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The Effects of Different Plant Activators on Fruit and Seed Yield and Properties of Snack Pumpkin (*Cucurbita pepo* L.)

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Abstract
Pumpkin consists of the species of the genus Cucurbita in the *Cucurbitaceae* family. *C. pepo* and rarely *C. moschata* species are using as snack seeds growing in Turkey. This study was carried out to examine the effects of different plant activators on the fruit and seed yield and quality of the snack pumpkin which is observed in Cukurova University Pozanti Agricultural Research and Application Center, during 2015 and 2016 growing years. Crop-set (CR), Effective microorganisms (EM1), Endoroots soluble (ERS), Vitormone-Plus Drip (VIT), *Bacillus subtilis* OSU 142, *Bacillus megatorium* M3, *Azospirillum sp.* SP 245, *Spirulina platensis* (SIP) were used as plant activators. Ecocompost (ECO), Camli Botanica liquid organic fertilizer (BOT) and Zincon (ZIN) were used as organic fertilizer. Organic fertilizer (OF) and conventional fertilizer application (CONV.) were determined as the control group. In the experiment, the plant activators were applied to the plants alone, in combination with each other and with organic fertilizer. As a result of the study, the best result in fruit and seed yield in the snack pumpkin obtained from the applications in combination with organic fertilizers of plant activators. The highest value, fruits diameter, fruit length, fruit circumference were obtained from CONV. application. Finally, the best results in seed width, seed length and seed length/width ratio were obtained from organic fertilizer and EM1 + OG application.

Keywords: Snack pumpkin, plant activators, yield

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1. Introduction

Pumpkin consists of the species of the genus Cucurbita in the *Cucurbitaceae* family. The pumpkins used for the seeds are grown mostly in the Central Anatolia and Thrace Region in Turkey and they are consumed throughout the year. In recent years, pumpkin (*Cucurbita pepo* L.) seeds have had great attention in respect of their nutrient and health benefit content (Revathy and Sabitha 2013). Pumpkin seed (*Cucurbita pepo* L.) is high in oil, protein, and total unsaturated fatty acids and provides an important source of nutrition (Meru et al. 2017). Turkey produced 41 326 tonnes of snack pumpkin in 2017(Anonymous 2017). Nowadays snack pumpkin of cultivation is more the dry sowing areas than irrigated sowing areas (Fidan 2014). Due to this reason, there is a decrease in pumpkin yield. Yield of snack pumpkin are affected by cultural applications such as production technique, soil fertility, fertilization, irrigated agriculture. In order to increase soil fertility is made some applications such as crop rotation, green manure, compost, vermicompost and plant activators. Plant activators can be termed single or combined plant growth promoting rhizobacteria (PGPR); nitrogen fixing bacteria such as *Azospirillum* and *Azotobacter;* phosphate fixing bacteria such as *Bacillus subtilis*, *Bacillus firmus* and *Pseudomonas striata*; mycorrhizal (*Glomus fasciculatum, Glomus intraradices* and *Glomus aggregatum* etc.) and microalgae (*Spirulina platensis*). Moreover, plant activators can also be used together with protein, mineral substance, vitamin, plant extract, and amino acid etc. PGPR can promote plant growth

and development by fixing atmospheric nitrogen, producing siderophores that chelate iron and make it available to the plant root; solubilizing minerals such as phosphorus, producing phytohormones and synthesizing some compounds or enzymes that can develop plant growth. Indirect growth stimulation of plants is also connected with protection them against the effects of phytopathogens (Grobelak et al. 2015). The beneficial effects of PGPR have been demonstrated in many agricultural crop species. Three levels of phosphorus were applied with *Glomus mosseae* to wheat (*Triticum aestivum* L.) plants over two successive years. Mycorrhizal inoculation significantly increased root colonization. *G. mosseae* inoculated plants in both years exhibited a two-fold higher root colonization than the indigenous mycorrhizal colonization (Ortas and Bykova 2018). Tomato plants inoculated with rhizobacteria gave significantly higher yield compared to the control treatment in the first 4 weeks of harvesting period (Kidoglu et al. 2008). The production of hormones is suggested to be one of the mechanisms by which PGPR stimulate barley growth. Effective *Bacillus* species, such as OSU-142, RC07, M-13, P. polymyxa RC05, P. putida RC06, and R. capsulatus RC04, may be used in agriculture (Cakmakci et al. 2007). The purpose of this study is to investigate the effects of different plant activators on yield and properties in fruit and seed of snack pumpkin.

