Original Research Article

The Effect of Different Organic Nutrients on Some Quality Properties of Popcorn (*Zea mays* L. *everta*)

ABSTRACT

Aims: Study was to aimed find out effect of different organic nutrients on some quality properties of popcorn.
Study design: Trial was designed in complete randomized block design with tree replications. Ant-Cin-98 popcorn cultivar was used in the study. Each parcel comprised 4 lines. The planting was made into a depth of 5-6 cm along the lines 5 meters long with a row spacing of 70 cm and intra row of 20 cm.
Place and Duration of Study: This study was conducted in Diyarbakır - Cermik conditions of Turkey between 2010 and 2011.
Methodology: The effect of conventional and fifteen different organic materials (torf, compost, cattle manure, chicken manure, horse manure, sheep manure, pigeon manure, vermicompost, seaweed + cattle manure, compost + humic acid, cattle manure + humic acid, chicken manure + humic acid, horse manure + humic acid, sheep manure + humic acid, torf + humic acid) to some quality parameters of popcorn were researched in the study.
Results: According to the investigated results, the highest and the lowest values were ranked between 19.98% (torf + humic acid) and 17.26% (vermicompost) for cob ratio, 138.65 g (seaweed + cattle manure) and 122.48 g (chicken manure) for 1000-kernel weight, 81.29 kg hl^{-1} (horse manure + humic acid) and 75.62 kg hl^{-1} (vermicompost) for test weight, 19.71 cm^3 g^{-1} (torf) and 17.17 cm^3 g^{-1} (sheep manure + humic acid), for popping volume 5.92% (torf) and 3.65% (horse manure + humic acid) for number of unpopped kernel.
Conclusion: Higher values obtained from organic nutrient sources than conversional application in all tested quality parameters. The implementation of organic fertilizers together with humic acid in popcorn produced better results in comparison to alone implementation of organic fertilizers. Also it was determined that using of natural enemies of *Trichogramma* spp against to corn borer can be possible without any chemicals.

Keywords: Organic nutrients, popcorn, popping volume, test weight

1. INTRODUCTION

The corn is also used in human nutrition directly and indirectly in addition to the use as industrial raw material and animal feed in the world. Although dent corn *(Zea mays* L. *indentata)* varieties comprise the vast majority of corns grown both in world and in Turkey, no statistics related to the cultivation area, manufacture and consumption amount of popcorn *(Zea mays* L. *everta)* in Turkey. It is reported that planting is made around the provinces of Adana, Canakkale, Adapazari, Antalya, Isparta and Burdur, in Aegean and Mediterranean Regions of Turkey [1]. Consumption of popcorn is increasing every passing day in Turkey.

The sub type of corn having grains popped when heated is popcorn. Popcorn is directly used in human nutrition. It generates pressure inside the grain through expansion when the humidity in the endosperm is heated because its grain is hard, its hull is thick and impermeable. At the same time the starch in the endosperm transforms with the effect of heat. The hull can't resist this pressure and bursts by splitting suddenly. The volume of the grains burst expands and they are eaten by salting or adding oil. Its consumption rises also in Turkey because of low cost and easy to prepare with popping machines, in pans or pots. Popcorn is commonly consumed while watching cinema and soccer matches and television during winter months. Additionally, it is preferred much by children [2].

Nowadays environmental pollution has reached a significant level as a result of the use of synthetic and chemical inputs in excessive amounts due to the production increase within conventional agriculture system. Organic fertilizers/matters, which are essential inputs of organic agriculture systems that have become widespread in parallel with the interest of people in organic products, are made available for producers under a great variety of names and contents in the market. It is necessary to utilize these matters in various ways to prevent environmental pollution caused by wastes, and to enhance organic matter level of our soil.

Different results have been obtained in studies conducted in different parts of the world regarding the subject of the study. Anac and Okur [3] have reported that application of Biofarm (certified organic fertilizer) and farm fertilizer as organic fertilizer (uncertified) to trial soil has led to significant increase in dry weight, mineral content and efficiency of corn compared to control. Yazici and Kaynak [4] have reported that seaweed increases yield and quality in organic farming, regulate the growth of plants, increase resistance to pests and diseases, improves the structure of the soil. Seker and Ersoy [5] have investigated the effects of different doses of compost, cattle manure, chicken manure and leonardit on the soil properties and the development of corn (*Zea mays* L.). They found as a result of the research that type and dose of used organic fertilizer affects soil properties and the corn's growth.

