

STUDY OF GERMINATION RATES OF *LYCOPERSICUM AESCULENTUM* L. VARIETIES OF SEEDS IN THE CASE OF FERTILIZERS TREATMENT

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Key words: *Reakom, ATONIK, Lycopersicon esculentum L., physiological processes*

INTRODUCTION

Lycopersicum esculentum L. (tomato) is an annual culture plant, originated in Peru, growing almost at all altitudes, occupying a third of the land for vegetables. Taxonomically, it is part of: *Magnoliophyta* spur; *Solanales* Order; The *Solanaceae* family; *Solanum* genus; *Lycopersicum esculentum* L. Species. The tomato is covered with glandular bristles, leaves are penny-divided, yellow flowers, pollinated. The beaks have skin-like epicarp, fleshy mesocarp and the endocarp in the form of a mucilaginous film around the seeds. Fruits are rich in minerals and vitamins (Gurău M., 2007).

Numerous researches have highlighted the nutritional qualities of tomatoes and their antioxidant properties. This has led to increased consumption of these vegetables both in developed and in the least developed countries, where they are categorized as luxury crops.

Researchers are constantly looking for the creation of productive and quality varieties adapted to environmental conditions. They are riched in vitamins A and C, fiber and also are cholesterol free. The average weight of tomato (148 g) contains only 35 calories. Tomato contains approximately 20-50 mg of lycopene / 100 g of fruit weight (Larisa I., 2015; Badaluta N., 2008, Zekki et al., 1996).

In tomato culture, an important factor for production quality is the substrate due to its chemical composition and physical properties. Plants need environmentally friendly conditions to develop well: temperature, humidity, light, a favorable soil, whose physical and chemical properties can be modified by fertilizers.

Macro- and microelements are important and necessary for plant growth and development; they influence growth, abundant flowering and fruit development. Also, biosimulating substances and appropriate nutrients favor frosts and droughts (Nakano, 2010, Dumas, 2003, Zekki et al., 1996).

Microelements are the chemical elements necessary for plants to form enzymatic systems with a maximum concentration not exceeding the 0,01 % value of dry matter. More than 30 microelements

classified in metals (Fe, Mn, Cu, Zn, Mo) and nonmetals (B, I, Se) were found into plant tissues. They can not be replaced by other substances. They are used by plants only in water-soluble form. In case of insoluble forms, complex biochemical processes are involved in the soil (Terabayashi, et al., 2004, Nakano, 2010).

Macroelements (N, P, K, S, Ca, Mg) are the chemical elements accumulated in plants at higher doses being absorbed by the plants both in the form of anions and in the form of cations, with predominantly plastic-constitutive functions (Nakano, 2010, Larisa I., 2015)

Biostimulators are compounds that stimulate rooting, seed and pollen germination, pollen tube growth, flower fertility, growth of shoots and fruit formation. It also causes a faster flow of minerals in the plant and an increase in chlorophyll content. In the soil, they have beneficial effects by stimulating multiplication of microorganisms and increasing the rate of decomposition of organic matter, indirectly improving soil fertility.

Biostimulators, micro and macronutrients participate in the improvement of the plant's physiological yield. If the required amount of microelements is presented, the plants are able to synthesize the entire spectrum of enzymes that allow the using of more intense energy, water and nutrition (N, P, K) and therefore to receive a higher yield. Microelements and ferments increase the recovery of tissue activity and prevent plant diseases. Microelements are compounds that improve the immune system of plants by canceling the state of physiological depression and general sensitivity of plants to parasitic diseases (Terabayashi, et al., 2004, Nakano, 2010).

In this paper was highlighted the action of a fertilizer (REACOM, Ukraine) and a biostimulator (ATONIK, Romania) on some physiological processes at *Lycopersicon Esculentum* L..

Some aspects were studied: the effect of different concentrations of REACOM on seed germination and on growth of *Lycopersicum aesculentum* L. varieties *Ace 55 VF*, *St. Pierre* and *Russian black*; the influence of REACOM treatment

time on tomatoes seeds on some physiological processes (germination, growth); the influence of various concentrations of ATONIK and of treatment time on physiological processes in *Lycopersicum esculentum* L. varieties *Ace 55VF*, *St. Pierre* and *Russian black*; comparing the action of the two growth promoters on the physiological yield of *Lycopersicum esculentum* L.; recommendations on the use of the two products in tomatoes crops (Raport NDR No 6/2000-40).

MATERIALS AND METHODS

1. Materials

The materials used in this paper were seeds of *Lycopersicum esculentum* L. varieties *Ace 55 VF*, *St. Pierre* and *Russian black* (Figs. 1-3). Biostimulators used were the chemical products REACOM from Ucraina and ATONIK from Romania.

Seeds of *Lycopersicum esculentum* L. have been purchased from the seed shop and seed authenticity is guaranteed by Agrosem Târgu - Mureş (Romania) producing company.

The *Ace 55 VF* is a mid-early variety with semi-definite growing. The fruits are uniformly reddish in color, they are round-crushed, weighing 160-190 g.

The variety is distinguished by firmness, taste and pleasant appearance. They are resistant to transport and handling. Productive variety is cultivated in the field (Fig. 1).



Fig. 1. *Lycopersicum esculentum* L. *Ace 55 VF* variety

St. Pierre's is a mid-early variety with an indeterminate growing. The fruits are round and firm, an average weight of 140-180 g, uniformly colored with pleasant taste. It is recommended to cultivate in protected areas and crops in the field (Fig. 2).

The *Russian black* is a variety with an indeterminate growing. Fruits are grouped in short clusters of black colour outside and dark red inside. They are firm with thick pulp and a pleasant taste. They are cultivated in the field and in protected areas (Fig. 3).