2. Materials and Methods

The experiment was carried out at Pozantı Agricultural Research and Application Center of Çukurova University during 2015 and 2016 growing seasons. 'Nusem' snack seed pumpkin and 'Beppo' naked seed pumpkin were used as plant material. Eight plant activators were used in this study; Crop-set (CR), contains crop fermentation of *Lactobacillus acidiophilus* and plant extract, manganese, copper, iron, zinc (Alltech Crop Science company). Effective microorganisms (EM1); contains photosynthesis bacteria, lactic acid bacteria, yeast, actinomycetes and molds (Kinagro Agriculture company). Endoroots soluble (ERS); contain *Glomus spp.* mycorrhizal (Bioglobal corporation). Vitormon Drip Plus (VIT) including *Azotobacter chroococum* + *Azotobacter vinelandii* (Bioglobal corporation) *Bacillus subtilis* OSU 142*, Bacillus megatorium* M3*, Azospirillum spp.* SP 245 were obtained from Yeditepe University, Turkey and *Spirulina platensis* (SIP) (Algbiotek company). Ecocompost (ECO) obtained from company Ekofarm, Camli Botanica liquid organic fertilizer (BOT; obtained from company Çamlı Feed) and Zincon (ZIN; which was obtained company Reva Agro) were used as organic fertilizer. Both plant activators and organic fertilizer provided from Turkey. Conventionally fertilizer (CONV.) have been used 100 kg N: 50 kg P_2O_5: 200 kg K_2O per ha. Seeds, in the first year of the experiment were planted in company the Atlas Seedlings on March 28st.2015 and second year of the experiment, on April 21st.2016, Çukurova University Biotechnology Research and Application Center was planted in greenhouses. Seedlings were taken to the field of planting at Pozantı Agricultural Research and Application Center. Total 1344 (24 application x 4 repetition x 14 seedlings) seedlings were planted for each cultivar. Seedlings were planted in the first year on April 21st.2015 and in the second year on May 09th.2016. In the experiment, the plant activators were applied to the plants alone or in combination with each other and with organic fertilizer. Organic fertilizer (OF) application with CONV. was determined as the control group. Each plant activator and organic fertilizer is applied at different times. Total 24 applications together with control were realized. These applications were carried out under four titles; 1) Sole plant activator application; CR, EM1, ERS, VIT, OSU 142, M3, SP 245, SIP. 2) Plant activators combination together with organic fertilizer applications; CR + OF, EM1+OF, ERS+OF, VIT+OF, OSU 142 + OF, M3+OF, SP 245+OF, *S*IP +OF. 3) Plant activators in combination with each other; OSU 142 + M3, OSU 142 + SP 245, M3 +SP 245. 4) Organic fertilizers; ECO, BOT, ZIN. The applications OF and CONV. were used as control. The application frequency, dose and application times are presented in Table 1.

Prior to land preparation, soil samples were taken and was analyzed in laboratory with Çukurova University the Faculty of Agriculture Department of Soil Science and Plant Nutrition. Fruits were collected from the plots and the following measurements were recorded: total fruit yield; fruits were harvested. The weight of each fruit were determined and divided to size of the plot. Fruits diameter, fruit length and fruit circumference (cm); five fruits were randomly selected from every repetition of each application and measured with a scale. Total seed yield; the seeds were removed and dried after all the fruits had been harvested and then seeds weighed taken from each plot. Per plant seed yield; seeds were weighed after had been dried seed and which obtained result divided into plant number, seed width, seed length, seed height/width ratio (mm); fifty seeds were used from every repetition of each application and measured by digital compass (± 0.1)). The experiment was established according to the split plot design with 4 repetitions. Plot size was 7 m^2 and 14 plants included in each the plot with 1 x 0.5 m between and

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within rows. Statistical analyzes were done by JMP 5.1 statistical package program. Tukey test was used to compare the means. Comparisons that yielded $P \leq 0.001$, $P \leq 0.01$ and $P \leq 0.05$ were considered to be statistically significant.

Table 1. Dose, time, form and frequency and of plant activators and organic fertilizer application

Plant activators	
1) CR	CR applied 60 ml in ha area. First application time, at the beginning of flowering. The next application time at the same dose 10 days apart.
2) EM1	Mixed 1l EM1 with 18 l water and then completed to 20 l. 4 l were taken from this mixture. The roots of the seedlings were kept in this mixture for 1 minutes and then were transplanted to the field. The application was made once every two weeks.
3) ERS	Application dose 250 g/da. Application time, the seedling has been dipped before planting. It was used once during the production season.
4) VIT	Once application, the seedling has been dipped before planting. The second application was made 2 months after the planting. Application dose 200 cc/da.
5) *Bacillus subtilis* OSU 142 6) *Bacillus megatorium* M3 7) *Azospirillum sp*. SP 245	1/10 mixture was prepared from the bacterial isolate and taken at the present bacterial concentration (cells / ml 10^9). This prepared blend (cell/ml 10^7) plants have been dipped for 20 minutes before planting and then planted. It was used once during the production season.
8)SIP	45 g/l *Spirulina spp*. solution has been prepared and 200 cc of this solution has been applied to the plants, near the seedling roots. It was used once during the production season.
Organic Fertilizer	
9) ECO	Applied before planting per plant 250 g and after 1 month planting 200 g per plant
10)BOT	Application dose 600 cc/da. Applied in three periods. The first application of seedling planted after a week. Second application, from this application after a month. Third application was made when fruits first occur
11) ZIN	Apply when planted seedling after 15 day, 750 cc-1 l/ da and second application was given at 750 cc-1 l / ha when the first fruits were observed.