Shafiq et al. [6] have conducted a study to determine the effect of four organic (chicken manure, farmyard manure, biofertilizer) and chemical fertilizer on efficiency and growth of two maize varieties. The researchers have stated they have found parameters such as plant height, seed number, 1000-kernel weight, grain yield and net profitability in the parcels where chemical fertilizers were applied higher when compared to other parcels and this has been followed by chicken manure applied parcels.

Selcuk and Tufenkci [7] have found that increasing humic acid application to corn has provided significant increase in number of grains per cob, cob length, plant height, 1000-kernel weight and the number of cobs. Cengiz et al. [8] have conducted a study to determine the effect of synthetic and organic fertilizers on yield and quality of the corn plant. They have reported that according to the results obtained, the effect of organic preparations and organic fertilizers in the trials to yield and yield factors is at least as favorable commercial fertilizers.

In this study, it was aimed determining the effect of some organic nutritional sources (torf, compost, cattle manure, chicken manure, horse manure, sheep manure, pigeon manure, vermicompost, seaweed + cattle manure, compost + humic acid, cattle manure + humic acid, chicken manure, horse manure + humic acid, torf + humic acid) on some quality properties of second crop popcorn.

2. MATERIAL AND METHODS

2.1. Material

Experiment was conducted in Diyarbakır province Cermik district under second crop conditions. Ant-Cin-98 popcorn variety was used in the experiment. Organic nutrient sources were used in the study (Table 1). Amount of total pure nitrogen both conventional and organic growing were 17 kg da^{-1} based on the regulation, principles and applications of organic agriculture in Turkey [9]. According to nitrogen content of organic material, maximum pure nitrogen amount (17 kg da^{-1}) was calculated for organic applications (Table 1). For conventional applications total of 17 kg da^{-1} nitrogen, 8 kg da^{-1} phosphor and potassium (15-15-15 NPK as bottom fertilizer and urea as top fertilizer) were given as pure per decare. Nitrogen content of nutritional sources used in the study and the amount of fertilizer thrown per decare were given in Table 1.

Table 1. The nitrogen content of organic nutrient sources and applied amount

	Nutritional Sources	N content (%)	The amount of applied (kg da^{-1})
1	Conventional manure (urea)	46	36.96 kg da^{-1}
2	Torf	1.2	1416 kg da^{-1}
3	Compost	2.5	680 kg da^{-1}
4	Cattle manure	3.5	486 kg da^{-1}
5	Chicken manure	3.0	567 kg da^{-1}
6	Horse manure	2.0	850 kg da^{-1}
7	Sheep manure	2.0	850 kg da^{-1}
8	Pigeon manure	6.0	283 kg da^{-1}
9	Seaweed + Cattle manure	2.0 + 3.5	51.5 kg da^{-1} + 457 kg da^{-1}
10	Vermicompost	1.5	1133 kg da^{-1} + 140 g da^{-1}
11	Compost + Humic acid	2.5	680 kg da^{-1} + 140 g da^{-1}
12	Cattle manure + Humic acid	3.5	486 kg da^{-1} + 140 g da^{-1}
13	Chicken manure + Humic acid	3.0	567 kg da^{-1} + 140 g da^{-1}
14	Sheep manure + Humic acid	2.0	850 kg da^{-1} + 140 g da^{-1}
15	Torf + Humic acid	1.2	1416 kg da^{-1} + 140 g da^{-1}
16	Horse manure + Humic acid	2.0	850 kg da^{-1} +140 g da^{-1}

2.1.1. Climatic characteristics of the research area

Climate values of 2010 and 2011 in which the research was conducted with long years were given in Table 2. The average highest temperature (32.7℃) was observed in July, the lowest temperature (12.0℃) in November between June-November months in 2010, and in 2011 the average highest temperature (31.5℃) in July, the lowest temperature (6.6℃) in November in accordance with the data received from Diyarbakır Regional Directorate of Meteorology. The highest value (61.8%) in terms of relative humidity occurred in October 2010, and the lowest value (22.3%) in August 2011. The water need of plants was met through irrigation during the growing period.

2.1.2. Soil *characteristics of the research area*

Total salt content was found to be 0.03%, organic matter content 1.19%, lime rate 9.8%, phosphor amount 2.75 kg da^{-1}, potassium amount 82.05 kg da^{-1} and soil pH 7.4 in the soil sample take from 0.30 cm soil depth in the place where trial was established in Diyarbakır province Cermik district.

