Scientific Papers, Series B, Horticulture, Vol. LVI, 2012
ISSN Online 2286-1580, ISSN-L 2285-5653

THE INFLUENCE OF THE TREATMENTS WITH GROWTH PROMOTERS AND FOLIAR FERTILIZERS ON PROTECTED CROPS OF TOMATOES

Jeni Gianina VOICU (SIMION)

Bucharest University of Agronomic Sciences and Veterinary Medicine, Faculty of Horticulture, 59 Mărăşti Avenue, postcode 011464, Bucharest, Romania, Phone: +40 (21) 318 25 64, Fax: +40 (21) 318 25 67, e-mail: gianina.simion@yahoo.com

Corresponding author email: gianina.simion@yahoo.com

Abstract

The work presents results obtained in protected culture of the tomatoes under different treatments with growth promoter (V4 - P & R) and foliar fertilizers (Folimax, Agriphyte). The hybrid Balkan grown in the south of Romania in plastic high tunnels, reacted favourably to the treatment experienced. The vegetation period of the plants have been reduced from 121 days (V1-untreated control) to 110-113 days (foliar fertilizers: V2 – Folimax, V3 – Agriphyte). For the growth promoter (P & R) the vegetation period have been reduced to 107 days. Therefore it is possible to see that the vegetation period was reduced with 14 days for V4 P&R and with 8-11 days (V2 Folimax, V3 Agriphyte). It has been remarked favourable effect on growth in height of the tomato plants (with 12-19 cm higher than V1). The treatments with growth promoter and foliar fertilizers also has determined an increase in the number of fruits on the plant and in the mean mass of the fruits (with 11 -12. 5 g than V1). The yield was 54.6 t/ ha (V1 untreated control), 59.4 t/ ha (V4 - P&R) 66.3 (V2 Folimax) and 69.6 t / ha (V3 Agriphyte), the differences being significant and very significant.

Key words**:** *Agriphyte , Folimax, Lycopersicon esculentum, Mill., P&R,, tomatoes.*

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 [6].

For obtaining good productions with maximum economic efficiency it needs to practice some technologies in which stimulating of growth and development of plants, fertilisation 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 fertilisers in protected crops shows that use of foliar fertilizers has very good effects in vegetable crops in all growth and development phases [3, 4].

Foliar fertilisation 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 [6].

Between foliar fertilizers, the literature mentions foliar fertilizers type F (231; 141; 411), the product Cropmax [2], liquid foliar fertilizer Folimax [5]. The growth promoters are used for the regulation of the processes of growth and development of plants especially when the microclimate conditions are not favourable.

Many authors recommended that the treatments must be applied when the flowers are completely opened with a solution of Tomatoset, 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.

MATERIAL AND METHOD

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 2011 in Poiana, Ialomiţa County in high tunnel of 480 m^2.

The experimentation 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 (untreated), (Table 1).

Table 1 Experimental variants -hybrid Balkan-2011

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 hybrid Balkan: early tomatoes indefinite, the plants are vigorous, fruits are round with 3-4 seeds lodge, dark red, uniform, of 250-300g weight and 4-5 fruit in a cluster, fruits are resistant to cracking, recommended for cultivation in plastic tunnels and field.

The technology used in the experiences was selected from the literature for tomatoes [2].

Under climatic conditions of the year 2011, the culture has been established by planting of seedling on 29 of the April. The seedling was by 60 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. It has been applied fertilization with different fertilizers (Folimax, Agriphyte) and growth promoter (P&R), depending on experimental variants. 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:

Morphometric determinations - plant height - 10 plants /repetition (30 plants/variant);

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 results were interpreted statistically by analysis of variance and it has been determined the correlations between parameters of productivity and yield [1].