3. Results and Discussion

The results of soil analysis showed that the soil is slightly alkaline, pH: 7.5-7.7, organic matter contents ranged from 1.7% to 1.8%. As a result of, measurements were made in fruits; total fruit yield (tonnes ha^{-1}), fruit diameter (cm), fruit length (cm) and fruit circumference (cm). The findings of these measurements presented in Table 2- 3. When the average data of both years are examined the total fruit yield the highest value obtained from ERS + OF (4.54 tonnes ha^{-1}) application, the lowest value ZIN (1.41 tonnes ha^{-1}) application (Table 2).

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Table 2. Total fruit yield values of different plant activator and organic fertilizer applications in Nusem and Beppo cultivars (Tonnes ha^{-1})

Applications	2015		Application x year	2016		Application x year	Application Average
	Nusem	Beppo		Nusem	Beppo		
CR	3.59 D-V	3.16 F-W	3.37 F-L	1.11 T-X	1.06 VWX	1.09 QR	2.23 EFG
EM1	2.50 I-X	2.73 H-X	2.62 I-R	1.09 U-X	1.13 T-X	1.11 QR	1.86 FG
ERS	3.52 D-V	4.35 C-M	3.94 C-K	1.21 S-X	1.72 M-X	1.46 N-R	2.70 C-F
VIT	2.78 H-X	4.26 D-N	3.52 E-K	1.05 VWX	0.93 VWX	0.99 R	2.26 EFG
OSU	1.82M-X	4.27 D-N	3.04 H-O	1.19 S-X	1.04 VWX	1.12 QR	2.08 FG
M3	2.93 G-X	3.48 D-V	3.20 G-N	1.14 T-X	1.47 O-X	1.31 O-R	2.26 EFG
SP 245	2.21 I-X	2.43 I-X	2.32 K-R	1.55 N-X	1.40 P-X	1.47 N-R	1.90 FG
SIP	4.03 D-P	5.74 A-F	4.88 A-G	1.51 O-X	1.70 M-X	1.60 L-R	3.24 B-E
ECO	4.38 C-M	6.13 A-D	5.25 A-E	3.12 F-W	3.40 E-W	3.26 G-M	4.26 AB
BOT	2.77 H-X	2.14 J-X	2.46 J-R	0.85 VWX	1.18 S-X	1.04 R	1.75 FG
ZIN	2.92 G-X	0.25 X	1.58 M-R	1.29 Q-X	1.17 S-X	1.23 PQR	1.41 G
CR+OF	3.79 D-U	7.44 AB	5.62 ABC	2.45 I-X	3.88 D-S	3.16 G-N	4.39 AB
EM1+OF	4.64 C-L	5.81 A-F	5.22 A-E	2.23 I-X	3.95 D-R	3.09 H-N	4.16 AB
ERS+OF	4.85 B-J	7.45 AB	6.15 A	2.05 K-X	3.81 D-T	2.93 I-P	4.54 A
VIT+OF	3.97 D-Q	8.04 A	6.00 AB	1.94 L-X	3.52 D-V	2.73 I-R	4.37 AB
OSU+OF	4.90 B-I	5.75 A-F	5.33 A-D	1.89 M-X	3.41 D-W	2.65 I-R	3.99 AB
M3+OF	4.17 D-O	6.12 A-E	5.14 A-F	2.40 I-X	3.57 D-V	2.98 I-P	4.06 AB
SP 245+OF	4.00 A-Q	6.99 ABC	5.50 ABC	2.34 I-X	4.03 D-P	3.18 G-N	4.34 AB
SIP+OF	3.99 D-Q	5.62 A-G	4.81 A-H	2.38 I-X	3.31 F-W	2.84 I-Q	3.82 ABC
OSU+M3	2.87 H-X	3.95 D-R	3.41 F-K	1.01 VWX	1.17 S-X	1.09 QR	2.25 EFG
OSU+SP245	4.15 D-O	4.31 C-M	4.23 B-J	1.24 R-X	0.72 WX	0.98 R	2.61 DEF
M3+SP 245	3.16 F-W	3.97 D-Q	3.56 D-K	1.21 S-X	1.22 S-X	1.21 PQR	2.39 D-G
OF	3.97 D-Q	4.70 C-K	4.33 B-I	2.14 J-X	2.89 H-X	2.52 J-R	3.43 A-D
CONV.	5.39 A-H	5.38 A-H	5.38 ABC	3.17 F-W	3.50 D-V	3.42 G-M	4.36 AB
Year x cultivars	3.64 B	4.77 A		1.73 D	2.30 C		
Year	4.20 A			2.02 B			

(N.S.: Not Significant,***: p<0.001; **: p<0.01; * : p<0.05, Tyear***=0.17, Tyearxcultivar**=0.33, Tyearxappxcult*=1.92, Tappxyear***= 1.78, Tapp***= 1.15)

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The highest value, fruits diameter (17.82 cm), fruit length (22.34 cm), fruit circumference (55.43 cm) were obtained from CONV. application and the lowest value fruit diameter (11.83 cm), fruit length (15.57 cm) and fruit circumference (36.45 cm) were taken from sole application of EM1 (Table 3).