Table 2. Rainfall, temperature and relative humidity values for 2010, 2011 and long years in Diyarbakır province

Months		Min. Temp. (ºC)	Max. Temp. (ºC)	Average Temp. (ºC)	Rainfall (mm)	Relative humidity (%)
	2010	14.9	40.8	27.2	8.0	47.6
June	2011	13.2	37.9	26.3	14.6	33.9
	Long years	16.9	33.7	26.3	7.2	36.0
	2010	18.0	44.0	32.7	0.0	34.3
July	2011	18.4	45.0	31.5	0.2	22.6
	Long years	21.7	38.5	31.2	0.7	27.0
	2010	18.0	43.6	32.4	0.0	32.2
August	2011	16.0	43.5	31.2	0.0	22.3
	Long years	21.0	38.1	30.3	0.3	27.0
	2010	13.6	41.2	26.8	3.0	44.7
September	2011	12.8	38.1	25.6	1.9	28.5
	Long years	16.0	33.1	24.8	2.6	31.0
	2010	7.3	30.0	17.6	49.2	61.8
October	2011	3.0	32.8	17.4	57.4	52.5
	Long years	10.1	25.3	17.2	30.8	48.0
	2010	1.0	26.1	12.0	0.0	57.4
November	2011	-4.7	19.9	6.6	104.0	61.1
	Long years	3.6	15.9	9.3	54.6	68.0

Resource: Anonymous [10].

2.2. Method

Before the starting of experiment, the trial area was planted with wheat in 2008 and 2009 for making the area suitable for organic farming in which the trial would be established, and wheat was cultivated and harvested without application of any chemical fertilizer and agricultural pesticide. Physical and chemical properties of the trial area were determined by taking soil sample from a depth of 0-30 cm on the trial area before planting.

The soil was made ready for planting by processing with goble disc and then with disc harrow prior to planting. The trial was established with three replicates according to randomized complete block experimental design. Each parcel comprised 4 lines. The planting was made by hand into a depth of 5-6 cm along the lines 5 meters long with a row spacing of 70 cm and intra row of 20 cm in 15-30 June. Most of the nutritional organic sources were applied with planting. Also some part of seaweed manure was applied before planting and the rest as foliar fertilizer in three times. An equal amount of water was given to the parcels with sprinkler irrigation after planting for germination, and furrow irrigation throughout the growing period due to lack of moisture in sufficient levels for output. A space of 2 meters was left between parcels to hinder water passage between parcels and the parcels were surrounded with berm. Cultural measures (tractor and hand hoeing) were implemented to combat the weed. Chemical pesticides were not used in the search, *Trichogramma sp*. predator that was obtained from Adana Agricultural Research Institute Biological Control Unit was used within scope of biological control against Corn Cob Worm which leads to great productivity losses for corn plants. Values were taken from two rows in the middle after discarding 0.5m from both beginnings and one rows situated at either sides of the parcel as edge effect during the harvest between 20-25 September. Variance analysis was made with the values obtained by using Totemstat-C software package, the significance of the differences between averages were determined through Duncan multi comparison test [11]. In the study, the years were subjected to variance analysis separately and jointly.

3. RESULTS AND DISCUSSION

3.1. Cob Ratio (%)

Considering 2010-2011 year averages according to Table 3, cob ratio varied between percent 17.26-19.98 in different nutrient applications. The highest cob ratio value was determined to be 19.98% in torf + humic acid. The lowest cob ratio was obtained as 17.26% from vermicompost application along combined averages in the trial.

Table 3. Cob ratio (%) values found in popcorn grown using different nutritional sources and the groups formed according to Duncan Test

Nutritional Sources	**2010^{ns}**	**2011^{ns}**	**Average‡**
Conventional fertilizer	15.74	20.24	17.99 AB
Torf	14.44	22.40	18.42 AB
Compost	14.29	20.63	17.46 AB
Cattle manure	15.25	22.06	18.65 AB
Chicken manure	15.41	22.41	18.91 AB
Horse manure	15.37	20.01	17.69 AB
Sheep manure	15.46	19.39	17.43 AB
Pigeon manure	15.93	21.99	18.96 AB
Seaweed + cattle manure	15.73	24.16	19.95 A*
Vermicompost	15.30	19.21	17.26 B
Compost + humic acid	14.67	20.87	17.77 AB
Cattle manure + humic acid	15.50	22.92	19.21 A
Chicken manure+ humic acid	15.36	23.43	19.40 A
Sheep manure. + humic acid	15.71	22.14	18.92 AB
Torf + humic acid	15.51	24.45	19.98 A
Horse manure + humic acid	15.64	21.40	18.52 AB
Average	15.33 B	21.73 A	
LSD	Year: 2.014 2010-2011 Average nutritional sources: 2.539		