RESULTS AND DISCUSSIONS

In the conditions of the place Poiana, Ialomiţa county in the year 2011, emergence it has been produced on February 28, on 3 days after seeding. The period from emergence to flowering was different depending by variant: 75 days for variant V1 (control), 76 days for V2 (Folimax), 79 days for V3 (Agriphyte) and 81 days for V4 (P & R). From the analysis of these data it can be said that both of the two fertilizers as well as growth promoter used has determined a slight delay in the processes of development of the plants. Differences from the control in respect of flowering have been 1-4 days at Folimax and Agriphyte, and 6 days at P & R. The beginning of fruits setting it can be observed first at control on May 25, at 87 days from emergence. At the other variants beginning of fruits setting occurred at 88 days (V2), 89 days (V3) and, 90 days (V4), with a delay of 1-2 days on the two fertilizers and 3 days on the P&R.

Analyzing the beginning of the harvest it can be observed that it has been some changes. First variant has been harvested V4 - P&R (July 15, at 138 days from emergence and 63 days from treatment), followed by V3 – Agriphyte (July 18, at 141 days from emergence and 66 days from treatment), V2 – Folimax (July 21, at 144 days, respectively 69 days) and the last was V1 - control (July 29, at 152 days from emergence).

It can be observed the favourable effect of fertilizers and stimulators on decreasing of vegetation period. The treatments stimulate the maturity of fruits by 14 days for P&R, 11 days for Agriphyte and 8 days for Folimax (Table 2, Fig. 1, Photo 1).

Table 2. The influence of stimulation and foliar fertilization on the phenophasis of the protected cultures of tomatoes – hybrid Balkan - 2011

Variant	Sowing time	Emergence time	Flowering time		Beginning of fruits setting		Beginning of harvesting			Period of vegetation	
			Date	Days no. from emergence	Date	Days no. from emergence	Date	Days no. from emergence	Days no. from treatment	Days no. from emergence	Differences
V1 Control	25.02	28.02	13.05	75	25.05	87	29.07	152	-	152	-
V2 Folimax			14.05	76	26.05	88	21.07	144	69	144	8
V3 Agriphyte			17.05	79	27.05	89	18.07	141	66	141	11
V4 P&R			19.05	81	28.05	90	15.07	138	63	138	14

* Planting: April 29
** Application of treatment: May 13

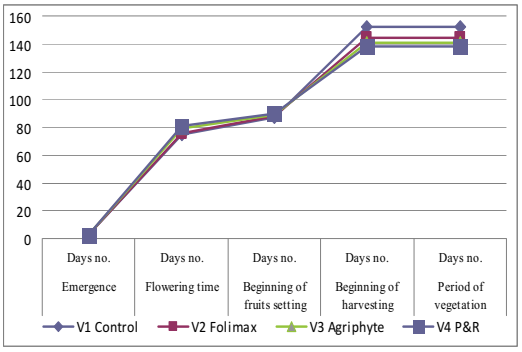

Fig. 1. The influence of stimulation and foliar fertilization on the phenophasis of the protected cultures of tomatoes –hybrid Balkan – 2011

Photo 1. Observation at tomato variants

The height of plants at 35 days from treatments (June 18) vary between 103,3 cm at V1-control and 122.9 cm at V4-P&R, which surpass the control by 19.6 cm. On the 28th of August, after three months of the treatments, the height of the plants was by 182.9 cm for V4, which surpass the control with 14.5 cm. The influence of treatments on the height of plants were bigger at first determination (35 days from treatments) than second one. The differences between treated variants and control was by 12.1-19.6 cm (first determination), bigger than the differences measured at second determination (9.9-14.5 cm). At both determinations the differences was very significant for P&R and for Agriphyte and distinct significant for Folimax (Table 3, Fig. 2).