Table 3. Different plant activator and organic fertilizer applications Nusem and Beppo cultivars fruits diameter, fruit length and fruit circumference (cm)

Applications	2015 (Applications x year)			2016 (Applications x year)		
	Fruits diameter[1]	Fruit length[2]	Fruit circumference[3]	Fruits diameter	Fruit length	Fruit circumference
CR	15.10 F-L	21.04 A-F	45.40 H-O	10.54 MN	13.70 L	33.11 Q
EM1	13.41 J-M	18.03 F-K	40.70 J-Q	10.25 N	13.10 L	32.20 Q
ERS	16.46 A-I	21.03 A-F	50.16 B-J	12.11LMN	14.53 JKL	38.05 M-Q
VIT	15.39 E-K	20.70 A-F	47.25 D-M	10.61 MN	13.31 L	33.43 Q
OSU	14.94 H-L	18.47 E-I	45.72 H-N	10.62 MN	14.45 KL	33.34 Q
M3	15.03 H-L	19.93B-G	45.13 H-O	11.45 MN	15.69 H-L	35.96 OPQ
SP 245	13.09 J-N	18.98D-H	39.92 L-Q	11.68 MN	14.40 KL	36.70 N-Q
SIP	18.29 A-E	21.96 A-E	55.98 A-F	12.80 K-N	16.53 G-L	40.19 L-Q
ECO	18.57 A-D	22.18 A-E	56.52 A-E	16.04 B-J	20.92 A-F	50.39 A-I
BOT	13.34 J-M	18.52 E-I	40.54 K-Q	10.59 MN	13.45 L	33.41 Q
ZIN	14.72 I-L	18.35 E-J	44.17 I-P	11.21 MN	14.91 I-L	35.22 PQ
CR+OF	18.89 AB	21.56 A-F	56.51 A-E	15.59 D-K	19.77 B-G	48.95 B-L
EM1+OF	18.65 ABC	21.81 A-F	56.98 ABC	15.90 B-J	20.74 A-F	49.94 B-K
ERS+OF	19.12 A	23.14 AB	59.71 A	15.01 H-L	19.34 B-H	47.14 E-M
VIT+OF	19.22 A	22.99ABC	58.02 AB	15.41 E-K	19.72 B-G	48.39 C-L
OSU+OF	18.03 A-G	22.70 A-D	56.73 A-D	15.06 G-L	19.18 C-H	47.31 D-M
M3+OF	18.07 A-F	22.15 A-E	55.32 A-G	15.70 C-K	20.40 A-F	49.31 B-L
SP 245+OF	18.62 ABC	22.43A-D	56.70 A-D	16.01 B-J	20.18 A-G	50.29 A-I
SIP+OF	17.78 A-H	22.09 A-E	54.56 A-H	15.44 E-K	20.30 A-G	48.49 C-L
OSU+M3	15.16 F-K	20.01B-G	45.89 G-N	10.43 MN	14.40 KL	32.73 Q
OSU+SP 245	16.87 A-I	21.10 A-F	50.97 A-I	10.18 N	13.16 L	31.63 Q
M3+SP 245	15.26 F-K	20.48 A-F	46.11 G-N	10.44 MN	13.72 L	32.78 Q
OF	17.07 A-I	21.24 A-F	51.33 A-I	14.88 H-L	19.40 B-H	46.74 F-M
CONV.	18.49 A-D	24.03 A	57.02 ABC	17.14 A-I	20.65 A-F	53.83 A-H

(1; Tappxyear***= 2.99, 2; Tappxyear***= 3.85, 3; Tappxyear***= 9.49)

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According to the results highest total seed yield (107.74 g/m^2), per plant seed yield (53.87 g/plant) were obtained from application of CR + OF while the lowest value (35.12 g/m^2), (18.78 g/plant) obtained of EM1 from sole application (Table 4 and Table 5).