**There is no significant difference at 0.05 level according to Duncan Test among the averages falling within same letter group.*
†: P≤ 0.01, ‡: P≤ 0.05 ns: No significant

3.2. 1000-Kernel Weight (g)

Considering 2010-2011 year averages according to Table 4, 1000-kernel weights varied between 122.48-138.65 g in different nutrient applications. While the highest 1000-kernel weight value was determined to be 138.65 g in seaweed manure + cattle manure, and afterwards this was followed by horse manure + humic acid (137.41) with sheep manure +humic acid (137.11) respectively. In the meantime, conventional fertilizer application ranked sixth among the applications with a 1000-kernel weight value of 132.41 g. The lowest 1000-kernel weight was obtained as 122.48 g from chicken manure application along combined averages in the trial. In terms of 1000-kernel weight, we can say that the abundance of all applications in second year compared to the first year resulted from both climate and environmental conditions and positive effect of nutritional sources.

The effect of nutritional sources plant on 1000-kernel weight in respect of corn plant was given by obtaining different results in different studies. Prasanna et al. [12] have reported that they received the highest 1000-kernel weight from vermicompost in respect of corn plant, Shafiq et al. [6] said that chemical fertilizer yielded 1000-kernel weight higher than organic fertilizers (chicken manure, farmyard manure, bio-manure).

Table 4. 1000-kernel weight (g) values found in popcorn grown using different nutritional sources and the groups formed according to Duncan Test

Nutritional Sources	2010†	2011†	Average†
Conventional fertilizer	123.38 a*	141.43 de	132.41 A-E
Torf	113.97 a-d	131.68 e	122.82 DE
Compost	105.78 cd	141.89 cde	123.84 CDE
Cattle manure	115.6 abc	144.02 bcd	129.81 A-E
Chicken manure	105.22 cd	139.73 de	122.48 E
Horse manure	117.10 ab	148.31 a-d	132.71 A-E
Sheep manure	118.27 ab	150.04 a-d	134.16 ABC
Pigeon manure	120.25 a	148.00 a-d	134.13 A-D
Seaweed + cattle manure	121.47 a	155.84 a	138.65 A
Vermicompost	104.40 d	148.73 a-d	126.56 B-E
Compost + humic acid	107.73 bcd	146.87 a-d	127.30 B-E
Cattle manure + humic acid	117.72 ab	148.64 a-d	133.18 A-E
Chicken manure+ humic acid	108.85 bcd	144.84 a-d	126.85 B-E
Sheep manure. + humic acid	120.30 a	153.92 ab	137.11 AB
Torf + humic acid	116.38 abc	143.64 cde	130.01 A-E
Horse manure + humic acid	121.00 a	153.82 abc	137.41 AB
Average	114.84 B	146.34 A	
LSD	Year: 4.826 2010 Nutritional sources: 10.021 2011 Nutritional sources: 10.175 2010-2011 Average nutritional sources: 9.841		

**There is no significant difference at 0.05 level according to Duncan Test among the averages falling within same letter group.*
†: P ≤ .01, ‡: P ≤ .05 ns: No significant

Various results were obtained in different studies carried out related to 1000-kernel weight in popcorn. Idikut et al. [13] 114.9-122.9 g; Ertas et al. [14] 54.8-64.6 g; Gokmen et al. [15] 129.0-213.0 g; Ozkan [16] 127.0-133.0 g; Tekkanat and Soylu [17] 114.68-175.93 g; Oktem et al. [26] 291.0-342.0; Ozkaynak and Samancı [18] have reported 1000-kernel weight varying between 86.0-140.0 g in lines, 83.0-115.0 g in hybrids.

3.3. Test weight (kg hl^{-1})

Average values of the proportion of test weight determined in different nutritional sources in popcorn grown organically between 2010 and 2011 and the groups formed according to Duncan multi comparison test were given in Table 5.