Fig. 2. *Lycopersicum esculentum* L. *St. Pierre* variety



Fig. 3. *Lycopersicum esculentum* L. *Russian black* variety

REACOM is a biostimulator that contains microelements based on metal chelates. They are highly concentrated aqueous solutions, the diffusion of 1-hydroxyethylidene diphosphate of metals: Fe^{3+} , Mn^{2+} , Zn^{2+} , Cu^{2+} , Co^{2+} , Mo^{6+} and B^{3+} . The proportion of microelements differs according to the crops, the total concentration of the complexes in the initial solution is in the range of 160-200 g/L, the content of the microelements is 3.6% by weight of the product (Table 1). The freeze temperature is -3°C ; the properties of micro-fertilizers are totally preserved after defrost.

All metallic chelates, in general, and REACOM micronutrients in particular, have a number of advantages over inorganic salts: they are non-toxic; are resistant throughout the pH range of zonal soils and are compatible with mineral fertilizers; are completely water soluble and easily absorbed by plants; bind easily to soil in poorly soluble compounds and are not destroyed by microorganisms; are effective on calcareous soils and are compatible with many pesticides.

From the results presented in Table 2 it can be noted that REACOM micro-fertilizers are capable of increasing yields of crops while improving product quality on different soil types (Aristov A. N., 1985). The use of REACOM is based on soil, crop and plant

phenophases, and ranges from 3 to 7 L / ha (Larisa I si colab., 2015).

The optimization of the microelement feed process is accompanied by the penetration of macro- and microelements into plants and, in general, the increase of cultural productivity by maintaining and

increasing the amount of important components (proteins, sugars, vitamins etc.).

Researches realized to diferent species found that the penetration of water through the seeds shell and their swelling increased significantly in the presence of micronutrients (Table 3).

Table 1. The chemical composition of REACOM chelated micro-fertilizer complex, manufactured in Ukraine

Chemical indicator	Unit of measurement	Product	
		Liquid	Powder
pH	-	5.0-8.5	-
Density	g/cm ³	1.15-1.35	-
Zinc (Zn)	%	> 3.25	> 13.0
Copper (Cu)	%	> 2.6	> 10.4
Boron (B)	%	> 2.3	> 9.2
Manganase (Mn)	%	> 2.0	> 8.0
Molybdenum (Mo)	%	> 1.0	> 4.0
Cobalt (Co)	%	>1.4	> 5.6
Iron (Fe)	%	> 5.0	> 20.0

Table 2. Influence of REACOM micro-fertilizers on crop productivity (Aristov A. N., 1985)

Research Unit	Culture	Yield of the control sections, t / ha	The increase in the use of micronutrients, t / ha		
			Seed processing	Roots feeding	Seed processing + roots feeding
Nikolaev research station (V.V. Vereshchagin, V. V. Wild)	Winter wheat	32.8	-	4.4	-
CHAPP Seed Office	Winter wheat: Kievshii-8	56.1	-	-	5.9
	Luzanovka	58.6	-	-	5.2
	Belo□ercov	56.6	-	-	4.4
Institute of Agricultural Grain (L.F. Demishev)	Winter wheat,	29.0	29.0	4.1	6.1
	Maize,	31.5	11.5	-	-
	Lucerne, green seeds	1.14	0.19	-	-
		106	6.0	-	-
Institute of Pedology and Agrochemistry	Winter wheat,	20.0	6.3		
	barley,	24.9	6.8		
	Sunflower core	13.0	2.6		
		11.9	3.3		
Experiment Station of Rovensk (L.Ya. Lukaschuk)	Summer wheat	29.5	4,2		
Experiment Station of Donetsk IPA (N. V. Bayrak)	Sunflower	13.5	5,2		
Experiment Station of Sumsk (M. P. Bondarenko)	Sunflower	25.8	-	2.5	-
Institute of Sugar Beet (A. S. Zarishnyak)	Sugar beet	340	-	460	-
Potato Research Institute (P. F. Kalitsky)	Potatoes: Svitanok	85.0		29.0	
	Kiev	132		25.0	
		98.0		30.0	
Institute of Vegetable Research of Donetsk (G. V. Sergeev)	Onion (seeds)	4.3		0.86	
	Pepper (seeds)	1.5		0.34	
Institute of viticulture and winemaking V. E. Tiarov (G.M. Kucer)	Grapes	5.6 (*)	-	1.3 (*)	-

* Grapes - the harvest of the first bush, kg

Table 3. Influence of micro-fertilizers on seed swelling (% of initial weight) (Aristov A. N., 1985)

Work variants	Species	Seed weight (g)		
		After 3 h	After 7 h	After 25 h
Blank	Maize	110.6	120.8	130.2
	Green peas	109.8	146.3	192.0
Processed micro-fertilizer sample	Maize	116.5	124.3	140.5
	Green peas	109.8	153.6	196.5

At seed germination, the water is important, but also the dissolved minerals, which penetrate into the plant through the primary roots, stimulating their growth.

As the results of the above-mentioned research show, seed treatment with micro-fertilizers improves germination, increases the number of roots and their length, so all the indicators that characterize the first stages of plant ontogenesis are improved.

The REACOM microfertilizer also has fungicidal properties, so seed treatment with the micro-fertilizer can reduce the treatment of seeds with other toxic substances used to treat the seeds.

ATONIK (Aectra Agrochemicals S.A. Romania) is a growth biostimulator with a role in stimulating of rooting processes and seed germination of horticultural plants. ATONIK is a systemic product that penetrates the plant shortly after application. It is the oldest biostimulator of growth and fructification in the world (since 1945), being intensively used by farmers in over 70 countries on 5 continents.