Table 4. Total seed yield values of different plant activator and organic fertilizer applications in Nusem and Beppo cultivars (g/m^2)

Applications	2015		Applications x year	2016		Applications x year	Application average
	Nusem	Beppo		Nusem	Beppo		
CR	77.94 G-W	69.79 J-Z	73.87 E-K	22.54 YZ	24.56 XYZ	23.55 OP	48.71 E
EM1	48.52 P-Z	46.30 P-Z	47.41 J-P	20.15Z	25.50 XYZ	22.82 P	35.12 E
ERS	70.40 I-Z	96.47 C-P	83.44 E-I	29.23 V-Z	26.64 W-Z	27.93NOP	55.69 DE
VIT	60.92 M-Z	76.64 G-X	68.78 F-L	24.78 XYZ	25.74 W-Z	25.26 OP	47.02 E
OSU	37.47 R-Z	74.06 H-Y	55.76 I-P	28.99 V-Z	23.46 YZ	26.23 OP	40.99 E
M3	53.31 O-Z	76.37 G-X	64.84 G-M	27.14 V-Z	37.05 S-Z	32.09M-P	48.47 E
SP 245	37.33 R-Z	51.89 O-Z	44.61 K-P	54.76 N-Z	54.76 N-Z	43.09 K-P	43.85 E
SIP	88.92 E-S	120.99 A-J	104.95 A-E	38.25 R-Z	38.24 R-Z	38.25 L-P	71.60 CD
ECO	85.22 E-S	118.52 A-K	101.87 A-F	87.80 E-S	89.41 D-R	88.60 D-I	95.23 AB
BOT	66.88 K-Z	43.24 Q-Z	55.06 I-P	20.44 Z	27.34 V-Z	23.89 OP	39.48 E
ZIN	56.83 N-Z	83.00 F-U	69.92 F-L	23.79 YZ	26.29W-Z	25.04 OP	47.48 E
CR+OF	102.94 C-O	135.79 A-E	119.37A-D	60.78M-Z	131.44A-F	96.11 B-G	107.74 A
EM1+OF	96.92 C-P	113.69 B-L	105.30 A-E	63.68 L-Z	122.15A-I	92.92 C-H	99.11 AB
ERS+OF	123.98A-H	146.45ABC	135.22 A	51.28O-Z	69.81 J-Z	60.55 H-N	97.88 AB
VIT+OF	91.06 D-Q	169.21 A	130.14 AB	47.54 P-Z	82.35 F-U	64.95G-M	97.54 AB
OSU+OF	84.96 E-S	119.46 A-J	102.21 A-F	56.79 N-Z	76.64 G-X	66.72 G-L	84.46 BC
M3+OF	112.67B-M	127.18A-G	119.92A-D	69.55 J-Z	93.62 D-Q	81.58 E-J	100.75AB
SP 245+OF	83.90 E-S	126.45A-G	105.18 A-E	56.63 N-Z	88.42 E-S	72.53 E-K	88.85ABC
SIP+OG	98.28 C-P	161.12 AB	129.70 AB	66.50 K-Z	71.97 H-Z	69.23 F-L	99.47 AB
OSU+M3	58.08 N-Z	84.93 E-S	71.51 E-L	20.57 Z	29.45 V-Z	25.01 OP	48.26 E
OSU+SP 245	96.99 C-P	71.35 I-Z	84.17 E-I	23.45 YZ	24.00 YZ	23.72 OP	53.95 DE
M3+SP 245	70.97 I-Z	66.23 K-Z	68.60 F-L	23.58 YZ	31.42 T-Z	27.29NOP	47.95 E
OF	79.10 G-V	93.23 D-Q	86.16 D-I	54.04 O-Z	60.22 N-Z	57.13 I-O	71.64 CD
CONV.	141.43 A-D	106.70C-N	124.06ABC	83.40 F-T	91.37 D-Q	87.39 D-I	105.72AB
Year x cultivar	80.21 B	99.13 A		43.01 D	57.14 C		
Year	89.67 A			50.08 B			

(Tyear***=3.42, Tyearxcultivar; N.S., Tyearxappxcult***=36.99, Tappxyear***=34.25, Tapp***=22.13)

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Table 5. Different plant activator and organic fertilizer applications Nusem and Beppo cultivars perplant seed yield (g/plant)