Considering 2010-2011 year averages, test weight ranged from 75.62 kg hl^{-1} and 81.29 kg hl^{-1} in different nutrient applications. When examined the Table 5, the highest test weight value was 81.29 kg hl^{-1} in horse manure + humic acid application, and afterwards respectively, torf + humic acid (80.58 kg hl^{-1}) and sheep manure + humic acid (80.56 kg hl^{-1}) applications. Meanwhile, the lowest test weight was obtained as 75.62 kg hl^{-1} from vermicompost. The difference of nutrient elements in the structure of organic and conventional nutritional sources at the end of the study, was seen affecting these fertilizer sources at different levels. In the trial, the difference among fertilizer applications was found to be statistically significant.

As a result, the highest test weight of the parcel is administered with a growth regulator of humic acid organic fertilizer is taken. The studies have shown that humic acids in plant dry weight effects are available. Some researchers reported that fresh and dry weights increased significantly (P < .05) with treated humic acid at different levels compared to control [6, 19, 20]. Asli and Neuman [21] reported that the humic acids reduce the dry weight of corn.

Table 5. Test weight (kg hl^{-1}) values found in popcorn grown using different nutritional sources and the groups formed according to Duncan Test

Nutritional Sources	**2010‡**	**2011†**	**Average†**
Conventional fertilizer	80.57 ab	76.55 e	78.56 AB
Torf	78.70 ab	80.62 abc	79.66 A
Compost	75.68 bc	79.47 bcd	77.58 AB
Cattle manure	76.43 abc	80.60 abc	78.52 AB
Chicken manure	75.98 abc	79.62 bcd	77.80 AB
Horse manure	78.13 abc	81.32 abc	79.73 A
Sheep manure	76.10 abc	79.82 bcd	77.96 AB
Pigeon manure	79.28 ab	80.63 bc	79.96 A
Seaweed + cattle manure	79.38 ab	79.25 cd	79.32 A
Vermicompost	73.47 c	77.77 de	75.62 B
Compost + humic acid	75.95 bc	82.78 a	79.37 A
Cattle manure + humic acid	76.87 abc	81.42 ab	79.14 AB
Chicken manure+ humic acid	80.95 a	79.80 bcd	80.38 A
Sheep manure. + humic acid	80.23 ab	80.88 abc	80.56 A
Torf + humic acid	79.75 ab	81.40 abc	80.58 A
Horse manure + humic acid	80.88 ab	81.70 ab	81.29 A
Average	78.02 B	80.23A	
LSD	Year: 0.463 2010 Nutritional sources: 4.445 2011 Nutritional sources: 1.955 2010-2011 Average nutritional sources: 3.346		

**There is no significant difference at 0.05 level according to Duncan Test among the averages falling within same letter group.*
†: P ≤ .01, ‡: P ≤ .05 ns: No significant

3.4. Popping Volume (cm³ g^{-1})

Considering 2010-2011 year averages according to Table 6, popping volume varied between 17.17 cm³ g^{-1}- 19.71 cm³ g^{-1} in different nutrient applications. When examined the Table 6, the highest popping volume value was 19.71 cm³ g^{-1} in torf application, and afterwards respectively, vermicompost (19.41 cm³ g^{-1}) and pigeon manure (18.98 cm³ g^{-1}) applications. Meanwhile, the lowest popping volume was obtained as 17.17 cm³ g^{-1} from sheep manure + humic acid. The difference of nutrient elements in the structure of organic and conventional nutritional sources at the end of the study, was seen affecting these fertilizer sources at different levels.

Besides, even though no study has been carried out about popping volume in organic popcorn, different study results obtained related to popping volume as 19.79-22.92 cm³ g^{-1} [14] ; 19.67-25.33 cm³ g^{-1} [18]; 18.50-35.25 cm³ g^{-1} [17]; 21.0-27.5 cm³ g^{-1} [22]; 28.1-28.7 cm³ g^{-1} [16] have a nature supporting our research results.

Table 6. Popping volume (cm³/g) values found in popcorn grown using different nutritional sources and the groups formed according to Duncan Test

Nutritional Sources	2010^{ns}	2011^{ns}	Average‡
Conventional fertilizer	18.95	17.42	18.18 AB
Torf	20.41	19.00	19.71 A*
Compost	19.93	17.75	18.84 AB
Cattle manure	19.66	19.04	19.35 AB
Chicken manure	18.99	17.68	18.33 AB
Horse manure	19.02	18.43	18.72 AB
Sheep manure	19.00	17.64	18.32 AB
Pigeon manure	19.20	18.76	18.98 AB
Seaweed + cattle manure	18.54	16.65	17.60 AB
Vermicompost	20.56	18.26	19.41 A
Compost + humic acid	18.62	17.15	17.89 AB
Cattle manure + humic acid	18.27	18.09	18.18 AB
Chicken manure+ humic acid	18.95	17.65	18.30 AB
Sheep manure. + humic acid	17.40	16.93	17.17 B
Torf + humic acid	19.42	16.12	17.77 AB
Horse manure + humic acid	17.75	17.61	17.68 AB
Average	19.04 A	17.76 B	
LSD	Year: 0.467 2010-2011 Average nutritional sources: 2.011		