In Romania it has been approved since 1977, being considered indispensable in obtaining of high quality products for export. Its unique polyphenol-based composition (Table 4) has, among many others, a role in the proliferation and growth of shoots, photosynthesis, flower fertility and fruit formation, even in conditions of biotic and abiotic stress.

It increases the degree of fertility of the flowers by stimulating the elongation of the pollen tube and the germination of the pollen. It also increases plant resistance to stress factors (drought, frost, phytotoxicity due to herbicides).

Table 4. Chemical composition of ATONIK Biostimulator (Aectra Agrochemicals S.A. Romania)

No.	Chemical indicator	Unit of measurement	Product status
			Liquid
1.	pH	-	8.36
2.	Density	g/cm ³	1.0019
3.	Sodium 2-nitrophenolate (C ₆ H ₄ NNaO ₃)	%	0.2
4.	Sodium P-nitrophenoxide (C ₆ H ₄ NNaO ₃)	%	>0.3
5.	Sodium 5-nitroguaiacolate (C ₇ H ₄ NNaO ₄)	%	> 0.1

ATONIK has the highest stimulation percentage of nitrate-reductase activity, a very important enzyme for accessibility / use of nitrogen by plants.

Nitrate reductase catalyses the reduction of nitrates to nitrites, this chemical reaction being

particularly important for the production of proteins in plant. After application of the product, its active substances penetrate immediately and very easily into plants cells, being rapidly metabolized to compounds that naturally occur in plants and perform similar functions.

For tomato culture grown in protected areas (greenhouses, solariums) or in the field, the ATONIK biostimulator is applied to seed germination or transplantation of seedlings by soaking them into 10 mL / 10 L water (seeds / roots treatment) and to leaves in the following phenophases in the amount of 0.06 L / 1000 m² or 0.6 L / ha (leaf) 7-14 days before flowering or when the flower button or floral binding occurs (www.aectra.ro/produs/ATONIK, www.pannonmag.hu/ATONIK%20angol.pdf, <http://www.depozitdepesticide.ro/ATONIK>).

2. Methods

Study of the germination rate of certain seeds of *Lycopersicum esculentum* L. varieties by treatment with biostimulating substances

To determine the germination capacity, the seeds were differently treated in two variants. Thus, a part of the seeds were submerged in the two different types of fertilizers (REACOM or ATONIK) of different concentrations (50%, 100% and 150%) for 2, 4, 6 hours and then moistened daily with distilled water for 12 days.

Other tomatoes seeds were daily wetted with different biostimulator concentrations for 6, 9 and 12 days. A number of 33-34 seeds were placed in disposable cans on gauze (Fig.4).

- 50% REACOM or ATONIK concentration represents half of the amount suggested by the manufacturer on the package leaflet for use: ATONIK (AI) - 0,3L/ha and REACOM (R I) - 1,5L/ha.
- 100% concentration is the amount of product recommended by the manufacturer on the package leaflet for use: ATONIK (AII) - 0, 6 L/ha and REACOM (R II) - 3 L/ha.
- 150% concentration is with 50% more than recommended by the manufacturer: ATONIK (AIII) - 0,9 L/ha and REACOM (R III)- 4,5 L/ha.

For each work variant, triplicates were performed and were daily monitored to determine the yield of germination per variation. The seeds were daily moistened by 3 mL per can with different concentrations of REACOM or ATONIK, except for the seeds of the control sample which were moistened with distilled water.



Fig. 4. Appearance on the germination of tomatoes seeds in the presence of REACOM and ATONIK solutions

The physiological process of germination was carried out under controlled conditions, the disposable cans being introduced into the Sanyo breeding room, where certain parameters were maintained constant: temperature of 20°C, photoperiod 16 hours light - 8 hours dark, the light intensity: 22 lux.

The seed whose roots were equal in size to the length of the seed was considered germinated. The tomatoes seeds were photographed at a preliminary stage with a Nikon digital camera.

Biometric study of some morphological characters and statistical processing of the obtained values

The biometric study was performed on *Lycopersicum esculentum* L., *Ace 55 VF*, *St. Pierre* and *Russian black* varieties. After seeds germination, the plastic boxes were kept in the growth chamber until seedlings development. The plantlets were moistened daily with 3 mL biostimulating solution.

Twelve days after the start of the experiment, biometric measurements were performed, following the roots and hypocotyl length, the cotyledon width, the green weight of the plants (Fig. 5).

The length of roots and of hypocotyl, the width of the cotyledon were measured in centimeters by an electronic caliper, and the green weight of the plants in grams, with an analytical balance (ACCULAB) (Fig. 5). The data obtained were statistically processed and interpreted.

