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Improvement of Vegetable Crops Cultivation Technology by Applying Biostimulant in Protected Area

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ABSTRACT

In 2017-2019, during the winter-spring crop rotation period the effect of organic biostimulant Fulvit on the tomato variety “Lusarpi F₁”, cucumber varieties “Nazrvan 45”, “Nare” and on the sweet pepper varieties “Loshtak” and “Narinj” have been studied in greenhouse conditions.

The fertilizer was introduced through foliar application method in nutritional form with 1/100 dosage, 3 times with 10-15 days’ intervals.

The research results have revealed that in comparison with the control variant in the rest investigated varieties Fulvit fertilizer has promoted the plants growth and development; it has also improved the fruit and seed quality as well as yield capacity and profitability.

Introduction

The production of organic agricultural products is expanding both in Armenia and worldwide, becoming one of the most promising and perspective sectors of agriculture.

Synthetic growth stimulants, fertilizers and pesticides have been used in the crop cultivation for many years, the residuals of which are stored in soil, water and then transferred to vegetable crops (Djuvelikyan, 1999, Bezuglova, 2002).

Organic agriculture is a system aimed to improve and encourage the agricultural production in view of nature protection, as well as social and economic development.

During the production of organic food no toxic or artificial materials, sustainable pesticides, chemical fertilizers or radiation is ever applied. This stimulates biodiversity, biological activities of soil and improves biological phases. Nevertheless, local organic seed varieties haven’t been produced in Armenia yet, which is an obstacle for the local varieties to be involved in the production of organic agriculture.

Organic fertilizers are recommended for producing organic, valuable and competitive seeds of local varieties for basic vegetable crops (tomatoes, sweet pepper, cucumber).

The liquid biostimulant Fulvit is an organic fertilizer manufactured by “EcoPlant” company, which contains

biologically active substances, humic and fulvic acids produced on biohumus base.

Our survey results have revealed that the use of Fulvit in Armenia and Nagorno-Karabakh Republic has had a positive impact on the growth, development, yield quality, disease and pest resistance, as well as on a number of other key indicators of vegetable crops. The aforementioned raised interest among the researchers and served as a background for the study and justification of the application effect of the mentioned fertilizer on the tomato variety “Lusarpi F₁”, cucumber varieties “Nazrvan 45” and “Nare”, sweet pepper varieties “Loshtak” and “Narinj”.

Materials and methods

In the glass greenhouse of the Scientific Center of Vegetable and Industrial Crops at the Ministry of Economy, RA, the effect of Fulvit fertilizer on the hybrid of tomato variety “Lusarpi F₁”, cucumber varieties “Nazrvan-45” and “Nare”, sweet pepper varieties “Loshtak” and “Narinj” was studied during the winter-spring crop rotation period, in 2017-2019. The plants transplanted in the greenhouse were treated with experimental fertilizer by foliar nutrition with the dose of 1/100. The foliar nutrition in the transplanted crops was implemented thrice, with 10-15-day interval during the vegetation period. Bio-liquid served as a control variant (standard), which was introduced with the same method (foliar nutrition) and doses.

The phenological and morphological observations of the plants were carried out throughout the whole vegetation period through the accepted method of State Variety Trial of Agricultural Crops (Fedin, 1985).

The fruits were sampled for chemical analyses at the start of fruiting stage, and just before the termination of the experiment. The dry matter content was identified by the refractometer “IGF-454B2M”, sugar content - by Bertrand’s method and vitamin C- by Moore’s method (Peterburgskiy, 1968).

Seedlings were grown in trays and the plants of the experimental crop varieties were planted in the greenhouse according to 90+60x50 cm scheme. Significance of differences in treatments was tested using the least significant difference (LSD) method. The LSD values were calculated at P<0.05 probability level (Dospekhov, 1985).

Results and discussions

Upon our experiments the effect of Fulvit fertilizer on the growth, development and yield capacity of vegetable

crops has been studied. It is worth mentioning that plants grown through Fulvit fertilizer had intense green color, which indicates on high chlorophyll content and intensive photosynthesis in the leaf chloroplasts.

The results of the study showed that depending on the application of the Fulvit fertilizer, the duration of phenological stages in the vegetable crops also changed (Table 1).

Table 1. Duration of phenological stages of vegetable crops depending on the application of Fulvit fertilizer (per days)*

Variants	Number of days from mass germination to				Duration of yielding period
	flowering	fruiting	first yield	last yield	
Tomato variety “Lusarpi F₁”					
Control	59	82	104	193	89
Fulvit	56	78	95	193	98
Cucumber variety “Nazrvan 45”					
Control	37	49	57	126	69
Fulvit	36	45	52	126	74
Cucumber variety “Nare”					
Control	50	50	63	104	41
Fulvit	48	47	53	110	51
Sweet pepper variety “Loshtak”					
Control	73	95	120	180	60
Fulvit	70	90	117	180	63
Sweet pepper variety “Narinj”					
Control	70	91	118	180	62
Fulvit	65	82	110	180	70

*Composed by the authors.