Table 3. The influence of treatments with stimulators and foliar fertilizers on average height of plant at one month, respectively three months from treatments

Variant	Date	The average height			Significance	Date	The average height			Significance
		-cm-	Differences	% from control			-cm-	Differences	% from control	
V1 Control	18.06.	103.3	-	100.0	-	28.08.	168,4	-	100.0	-
V2 Folimax		115.4	12.1	111.7	**		178,3	9.9	105.9	**
V3 Agriphyte		122.1	18.8	118.2	***		182,6	14.2	108.4	***
V4 P&R		122.9	19.6	119.0	***		182,9	14.5	108.6	***
DL 5%			5.7198741			DL 5%		4.432251		
DL 1%			8.6615236			DL 1%		6.7116943		
DL 0.1%			13.914469			DL 0.1%		10.782129		

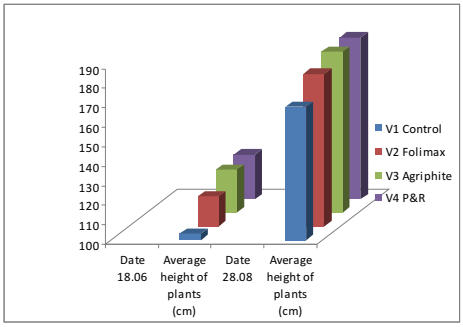

Fig. 2 The influence of treatments with stimulators and foliar fertilizers on average height of plants

The treatments has been influenced the dynamics of harvest at protected crops of tomatoes (Table 4, Fig. 3, Photo 2).

Regarding the precocity of harvest it can be observed that the best results were obtain at P&R, which was harvest with 14 days before control, followed by Agriphyte (6 days before control), respectively Folimax (3 days before control).

Consider the yield obtained until the end of July it can be observed that the treatments has been influenced the precocity of the harvest. On first place it was ecologic stimulator P&R which until end the July was harvested 55.5% from the total production, followed by Agriphyte (41.4%) and Folimax (36.2%). At the same time the control has only 23.4% from the total production.

Consider the total production on the first places it was the foliar fertilizers variants (V2 and V3) which surpass the control with 21-27%.

Table 4. Dynamics of harvest at tunnel tomatoes culture – Balkan-2011

Variant	Date								Total	
	15.07.	18.07.	21.07.	29.07.	Total July		10.08.	15.08.		
					Kg/pl.	% from total			kg/plant	%
V1 Control	-	-	-	0.356	0.356	23.4	0.400	0.764	1.520	100
V2 Folimax	-	-	0.313	0.353	0.666	36.2	0.432	0.742	1.840	121
V3 Agriphyte	-	0.134	0.310	0.355	0.799	41.4	0.464	0.667	1.930	127
V4 P&R	0.122	0.152	0.303	0.339	0.916	55.5	0.356	0.378	1.650	109

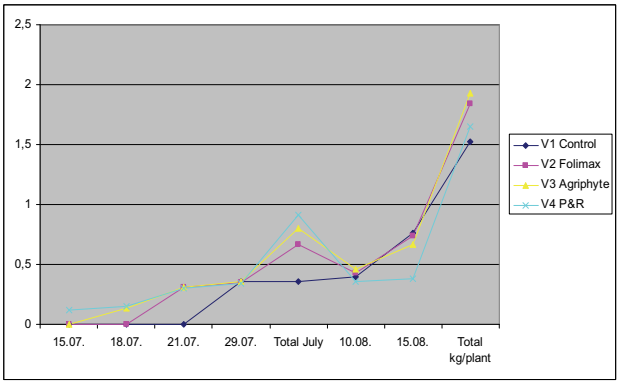

Fig. 3. Dynamics of harvest at tunnel tomatoes culture– 2011

Photo 2. Fruits of hybrid Balkan

In the climatic conditions of the year 2011 the number of fruits/plant was by 19 to 22. While applying foliar fertilizers Folimax and Agriphyte has caused a rise in the number of fruits on the plant with 6-9%, the stimulator P&R has caused decrease with 7% of the number of fruits (Table 5). The average mass of the tomato fruits was between 75 g (control) – 87 g (P&R). It can be seen that all treated variants surpass the control by 15-17%.