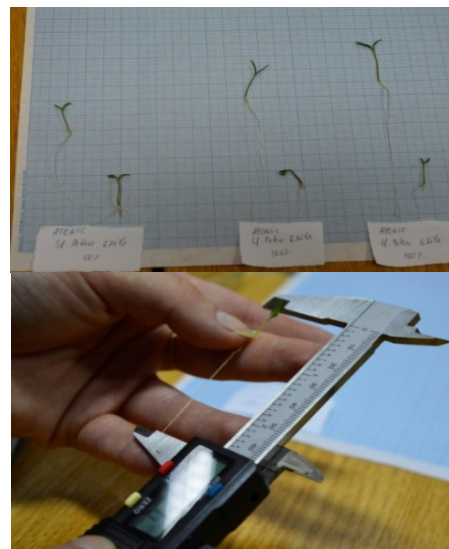


Fig. 5. Seedling of *Lycopersicum esculentum* L. 12 days after planting

RESULTS AND DISCUSSIONS

1. Study of seeds germination rate of *Lycopersicum esculentum* L. varieties using treatment with biostimulating substances

Although seed germination conditions were the same for all studied varieties, the germination rates varied within fairly wide limits (Table 5). To some varieties, the first germinated seeds were observed after 5 or 6 days from inoculation in the boxes plastic. All blank samples and *Russian black* variety, treated with ATONIK, recorded a high percentage of germination. The *Ace 55 VF* and *St. Pierre* varieties treated with ATONIK recorded a germination percentage of up to 93% and 80% respectively (Table 5). The tomato varieties treated with ATONIK biostimulator - AI, AII and AIII for 6, 9 or 12 days, recorded a germination percentage above 60% for most samples. Thus, the *Russian black* variety shows a 100% germination yield on ATONIK AII and AIII - 9 days, as well as ATONIK AIII - 12 days. All samples treated with ATONIK revealed an increased yield of seed germination (over 70%) comparable to that of the control sample.

Of the total samples of tomatoes immersed in ATONIK AI, AII and AIII for 2, 4 or 6 hours, the *Sf. Pierre* variety is distinguished with an 80% germination efficiency on the ATONIK AII - 6 hours (Fig. 6). Most samples showed an average germination rate of 20-65%.

Of the samples treated with REACOM - RI, RII and RIII for 2, 4 or 6 hours, we noticed the *Russian black* and *Sf. Pierre* varieties that showed an 80% germination rate on REACOM RII variants - 2, 6 hours. The other samples revealed a moderate seed germination rate that oscillated between 13% and 60% after the same time interval (Fig. 7).

Table 5. Seeds germination percentage of *Lycopersicum esculentum* L., in the case of *Ace 55 VF*, *St. Pierre* and *Russian black* varieties under treatment with ATONIK stimulator and with distilled water (control sample)

<i>Lycopersicum esculentum</i> L.		Control sample	Samples treated with ATONIK								
			6 days			9 days			12 days		
			AI	AII	AIII	AI	AII	AIII	AI	AII	AIII
<i>Ace 55 VF</i> variety	Germination percentage after 5 days (%)	80	60	0	0	53	53	60	53	0	87
	Total germination percentage (%) after 12 days	93	87	67	73	60	80	87	80	80	93
<i>Sf. Pierre</i> variety	Germination percentage after 5 days (%)	73	87	80	53	73	80	47	60	40	20
	Total germination percentage (%) after 12 days	80	93	80	93	93	80	87	73	73	53
<i>Russian black</i> variety	Germination percentage after 5 days (%)	100	93	93	73	73	87	100	93	87	73
	Total germination percentage (%) after 12 days	100	100	93	73	87	100	100	100	87	100

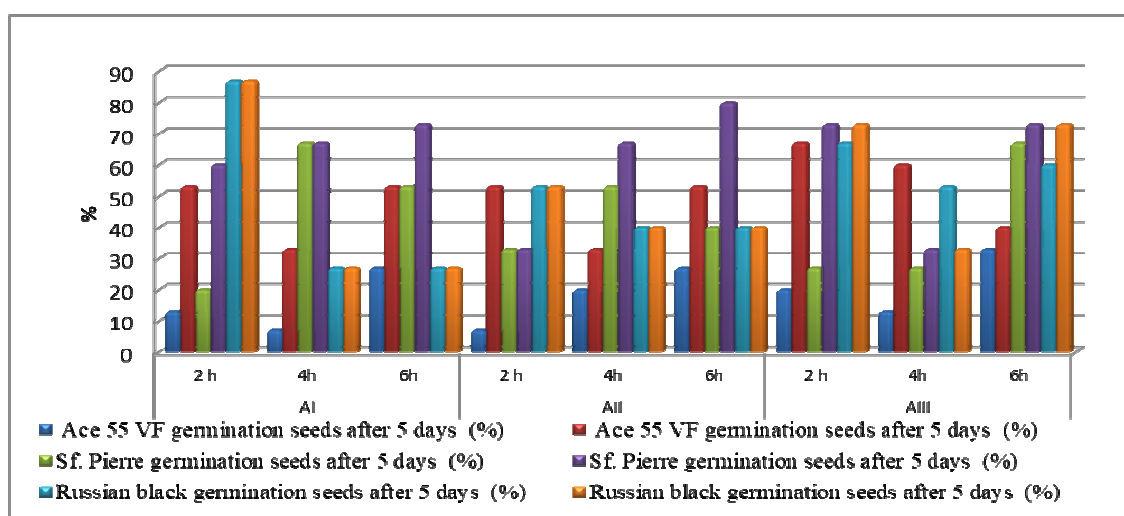


Fig. 6. Seeds germination percentage of *Lycopersicum esculentum* L., in the case of *Ace 55 VF*, *St. Pierre* and *Russian black* varieties under treatment with ATONIK stimulator