Applications	2015		Applications x year	2016		Applications x year	Application average
	Nusem	Beppo		Nusem	Beppo		
CR	38.97 G-W	33.19 K-Z	36.08 F-L	11.27 Z	12.28 XYZ	11.77 P	23.92 F
EM1	24.26 P-Z	28.03 N-Z	26.14 K-P	10.07 Z	12.75 W-Z	11.41 P	18.78 F
ERS	35.20 I-Z	48.23 C-P	41.72 E-K	15.11 U-Z	13.32 W-Z	14.21 NOP	27.97 DEF
VIT	30.46 M-Z	38.37 G-X	34.41 G-M	11.92 YZ	12.87 W-Z	12.39 OP	23.40 F
OSU	18.73 R-Z	37.56 G-Y	28.15 J-P	15.04 U-Z	11.73 YZ	13.38 NOP	20.76 F
M3	26.65 O-Z	37.85 G-Y	32.25 H-M	13.57 W-Z	21.01 Q-Z	17.29 M-P	24.77 F
SP 245	18.66 R-Z	25.94 O-Z	22.30 L-P	15.71 S-Z	27.38 N-Z	21.54 L-P	21.92 F
SIP	44.46 D-R	60.49 A-J	52.47 A-F	25.49 O-Z	19.12 R-Z	22.31 L-P	37.39 CD
ECO	47.69 C-P	59.73 A-K	53.48 A-E	43.90 D-R	44.70 D-R	44.30 D-J	48.89 AB
BOT	33.44 K-Z	25.39 O-Z	29.41 I-O	10.22 Z	13.67 W-Z	11.94 P	20.68 F
ZIN	28.41 N-Z	41.50 E-T	34.95 G-L	11.89 YZ	13.14 W-Z	12.52 OP	23.74 F
CR+OF	51.47 C-O	67.89 A-D	59.68 A-D	30.39 M-Z	65.72 A-F	48.05 B-H	53.87 A
EM1+OF	48.46 C-P	59.26 B-L	52.65 A-F	31.84 L-Z	61.07 A-I	46.46 C-I	49.55 AB
ERS+OF	61.99 A-H	73.22 ABC	67.61 A	25.64 O-Z	34.90 I-Z	30.27 I-N	48.94 AB
VIT+OF	40.24 F-V	84.60 A	62.42 ABC	23.77 P-Z	41.17 E-U	32.47 H-M	47.45 ABC
OSU+OF	42.48 D-R	59.73 A-J	51.10 A-G	28.39 N-Z	38.32 G-X	33.36 H-M	42.23 BC
M3+OF	56.84 B-M	63.59 A-G	59.96 A-D	34.77 J-Z	46.81 D-Q	40.79 E-K	50.37 AB
SP 245+OF	41.95 D-S	63.22 A-G	52.59 A-F	28.31 N-Z	44.21 D-R	36.26 F-L	44.42 ABC
SIP+OF	49.14 C-P	80.56 AB	64.85 AB	33.25 K-Z	35.98 H-Z	34.61 G-L	49.73 AB
OSU+M3	32.57 L-Z	42.46 D-R	37.51 E-L	10.29 Z	14.72 V-Z	12.50 OP	25.01 F
OSU+SP245	48.49 C-P	35.67 I-Z	42.08 E-K	11.72 YZ	12.00 YZ	11.86 P	26.97 DEF
M3+SP 245	35.48 I-Z	41.04 E-U	38.26 E-L	11.79 YZ	15.50 T-Z	13.64 NOP	25.95 EF
OF	43.35 D-R	46.61 D-Q	44.98 D-J	27.02 O-Z	30.11 M-Z	28.56 J-P	37.77 CDE
CONV.	66.84 A-E	56.33 C-N	60.09 A-D	41.70 D-T	45.68 D-Q	43.69 D-J	51.89 AB
Year x cultivar	40.24 B	50.19 A		21.79 D	28.67 C		
Year	45.21 A			25.23 B			

(Tyear***=1.71, Tyearxcultivar=N.S., Tyearxappxcult***=18.57, Tappxyear***=17.20, Tapp***=11.11)

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When the number of seeds per fruit were examined, ESR + OF (341.89 units) was the leading one according to other applications. From ZIN application (182.55 units) was taken as the least number of seeds per fruit (Table 6). The highest value in the number of seeds per fruit, were provide from ESR + OF (341.89 unit) application while at least the number of seeds per fruit was taken from ZIN application (182.55 unit) (Table 6).

Table 6. Different plant activator and organic fertilizer applications Nusem and Beppo cultivars per plant number of seeds (unit)

