ha)	%	Differences (t/ha)	Significance
A1 Ghittia	59.763	100	-	
A2 Balkan F ₁	63.626	106	3.863	**
DL 5% 1.5423				
DL 1% 3.57957				
DL 0.1% 11.33411				

The influence of treatment on tomatoes production can be observed in table 4. As shown in this table all variants treated with foliar fertilizers (Folimax, Agriphyte) and /or

growth promoter P&R exceed untreated control with very significant differences.

Table 4. The influence of treatment of tomatoes production

Treatment	Average production (t/ha)	%	Differences (t/ha)	Significance
b1 Control	51.933	100	-	
b2 Folimax	65.293	126	13.360	***
b3 Agriphyte	68.292	131	16.359	***
b4 P& R	61.261	118	9.328	***
DL 5% 1.884312				
DL 1% 2.644951				
DL 0.1% 3.734048				

Regarding the influence of foliar fertilizer treatments and growth promoter on each variety (Table 5) it can be noted that the yield differences obtained from untreated control are very significant.

Table 5. The influence of treatments on each variety production

Variant (treatment)	Average production (t/ha)	%	Differences (t/ha)	Significance
a1b1 (Control)	48.865	100	-	
a1b2	64.210	131	15.345	***
a1b3	66.957	137	18.092	***
a1b4	59.020	121	10.155	***
a2b1 (Control)	55.001	100	-	
a2b2	66.376	121	11.375	***
a2b3	69.626	127	14.625	***
a2b4	63.501	115	8.500	***
DL 5% 2.6648189				
DL 1% 3.7405256				
DL 0.1% 5.280742				

If it is taking into account both factors (variety and treatment) it can be noted that the variant treated with Agriphyte had the most consistent behavior regardless of the variety under study,

being superior to other types of treatment (Table 6, Figure 3 and 4). The largest increases of production was realized by Balkan F₁ hybrid treated with Agriphyte (69.626 t/ha).



Figure 3. Fruits of hybrid Balkan F1



Figure 4. Fruits of variety Ghattia

Table 6. The influence of variety and treatment on tomatoes production

Variant (treatment)	Average production (t/ha)	%	Differences (t/ha)	Significance	Variant (treatment)	Average production (t/ha)	%	Differences (t/ha)	Significance
a1b1 (Control)	48.865	100	-		a1b3 (Control)	66.957	100	-	
a2b1	55.001	113	6.136	**	a2b1	55.001	82	-11.956	000
a2b2	66.376	136	17.511	***	a2b2	66.376	99	-0.581	
a2b3	69.626	142	20.761	***	a2b3	69.626	104	2.669	*
a2b4	63.501	130	14.636	***	a2b4	63.501	95	-3.456	0
a1b2 (Control)	64.210	100	-		a1b4 (Control)	59.020	100	-	
a2b1	55.001	86	-9.209	000	a2b1	55.001	93	-4.019	0
a2b2	66.376	103	2.166		a2b2	66.376	112	7.356	**
a2b3	69.626	108	5.416	**	a2b3	69.626	118	10.606	***
a2b4	63.501	99	-0.709		a2b4	63.501	108	4.481	**
DL 5% 2.6107467					DL 5% 2.6107467				
DL 1% 4.1067505					DL 1% 4.1067505				
DL 0.1% 7.7606017					DL 0.1% 7.7606017				

As shown in figures 5 and 6 the vitamin C and lycopene content of tomato fruits are bigger for treated variants than control regardless of variety.