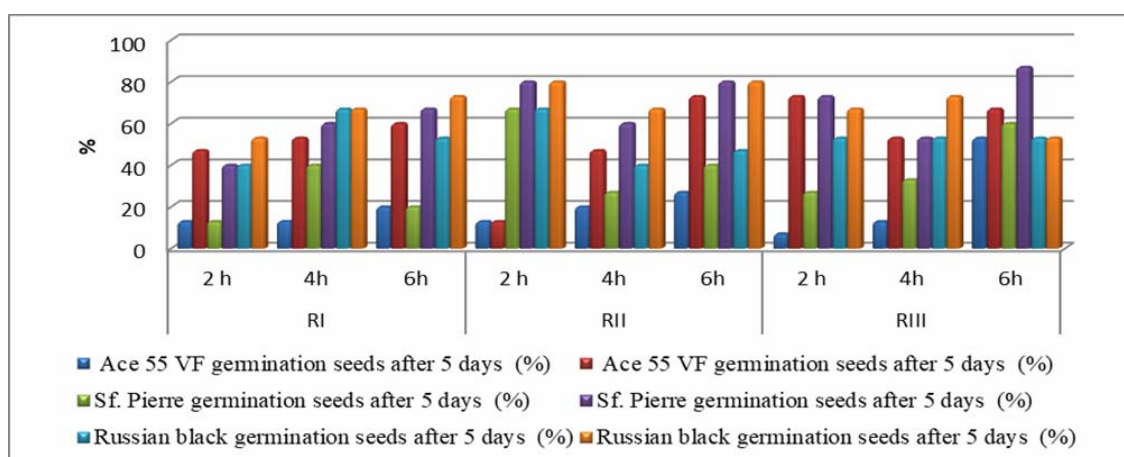


Fig. 7. Seeds germination percentage of *Lycopersicum esculentum* L., in the case of *Ace 55 VF*, *St. Pierre* and *Russian black* varieties under treatment with REACOM stimulator

2. Biometric study of some morphological characters and statistical processing of the obtained values

The control sample for the three tomatoes varieties recorded values between 0.1 cm (*Ace 55 VF*) and 5 cm (*Ace 55 VF*), for the root length character. For the character of the hypocotyl length, the mean value recorded on the control sample is 1.55 cm (*Russian black* variety). The cotyledon recorded biometric values between 0.5 - 1 cm for all three tomatoes varieties (Table 6).

Table 6. Variation of some morphological characters at *Lycopersicum esculentum* L. soiurile *Ace 55 VF*, *Sf. Pierre*, *Russian black* under treatment with distilled water (control sample)

<i>Lycopersicum esculentum</i> L.		Control sample		
		<i>Ace 55 VF</i> variety	<i>Sf. Pierre</i> variety	<i>Russian black</i> variety
Root length (cm)	Maximum value	5	4.9	3.7
	Minimum value	0.1	1.9	1.6
	Average (\bar{X})	5.51	2.578	2.325
Hypocotyl length (cm)	Maximum value	2.1	2.6	2.5
	Minimum value	1.3	0.2	1.3
	Average (\bar{X})	1.766	1.6	1.684
Cotyledon length (cm)	Maximum value	1	1	1
	Minimum value	0.5	0.5	0.5
	Average (\bar{X})	0.733	0.733	0.727
Fresh biomass (g)		0.172	0.212	0.217

The average fresh biomass of tomatoes plants recorded maximum values for *St. Pierre's* (0,212 g) and minimum values for *Ace 55 VF* variety (0,172 g).

Biometric measurements of morphological characters in *Lycopersicum esculentum* L. with ATONIK treatment

In the case of *Ace 55 VF* variety, we have noted that under the condition of ATONIK fertilizer, the root length value is between 0.2 cm (AI - 4 hours) and 12.7 cm (AIII - 2 hours). Higher values also recorded AIII - 4 hours (12 cm), AIII- 6 hours (10,3 cm) and AII- 4 hours (10,1 cm) (Fig. 8).

The character of the hypocotyl length recorded on average the value of 1.4 cm and the seed-lobe length character, the value of 0.5 cm.

Fresh biomass revealed values for AI, AII, AIII - 2 hours (0.174 g, 0.176 g and 0.227g respectively).

Root length character for *Sf. Pierre* variety recorded values between 0.5 cm (AI - 2 hours) and 12.5 cm (AIII - 4 hours) (Fig. 9). It can be observed average values obtained for hypocotyl length character after treatment with ATONIK (1.3 cm) and small values for seed-lobe length character (0.6 cm).

Fresh biomass character has values close to the *ACE 55 VF* variety ranging from 0.129 g (AI - 4 hours) and 0.301 g (AIII - 2 hours).

The *Russian black* variety (Fig. 10) is highlighted among the three varieties tested with the highest yield of growth. Thus, the root length character records high values to the most samples - more than 7.4 cm the highest value being recorded to AII-2 hours (12.2 cm). Concerning the character of the hypocotyl length, the *Russian black* variety has an average of 1.2 cm. Fresh biomass has high levels to AI- 2 hours (0.320 g), AII- 2 hours (0.237g) and AIII- 2 hours (0.285g).