Applications	2015		Application x year	2016		Application x year	Application average
	Nusem	Beppo		Nusem	Beppo		
CR	244.06 D-U	238.66 D-V	241.36 C-H	117.20 T-W	141.25Q-W	129.22 IJK	185.29 E
EM1	253.33 C-U	278.80 B-R	266.06 B-G	115.65 T-W	133.75 R-W	124.70 IJK	195.38 DE
ERS	278.10 B-R	295.83 A-O	286.96 B-E	120.00 S-W	187.66 K-W	153.83H-K	220.40 DE
VIT	295.45 A-O	325.48 A-K	310.46 A-D	150.25 O-W	139.41 R-W	144.83 IJK	227.65 DE
OSU	258.60 C-T	321.66 A-K	290.13 B-E	154.25 N-W	140.72Q-W	147.48H-K	218.80 DE
M3	286.09 B-Q	312.64 A-L	299.36 A-E	153.41 O-W	189.75 J-W	171.58G-K	235.47CDE
SP 245	214.19G-W	220.29 F-W	217.24 D-I	150.07 O-W	230.52 E-V	190.29 F-J	203.77 DE
SIP	278.12 B-R	357.07 A-G	317.60 ABC	188.79 J-W	193.85 I-W	191.32 F-J	254.46BCD
ECO	254.25 C-T	340.75 A-H	297.50 A-E	323.71 A-K	346.46 A-G	335.08ABC	316.29 A
BOT	265.88 C-S	264.71 C-S	265.29 B-G	95.66 VW	138.25 R-W	116.95 JK	191.12 E
ZIN	219.73 F-W	200.00 H-W	209.86 E-J	142.77 P-W	167.72 L-W	155.2 H-K	182.55 E
CR+OF	365.70 A-F	343.01 A-H	354.36 AB	249.97 C-U	333.78 A-J	291.88 B-E	323.12 A
EM1+OF	303.43 A-M	351.10 A-G	327.26 ABC	241.35 D-V	377.00 A-D	309.17A-D	318.22 A
ERS+OF	390.57ABC	391.19 ABC	390.88 A	273.90 B-R	311.92 A-L	292.91 B-E	341.89 A
VIT+OF	253.76 C-T	432.73 A	343.24 AB	255.64 C-T	331.98 A-K	293.81 B-E	318.53 A
OSU+OF	305.35 A-M	347.95 A-G	326. 65 ABC	263.45 C-S	342.06 A-H	302.76 A-E	314.70 AB
M3+OF	286.26 B-Q	362.97 A-F	324.61 ABC	287.77 A-P	331.97 A-K	309.87A-D	317.24 A
SP 245+OF	323.31 A-K	337.90 A-I	330.61 ABC	264.12 C-S	369.87 A-E	316.99ABC	323.80 A
SIP+OF	366.77 A-E	343.68 A-H	355.23 AB	245.62 C-U	315.70 A-K	280.66 B-F	317.94 A
OSU+M3	299.52 A-N	338.57 A-I	319.05 ABC	83.41 W	95.88 VW	89.65 K	204.35 DE
OSU+SP 245	276.39 B-R	293.56 A-O	284.97 B-F	107.50UVW	198.00H-W	152.75H-K	218.86 DE
M3+SP 245	271.77 B-R	265.63 C-S	268.70 B-F	145.30 P-W	164.40M-W	154.85H-K	211.77 DE
OF	301.84 A-M	349.16 A-G	325.50 ABC	235.91 D-V	291.61 A-O	263.76B-G	294.63ABC
CONV.	413.35 AB	257.49 C-T	335.42 ABC	306.36 A-M	316.67 A-K	311.51A-D	323.46 A
Year x cultivar	291.91 B	315.45 A		194.67 D	241.26 C		
Year	303.68 A			217.96 B			

(Tyear***=9.55, Tyearxcultivar*=17.73., Tyearxappxcult**=103.23, Tappxyear***=95.58, Tapp***=61.70)

Seed width, seed length and seed length/width the highest value were obtained application of OF (9.91 mm), EM1+OF (18.13 mm) and EM1+OF (1.87); whereas the lowest values were obtained from application EM1 (8.79 mm), SP 245 (16.03 mm) and SP 245 (1.77) (Table 7).

Table 7. Different plant activator and organic fertilizer applications Nusem and Beppo cultivars of seed width, seed length, seed height/width ratios (mm)

Applications	2015 (Applications x year)			2016 (Applications x year)		
	Seed width[1]	Seed length[2]	Seed length / width[3]	Seed width	Seed length	Seed length / width
CR	9.40 A-H	17.16 A-K	1.83 AB	8.35 J	15.51 KL	1.85 AB
EM1	9.21 B-J	16.95 C-L	1.84 AB	8.37 IJ	15.31 L	1.82 AB
ERS	9.50 A-H	17.51 A-I	1.85 AB	8.54 HIJ	15.82 H-L	1.85 AB
VIT	9.28 A-J	16.85 D-L	1.82 AB	8.55 HIJ	15.52 KL	1.82 AB
OSU	9.13 B-J	16.74 E-L	1.84 AB	8.84 D-J	15.69 JKL	1.77 AB
M3	9.23 B-J	16.92 D-L	1.83 AB	8.86 D-J	16.30 G-L	1.83 AB
SP 245	9.52 A-H	16.72 E-L	1.78 AB	8.65 G-J	15.34 L	1.77 AB
SIP	9.58 A-G	17.87 A-G	1.87 AB	9.04 C-J	16.23 G-L	1.79 AB
ECO	10.26 A	18.78 A	1.84 AB	9.26 A-J	17.26 A-K	1.86 AB
BOT	9.22 B-J	16.59 E-L	1.81 AB	8.81 E-J	15.61 KL	1.77 AB
ZIN	9.18 B-J	16.61 E-L	1.81 AB	8.89 D-J	15.72 I-L	1.76 AB
CR+OF	10.08 AB	18.57 A-D	1.84 AB	9.58 A-G	17.44 A-	1.81 AB
EM1+OF	10.01 ABC	18.74 ABC	1.88 A	9.41 A-H	17.52 A-H	1.86 AB
ERS+OF	9.85 A-D	18.30 A-E	1.86 AB	9.01 C-J	16.65 E-L	1.84 AB
VIT+OF	10.15 AB	18.59 A-D	1.84 AB	9.33 A-J	16.99 B-L	1.81 AB
OSU+OF	10.02 ABC	18.58 A-D	1.86 AB	9.13 B-J	16.48 F-L	1.80 AB
M3+OF	9.50 A-H	17.81 A-G	1.87 A	9.40 A-H	17.04 A-L	1.81 AB
SP 245+OF	9.78 A-E	18.31 A-E	1.87 AB	9.39 A-I	17.20 A-K	1.83 AB
SIP+OF	9.74 A-F	18.22 A-F	1.87 AB	9.17 B-J	17.00 A-L	1.85 AB
OSU+M3	9.22 B-J	16.85 D-L	1.86 AB	8.65 G-J	15.57 KL	1.79 AB
OSU+SP 245	9.38 A-I	17.47 A-J	1.86 AB	8.80 E-J	15.55 KL	1.76 AB
M3+SP 245	9.53 A-H	17.77 A-G	1.86 AB	8.75 F-J	15.50 KL	1.77 AB
OF	10.12 AB	18.78 AB	1.86 AB	9.70 A-F	16.63 E-L	1.74 B
CONV.	9.63 A-G	17.68 A-G	1.87 AB	9.82 A-E	17.76 A-G	1.80 AB