The production of tomato hybrid Balkan in the year 2011 was between 54.6-69.6 t/ha. The best results was obtained at variants treated with Agriphyte and Folimax, in witch the differences of 15 t/ha respectively 11.7 t/ha against the control it was very significant. The difference of 4.8 t/ha against the control

for P&R variant was distinct significant (Table 6).

Table 5. The influence of treatments with stimulators and foliar fertilizers on the productive potential- tunnel tomatoes – Balkan-2011

Variant	Fruits no. / plant	%	Average mass of fruits	%
V1 Control	20.4	100	74.6	100
V2 Folimax	21.6	106	85.4	115
V3 Agriphyte	22.3	109	86.7	116
V4 P&R	18.9	93	87.1	117

Table 6. The sinthesis of production results at tunnel tomatoes hybrid Balkan - 2011

Variant	Total production (t/ha)	%	Difference (t/ha)	Significance
V1 Control	54.6	100	-	-
V2 Folimax	66.3	121	11.7	***
V3Agriphyte	69.6	127	15	***
V4 P&R	59.4	109	4.8	**

DL 5% 2.4143518
DL 1% 3.6560184
DL 0.1% 5.8732802

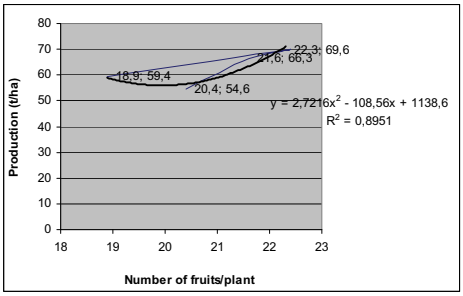

Fig. 4. Correlation between the number of fruits and tomatoes production

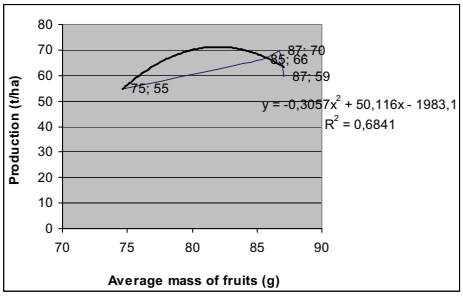

Fig. 5. Correlation between the average mass of fruits and tomatoes production

In Fig. 4 and Fig. 5 are shown correlation between total production of fruits and two parameters of production: fruits number/plant and average mass of the fruits.

The significant correlation coefficient (r = 0.950) between average number of fruits/ plant and average production at tomato hybrid Balkan indicates a strong relation between these characters. Contrary, the insignificant correlation coefficient (r = 0.827) between the average mass of the fruits and average production suggest that it doesn't exist any relation between these characters. These explain why the production of the fruits at P&R variant is lower than the other two treatment variants, despite of the bigger value for P&R variant average mass.

CONCLUSIONS

Treatments with stimulators and foliar fertilizers has been influenced the number of days necessary for each phenophase at tomato plants and reduced the period of vegetation (two weeks compare to control for P&R and 8-11 days at Agriphyte and Folimax).

The growth of plants was influenced very significantly by treatments with stimulator and foliar fertilizers. After one month the treated plants grow with 18.8 to 19.6 cm taller than control plants (untreated).

Foliar fertilizers determined the increasing of number of fruits/plant with 6-9% compare to control. On contrary P&R treatment determined decreasing of the number of fruits/plant with 7%.

The average mass of the fruits has been positively influenced by all treatments and the fruits was bigger with 15-17% than control. The biggest value of average mass of fruits was obtained at P&R variant.

There was discovered positive correlations between the productions and the two parameters of productions (number of fruits/plant and average mass of fruit). The value of correlation coefficient was bigger for the number of fruits/plant. The biggest productions of fruits was obtained at Agriphyte variant (69.6 t/ha) and Folimax 66.3t/ha which surpass the control very significantly, followed by P&R variant (59.4 t/ha) which surpass the control with a distinct significant difference.

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