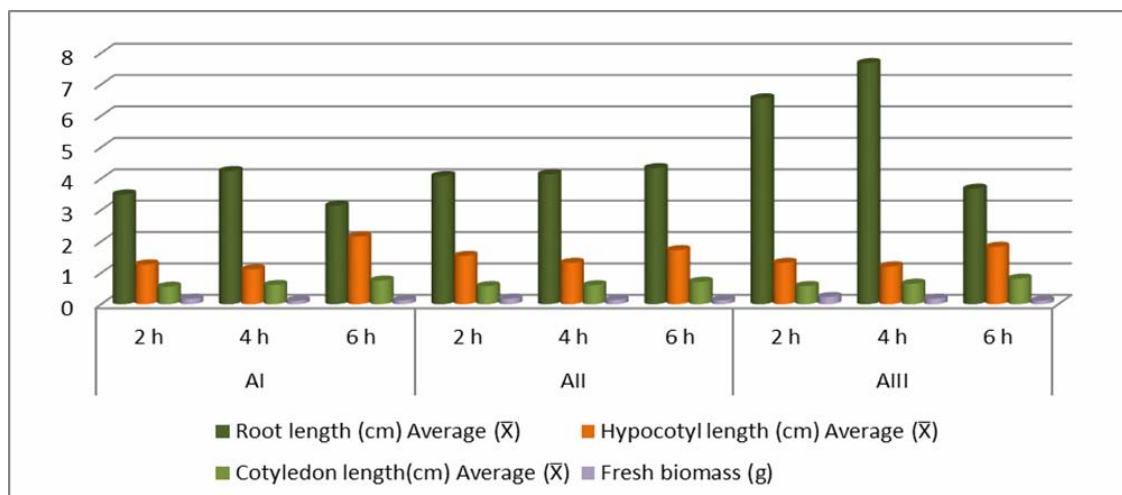


Fig. 8. Variation of some morphological characters at *Lycopersicum esculentum* L., *Ace 55 VF* variety under treatment with ATONIK stimulator

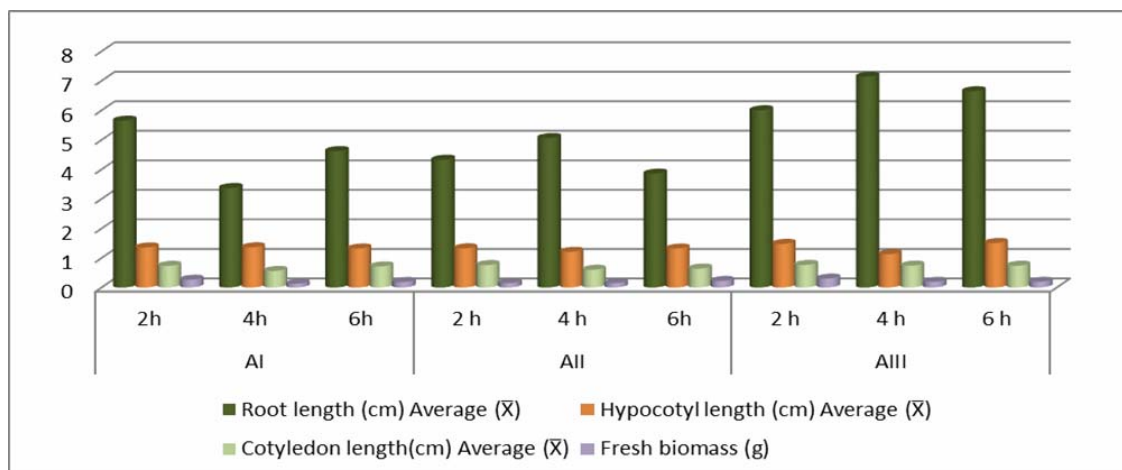


Fig. 9. Variation of some morphological characters at *Lycopersicum esculentum* L., *Sf. Pierre* variety under treatment with ATONIK stimulator

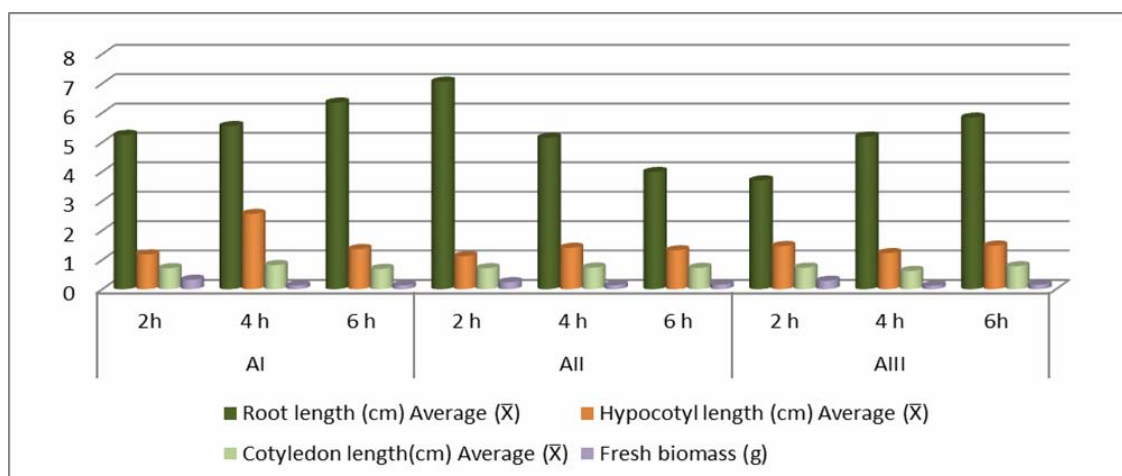


Fig. 10. Variation of some morphological characters at *Lycopersicum esculentum* L., *Russian black* variety under treatment with ATONIK stimulator

Biometric measurements of morphological characters in *Lycopersicum aesculentum* L. with REACOM treatment

Concerning the character of the root length in the case of *Ace 55 VF* variety of *Lycopersicum aesculentum* L., we find that the mean value oscillated between 8.4 cm (sample treated for 6 hours with RIII) and 6.31 cm (sample treated for 6 hours with RI) (Figure 11).

We observe the increase of the root length on all variants immersed for 2 hours (RI, RII, RIII) of 7.02-7.31 cm and the highest percentage in the case of RIII samples (7.31-8.4 cm).

The character of the hypocotyl length recorded values between 0.5-3.4 cm; the growth was stimulated on REACOM variants RI - 6 hours (3.4 cm), RII - 2 hours (2.8 cm), and RIII - 2 hours (2.8 cm).

The cotyledon length ranged values from 0.5 to 5 cm. The RII-6 hours sample is noted with a maximum of 5 cm cotyledon length.