(1,2,3; Tappxyear=N.S.)

When the two-year data of fruit and seed measurements were evaluated in general, there were decreases in different rates in the second year of the experiment compared to the first year. It is thought that this may be due to the differences in the environmental conditions and the activity of the pumpkin yellow mosaic virus transmitted to the field. In the mycorrhizal treatments an increase was recorded in the yield of root, shoot and fruit of tomato (Canbolat 2016). 4 different cucumber hybrids F1 were inoculated by 3 AMF [*Glomus intraradices*, *Glomus etunicatum* and *Gigaspora margarita*]. As a result, AMF-

inoculated seedlings had shorter shoots and longer roots than non inoculated (Tüfenkçi et al. 2012). In tomato, root infection rate increased with Symbion VAM (*Glomus fasciculatum*) inoculation and in parallel with this increase plant growth and total and marketable yield increased (Öztekin and Ece 2014). Similarly, in our study, total fruit yield was obtained most from ERS + OF application. The increase was indicated in the shoot, length of root, fresh and dry weight with the *Azospirillum* inoculation (Rathore 2012). *Bacillus* T8 and *Bacillus* OSU-142 alone or in combination have a great potential to increase the yield in quince (Arıkan et al. 2013). *Azospirillum* biofertilizer can be used in combination with 80% chemical nitrogen for enhance crop yield in rice plant (Islam et al. 2012). Peanut yield increased % 37 after seed treatment with *B. subtilis* A-13 (Turner and Backman 1991). Dual and triple combination inoculations of N2-fixing *Bacillus* OSU-140 and OSU-142, significantly increased yield of barley and sugar beet compared with single inoculations of OSU-142 and M-13. However, dual inoculation of N2-fixing OSU-140 and P-solubilizing M-13 did not always significantly increase yield of sugar beet and yield of barley (Şahin et al. 2004). Karlidag et al. (2007) reported that *Bacillus* M3 and OSU-142 or *Microbacterium* FS01 in combination have the potential to increase the yield, growth and nutrition of apple trees. Dursun et al. (2010) was reported that *Pantoea agglomerans* FF, *Acinetobacter baumannii* CD-1 and *Bacillus megaterium*-GC subgroup A. MFD-2 have a great potential to increase the yield, growth and mineral contents of tomato and cucumber vegetable species. Other scientist found similar results in studies related to the use of plant activator in combination with each other or alone (Orhan et al. (2006); Elkoca et al. (2007); Elwan and Abd El-Azeem 2015). In our study when compared other studies obtained different results. These reason for this may be different factors such as plant activators, plant material and environment conditions. Habibi et al. (2011) reported that maximum seed yield, oil yield and fruit yield were obtained with treatment that pumpkin seeds inoculated with free-living nitrogen fixing bacteria (NO) and phosphate solubilizing bacteria (PO) + 50% organic fertilizer. Organic tomato growing were used two plant activators (Crop-Set and ISR 2000) and two microbial fertilizers (Bionem and Natural Bioplasma) and consequently it was observed that yield ranged from 48.7 to 72.3 tonnes ha^{-1} and early yield ranged from 26.5 to 47.2 tonnes ha^{-1} (Ünlü and Padem 2009). As a result of the use of plant activators in combination with organic fertilizers, Kırkağaç 637 and Galia C8 melon varieties have positive effects on yield, quality, plant growth and nutritional status (Bayram 2014). Similar results in our study were obtained when compared to the results of these studies.

4. Conclusion

Results indicated in this study the best result in fruit and seed yield in the snack pumpkin have obtained from the applications in combination with organic fertilizers of plant activators. In the studies to increase the yield and quality of snack pumpkin, it is recommended to that plant activators that are resistant to potential diseases and pest be added at the experimental location as well as to increase the yield and quality.

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