**There is no significant difference at 0.05 level according to Duncan Test among the averages falling within same letter group.*
†: P ≤ .01, ‡: P ≤ .05 ns: No significant

3.5. Number of Unpopped kernel (%)

Average values of number of unpopped kernel determined in different nutritional sources in popcorn grown organically between 2010 and 2011 and the groups formed according to Duncan multi comparison test were given in Table 7. Considering 2010-2011 year averages, number of unpopped kernel ranged from 3.65% to 5.92% in different nutrient applications. When examined the Table 7, the highest number of unpopped kernel value was 5.92% in peat application, and afterwards respectively, chicken manure (5.63%) and compost (5.16%) applications. Meanwhile, the lowest number of unpopped kernel was obtained as 3.65 % from horse manure + humic acid. The difference of nutrient elements in the structure of organic and conventional nutritional sources at the end of the study, was seen affecting these fertilizer sources at different levels. In the trial, the difference among fertilizer applications was found to be statistically significant.

Besides, even though no study has been carried out about number of unpopped kernel in organic popcorn, different study results obtained related to non-popped grain rates as 12.43-16.91% [14], 3.49-12.19% in lines and 6.33-9.94% in hybrids [18]; 2.42-9.90% [17]; 2.77-3.48% [16], have a nature supporting our research results. Many researchers [14, 24, 25] have found significant differences in non-popped grain rate which is among major quality parameters of popcorn, and they reported that the impact of varieties had a largest share in this situation.

Table 7. Number of unpopped kernel (%) values determined in popcorn grown using different nutritional sources and the groups formed according to Duncan Test

Nutritional Sources	2010†	2011†	Average†
Conventional fertilizer	6.48 abc	3.51 b-e	5.00 A-D
Torf	7.05 a*	4.79 a	5.92 A
Compost	6.72 ab	3.59 b-e	5.16 ABC
Cattle manure	4.86 def	3.84 bcd	4.35 CD
Chicken manure	6.97 a	4.28 ab	5.63 AB
Horse manure	5.27 b-f	3.88 abc	4.58 BD
Sheep manure	4.74 ef	3.18 cde	3.96 CD
Pigeon manure	5.47 a-f	3.45 b-e	4.46 BCD
Seaweed + cattle manure	4.88 c-f	2.67 e	3.78 D
Vermicompost	5.91 a-e	3.63 bcd	4.77 A-D
Compost + humic acid	4.41 f	3.46 b-e	3.93 CD
Cattle manure + humic acid	6.33 a-d	3.23 cde	4.78 A-D
Chicken manure+ humic acid	4.63 ef	3.51 b-e	4.07 CD
Sheep manure. + humic acid	4.67 ef	2.81 de	3.74 D
Torf + humic acid	4.65 ef	3.10 cde	3.88 CD
Horse manure + humic acid	4.50 ef	2.79 de	3.65 D
Average	5.47 A	3.48 B	
LSD	Yıl: 0.467 2010 Nutritional sources: 1.393 2011 Nutritional sources: 0.889 2010-2011 Av. Nutritional sources: 2.011		

**There is no significant difference at 0.05 level according to Duncan Test among the averages falling within same letter group.*
†: P ≤ .01, ‡: P ≤ .05 ns: No significant

4. CONCLUSION

It has been determined with this study that organic popcorn production can be made also by using different nutritional sources under Diyarbakır ecological conditions. It has been ascertained that Ant-Cin-98 popcorn variety used in the trial can also be included in crop rotation systems across in south eastern Anatolia region. Higher values obtained from organic nutrient sources than conversional application in all tested quality parameters. Furthermore, it was observed that the implementation of organic fertilizers together with humic acid in popcorn produced better results in comparison to alone implementation of organic fertilizers. It has been proved that corn production can be made without the use of chemical pesticides in the trial. *Trichogramma sp*. beneficial insects can be introduced to local farmers and its use may be encouraged on corn planted areas.

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