For the character of fresh biomass of *Lycopersicum aesculentum* L., we noticed the REACOM work variants RII -2 hours with the biomass of 0,224 g and REACOM - RIII -2 hours with biomass of 0,250 g.

In the case of *St. Pierre* variety (Fig. 12), the root length character points values between 0.5 cm and 9.5 cm. Higher values, over 9 cm, recorded RI-2 hours (9.5cm); RII -2 hours (9 cm) and RIII - 2 hours (9.2 cm) and 6 hours (9.2 cm) respectively.

For the biometric character of the hypocotyl length, the samples of RI-6 hours and RII-2 hours with the maximum recorded value of 2.5 cm are noted. Most samples for cotyledon length character, the averaged value was of 0.75 cm. Fresh biomass

character shown high values in the case of RI - 2 hours (0.305 g) and RII - 2 hours (0.363 g) variants.

Morphological characters for *Russian black* variety (Fig 13): the root length character recorded high values on RI- 2 hours (12 cm) and RII- 2 hours (14.5 cm) and minimum on RI- 4 hours (8 cm) and RIII- 2 hours (8 cm); the average value of hypocotyl length was 1.40 cm; the length of the seed-lobe had a maximum of 1.1 cm (RI- 6 hours) and a minimum of 0.1 cm (RII - 2 hours); fresh biomass varied between 0.165 g (RII- 4 hours) and 0.318 g (RIII- 2 hours).

Comparing with tomato control sample, the two growth stimulators had beneficial effects to stimulate the growth of the vegetative parts of the plant, *Ace 55 VF*, *Sf. Pierre* and *Russian black* varieties.

Thus, in the case of variants treated with REACOM and ATONIK for 2, 4 or 6 hours, the recorded root length values were double or higher; the rest of the parameters highlight slightly higher values. Variants tested with ATONIK 6, 9 or 12 days obtained values similar to the control sample.

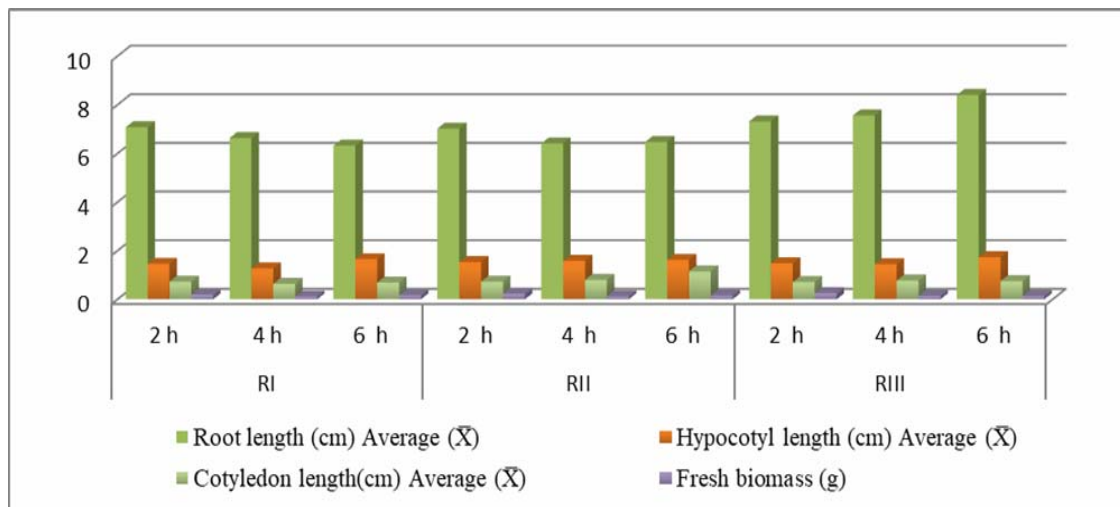


Fig. 11 Variation of some morphological characters at *Lycopersicum esculentum* L., *Ace 55 VF* variety under treatment with REACOM stimulator

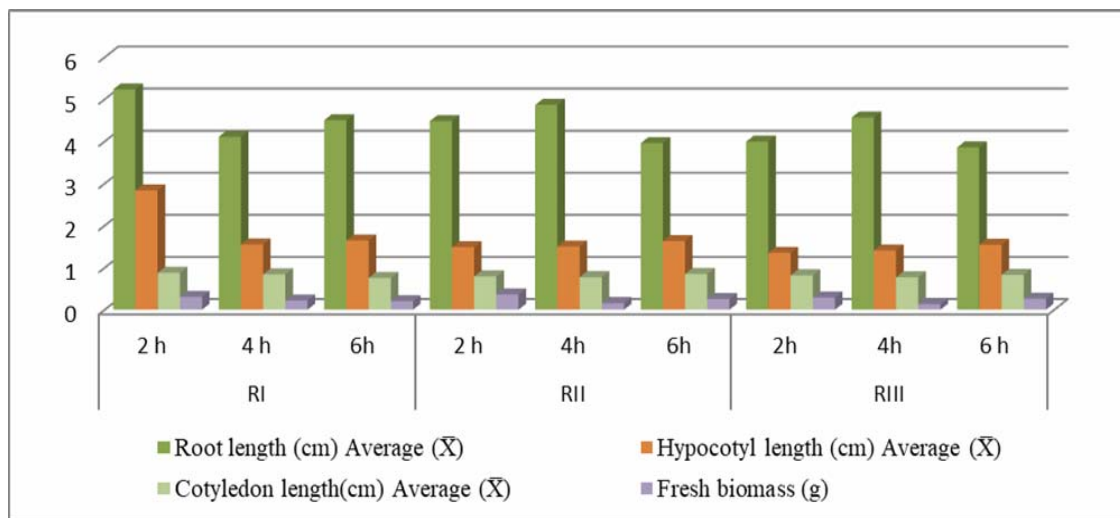


Fig. 12 Variation of some morphological characters at *Lycopersicum esculentum* L., *Sf. Pierre* variety under treatment with REACOM stimulator