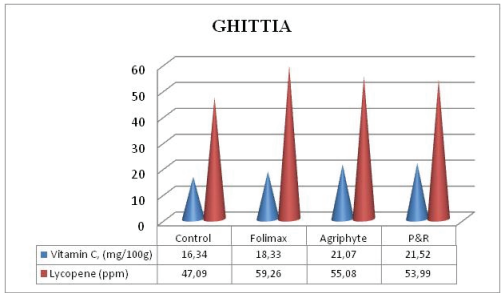


Figure 5. Vitamin C and lycopene content in variety Ghittia

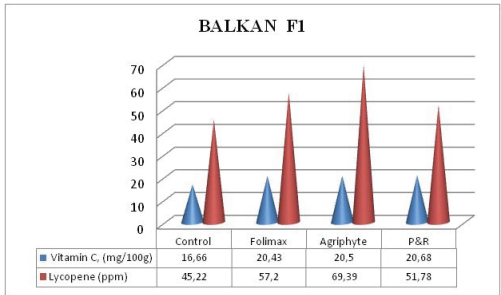


Figure 6. Vitamin C and lycopene content in hybrid Balkan F1

Regarding the carbohydrates content it can be observed that it does not vary much by treatment. The acidity of tomato fruits varies quite widely depending on the treatment and variety (Figure 7 and 8).

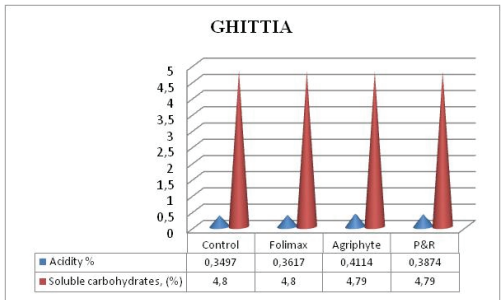


Figure 7. Soluble carbohydrates and acidity content in variety Ghittia

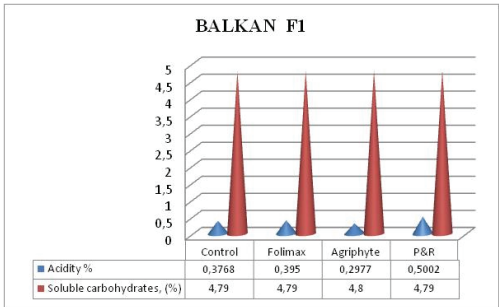


Figure 8. Soluble carbohydrates and acidity content hybrid Balkan F1

CONCLUSIONS

Growth promoter and foliar fertilizer treatments had a positive influence on the level of production and quality of tomato fruits grown in high tunnel, Poiana county Ialomita 2012.

Highest yield was obtained at Agriphyte treatment for both varieties Ghittia and Balkan F₁ (66.957 t/ha, respectively 69.626 t/ha).

Regarding the distribution of fruits on the quality classes, Ghittia shows in variant treated with Agriphyte, the biggest share of extra fruit quality class (40% of total production).

Production results were interpreted statistically. The differences between Balkan F₁ and Ghittia is distinctly significant and between control and treated variants were very significant.

Vitamin C and lycopene contents varied positively according to the treatment.

The highest content of vitamin C was recorded in variety Ghittia treated with growth promoter P& R (21.52%) and the highest lycopene content was at Balkan F₁ hybrid treated with Agriphyte (69.39 ppm).

ACKNOWLEDGEMENTS

The paper presents data from the Ph. degree thesis in the frame POSDRU / 107/ 1.5/S/76888, project financed from the European Social Fund through the Sectoral Operational Programme for Human Resources Development 2007-2013.

REFERENCES

- Ardelean M., Sestras R., Cordea Mirela, 2007. Horticultural experimental technique, Academic Pres Publishing House, Cluj-Napoca, p. 30-33.
- Ciofu Ruxandra, Stan N., Popescu V., Chilom Pelaghia, Apahidean S., Horgos A., Berar V., Lauer K.F., Atanasiu N., 2004. Treaty of vegetable crops, Ceres Publishing House, Bucharest, p. 308-319, 431-442, 603-646.
- Davidescu D., Davidescu Velicica, 2000. Horticultural agrochemistry, Ceres Publishing House, Bucharest.
- Lacatus V. et al., 2005. Vegetable crops in greenhouses and plastic tunnels, Ceres Publishing House, Bucharest.
- Lacatus V., 2006. Fertilization of tomato plants cultivated in protected system, Session of Scientific Paper, Vidra.
- Voican V., Lacatus, V., 2002. Protected culture of vegetables in greenhouses and plastic tunnels, Ceres Publishing House, Bucharest.