It should be noted that in the experimented crop varieties, where Fulvit fertilizer was applied the plant development stages accelerated depending on the crop and its variety. The number of days starting from germination to flowering stage was reduced by 1-5 days and to fruiting stage - by 3-5 days; as a result it affected the times of early yield formation as well. In the variant, where Fulvit fertilizer was applied the fruit ripening period was also accelerated by 3-10 days. The studied variants also differed by the duration of yielding period, which varied within 41–98 days depending on the crop and varieties. In the treated

variants, the cucumber variety “Nare” was distinguished by long yielding period (10 days longer than that of observed in the control variant). This pattern was observed in all experimented crops (Table 1).

The yielding period in the plants treated with Fulvit fertilizer started earlier than those in the control variant, which is a very important indicator, especially for greenhouse crops, since early yielding provides high price and consequently high profit level.

Analysis of the yield capacity indicators is significant for the evaluation of the new technology. Yield estimation has been conducted upon the research results; also the early and total yield amount has been determined. Analysis of yield data shows that the use of Fulvit fertilizer has promoted the increase of early and total yield amount. Depending on the crop species and its variety the use of Fulvit fertilizer provided 7.3 %-14.7 % growth in the total yield and 6.7 %-17.4 % growth in the early yield amount (Table 2).

According to the literature data the biochemical composition of the fruits of vegetable crops is conditioned by the morphobiological characteristics of the given species and varieties, as well as by different geographical origins, meteorological conditions and cultivation methods (Azaryan, Tadevosyan, 2014).

The data of table 2 indicate that in the variants, where the fruits were treated with Fulvit fertilizer the content of dry matters exceeds that of the control variant by 2.8 % in tomato fruit, by 4.6 % and 13.9 % in cucumber fruits, while in the varieties of sweet pepper the surplus made 4.1 % and 6.1 % respectively. The same regularity was marked in the data of total sugar content and vitamin C.

The research results evidence that in case of applying Fulvit fertilizer the net income was higher, which in its turn provided high profitability rate. Depending on the crop species and variety the latter fluctuated within the range of 91.2 %-173.7 % (Table 3).

Table 2. Vegetable crop yield capacity and qualitative indicators of fruit in case of Fulvit fertilizer application (2017-2019, kg /m²)*

Variants	Early yield, kg/m ²	Early yield surplus, %	Total yield, kg/m ²	Yield surplus, %	Dry matter, %	Sugar content %	Vitamin C mg/%
Tomato variety “Lusarpi F₁”							
Control	1.2	-	9.5	-	5.28	2.41	17.02
Fulvit	1.3	8.3	10.9	14.7	5.43	2.75	18.05
			LSD _{0.05} 1.1				
Cucumber variety “Nazrvan 45”							
Control	2.3	-	9.4	-	5.86	2.75	18.71
Fulvit	2.7	17.4	10.2	8.5	6.13	2.77	18.73
			LSD _{0.05} 0.7				
Cucumber variety “Nare”							
Control	3.0	-	11.3	-	3.31	1.44	6.05
Fulvit	3.2	6.7	12.4	9.7	3.77	1.51	6.25
			LSD _{0.05} 1.0				
Sweet pepper variety “Loshtak”							
Control	1.6	-	16.4	-	5.86	2.75	18.71
Fulvit	1.8	12.5	17.6	7.3	6.22	2.92	18.78
			LSD _{0.05} 0.9				
Sweet pepper variety “Narinj”							
Control	2.1	-	14.5	-	5.97	2.90	18.75
Fulvit	2.5	19.0	15.6	7.6	6.22	2.92	18.78
			LSD _{0.05} 0.5				

*Composed by the authors.

Table 3. The economic efficiency of vegetable crops due to application of Fulvit fertilizer (per 1000 m²)*

Variants	Total yield, centner	Gross product cost, thousand AMD	Production expenses, AMD	Net income, AMD	Profitability rate, %
Tomato variety "Lusarpi F₁"					
Control	95.0	3325	1950	1375	70.5
Fulvit	109.0	3815	1995	1820	91.2
Cucumber variety "Nazrvan 45"					
Control	94.0	4230	1780	2450	137.6
Fulvit	102.0	4590	1830	2760	150.8
Cucumber variety "Nare"					
Control		1920	995	925	92.9
Fulvit	106.0	2120	1050	1070	101.9
Sweet pepper variety "Loshtak"					
Control	16.4	4920	1950	2970	152.3
Fulvit	17.6	5280	1995	3285	164.6
Sweet pepper variety "Narinj"					
Control	14.5	5075	1950	3125	160.2
Fulvit	15.6	5460	1995	3465	173.7

*Composed by the authors.

Conclusion

The research results have testified that foliar nutrition with Fulvit fertilizer has had a positive effect on the

biomorphological, biochemical properties, as well as on the yield capacity of tomato, cucumber and pepper crops ensuring high level of profitability.

It is recommended to use Fulvit organic liquid fertilizer during the agro-technological activities in organic crop production and seed breeding for the main vegetable crops in greenhouse conditions which will significantly promote organic yield and seed production.

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