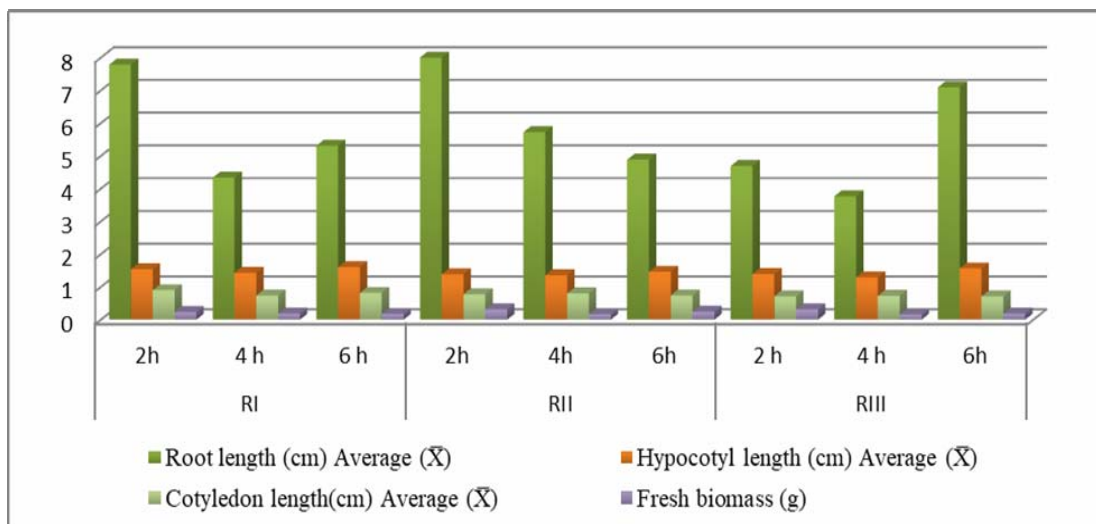


Fig. 13. Variation of some morphological characters at *Lycopersicum esculentum* L., Russian black variety under treatment with REACOM stimulator

CONCLUSIONS

Following investigations on the germination and growth of *Lycopersicum aesculentum* L. under conditions of microelements (REACOM or ATONIK) treatments, some conclusions can be noted. Treatment with ATONIK 6, 9 or 12 days stimulated the germination process in all tomato varieties, the Russian black variety recording a 100 % germination yield on the most of the variants tested.

Among the samples treated with ATONIK, the Russian black variety highlighted a high growth yield, followed by *Sf. Pierre* and *Ace 55 VF*. The best plantlet growth results were obtained on ATONIK AII - 2 hours variants and ATONIK AIII - 2 hours. The two growth stimulators had beneficial growth stimulating effects of plantlets vegetative parts of the *Ace 55 VF*, *Sf. Pierre*, *Russian black* varieties. On variants treated with REACOM and those treated with ATONIK 2, 4 or 6 hours, the values recorded for the root length character are often double, and the rest of the analyzed parameters showed slightly higher values compared to the control sample.

The *Ace 55 VF* variety recorded favorable results for plantlet growth on AII - 6 days; AI - 9 days and AI - 12 days variants. The growth of the plantlet is stimulated by the presence of AIII - 6 days in the case of the *Sf. Pierre* variety, and for *Russian black* variety AII - 6, 9 or 12 days. The root length character highlighted high values for all varieties in the case of RI - 2 hours variants and RII - 2 hours.

Due to the obtained results, we recommend ATONIK as a growth stimulator for the culture of *Ace 55 VF*, *Sf. Pierre*, *Russian black* varieties of *Lycopersicum aesculentum* L. in the mentioned concentration on the label. At 50% concentration, no significant results were obtained and if the negligible

solution is prepared and at doses higher than 100%, satisfactory results are obtained.

We do not recommend exceeding the concentration specified on REACOM label. This should be used exactly as stated in the prospectus (seeds immersion for a certain number of hours depending on the species).

ABSTRACT

The aim of this study was to highlight the action effects of a fertilizer containing microelements – REACOM (Ukraine) and a biostimulator – ATONIK (Romania).

It was followed: the effect of different concentrations of REACOM on seeds germination and growth of *Lycopersicum aesculentum* L. seedlings, in the case of *Ace 55 VF*, *Sf. Pierre* and *Russian black* varieties; the influence of REACOM treatment time on tomatoes seeds on some physiological processes (germination, growth); the influence of various concentrations of ATONIK and of treatment time on germination and growth of *Lycopersicum aesculentum* L., in the case of *Ace 55VF*, *Sf. Pierre* and *Russian black* varieties (germination, growth); comparing the action of the two growth stimulating products on the physiological yield of *Lycopersicum aesculentum* L.

The obtained results recommend for the tomato culture the ATONIK product as a growth stimulator in the mentioned concentration on the label; the use of higher or lower concentrations leads to unsatisfactory results. In the case of REACOM, the strict failure of prospectus has led to the slowing or even to the destruction of tomato seeds. The growth of tomato seedling is stimulated by the presence of ATONIK AIII - 6 days for the *Sf. Pierre*

variety, and in the case of *Russian black* variety, AII-6, 9 or 12 days.

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