Assessment of residual impacts of poultry manure on nutrient, sucrose, fructose, and glucose content of second crop onion

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Abstract: - This study was conducted to determine the effects of poultry manure applications on the nutrient, sucrose, fructose and glucose content of second-crop onions. This study was done in the research and practices area of Ege University, Odemis Technical Training College. Three onion (*Allium cepa* L.) varieties (Burgaz, Karbeyazı, Şampiyon) and also three different doses of poultry manure (20 t ha^{-1}, 40 t ha^{-1}, 60 t ha^{-1}) and mineral fertilizer were used in this research. A non-fertilized parcel was used as the control. The experimental design was a split plot with three replications.
Nitrogen, P, K, Ca, Mg, Fe, Zn, Mn, and Cu content in the leaf and bulb of onion samples were analyzed. In addition, sucrose, fructose, and glucose values in the bulb were determined. The highest nutrient contents of leaves and bulbs were obtained with the residual effect of 40 t ha^{-1} doses of poultry manure Karbeyazı variety contains the highest level of fructose, sucrose, and glucose compared to other varieties.

Key-words: - Onion, poultry manure, nutrient content, macro and microelements, sucrose, fructose and glucose content, environment

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1 Introduction

Currently, onion is one of the most important crops grown in the world [30]; [31]; [52]; [43]. Onion is one of our special foods, which has great importance in human nutrition and in Turkish cuisine, where it is valued as a nutritious staple.
In Turkey, fresh onion production is 138,993 tons and dry onion production is 2,131,513 tons. The cultivated area is 87,393 da for spring onions and 576,918 da for dry onions [5] The best onion cultivation is done in sandy-clay or clay-sandy, organic-rich soils. Heavy clay or sandy soils and excess moisture are not suitable for growing onions [20]; Günay, 1983; [48].
The soil is generally poor in organic matter in Turkey. Animal fertilizers with high organic matter content regulate and maintain soil fertility by improving the physical, chemical, and biological properties of soils. These materials are also storage of plant nutrients. High doses of fertilizers used in onion cultivation hurt human health and the environment [51]; [53]. Therefore, it is important to create conscious fertilization programs for sustainable production and sustainable living according to plant varieties. Crop production has increased with the increasing world population and this has increased the use of inputs. Synthetic chemical fertilizers, herbicides, and pesticides have also caused substantial damage to the ecology of agricultural systems (Manoj et al, 2019).
[50] reported that the residual effect of chicken manures and onion varieties as a second crop significantly affected the yield and bulb production in the field condition. The highest results were obtained especially with 60 t ha^{-1} of chicken manure application in the field condition.
[34] investigated the effects of NPK and animal manure applications on the yield and development of onion and garlic plants. It showed that the highest yield is obtained from plots where the recommended amount of NPK is mixed with animal manure.
[47] their study investigated the effects of mineral and animal fertilizers and their combinations and observed that low manure alone yields better results than NPK fertilization alone. However, the combination of animal manure with NPK yielded the highest marketable yield under favorable moisture

conditions.
20, 40, 60 t ha^{-1} animal manure, NPK (75:50:100 kg ha^{-1}), and 2, 3 times the applications and combinations with each other were examined in other research. It was noted that NPK fertilization only gives good results at low humidity levels. Also, the lowest onion yield was obtained from unfertilized parcels with an average of 16.2 t ha^{-1} [40]. [3] reported that the total onion product (9.55 t ha^{-1}) was more affected by animal fertilizers than the plant density. Similar studies can be found in [41], [42], [44].
The combination of mineral and organic fertilizer resulted in approximately 22 to 53% higher crop yields. In recent years, based on long-term field trials, organic and mineral fertilizers in combination give higher yields than only mineral or only organic fertilization [28]; [21]. Similar studies can be found in [29].
[10] studied the effects of chicken manure and inorganic fertilizers and their combinations on onion production. Applications increased the product, and they noted that the amount of dry matter was reduced.
As with each product, high yield and quality in onion production depends on soil nutrient content [45]. In this sense, issues such as increasing the fertility of our soil resources by natural means, preventing the pollution of underground waters by chemical substances, and the decrease of natural flora can be cared for by using conscious organic material.
The objectives of this study were (i) to find the effects of poultry manure doses on nutrient content in onion bulbs, (ii) to find the effects of poultry manure doses on nutrient content in onion leaves and (iii) to determine the residual effect of poultry manure applications on sucrose, fructose and glucose content of second crop onion.

2 Materials and Methods

This study was carried out to determine the effects of poultry manure on the nutrient content of second-crop onion grown after lettuce. This study was done in the research and application field of Ege University, Odemis Technical Training College. Three onion (*Allium cepa* L.) varieties (Burgaz, Karbeyazı, Şampion) were used.
In the research, 0, 20, 40, and 60 t ha^{-1} poultry manure was applied to the parcels for the production of lettuce in the previous production period. Mineral fertilizer, NPK (120:100:150 kg ha^{-1}), 15:15:15, K_2SO_4, and Ammonium Nitrate were applied to the lettuce plant. The lettuce was harvested on 04.04.2017 and then the planting of onion seedlings was carried out on the same trial plan.
To produce seedlings of onion varieties used in the experiment, seeds were cultivated on 23.01.2017. Onion seedlings were planted in their places on 05.04.2017 and harvested on 02.08.2017. In the study, after harvesting lettuce and before planting onion seedlings, soil samples were taken from each plot for analysis. A planting distance of 30x15 cm was used in the experiment and the distance between the parcel and the block was 1 m. The study was established with three replications according to the divided split trial design.
The composition of poultry manure that the residual effect investigated was analyzed according to [25] and is presented in Table 1.

Soil samples (0-20 cm) were collected from the individual experimental plots (15 samples) at the beginning of onion vegetation. The soil sample was air-dried, ground, and passed through a 2 mm sieve for the determination of chemical parameters. The pH [22], total soluble salt, [4], $CaCO_3$ [25] and organic matter content [39] were determined in the soil. Total N was also analyzed according to [11], the available K^+ was determined after extracting with 1 N NH_4OAc by flame photometer [6], [7] and available P was measured by colorimeter [38].
Leaf samples were taken from the youngest leaves for chemical analysis [23] before the onion bulbs reached maturity.
After the leaf and bulb samples were taken from plots, they were dried in 70°C, and ready for analysis [24]. In the study, the manure and onion bulbs and leaf samples were wet digested [(nitric (HNO3): perchloric acid (HClO4); 4:1] for P, K, Ca, Mg, Na, Fe, Cu, Zn, and Mn analysis. Following the digestions, quantifications were made for the phosphorus colorimetric method, for K, Ca, and Na by flame photometer and Mg, Fe, Cu, Zn, and Mn by AAS [35]; [13]. Total nitrogen in plant samples was analyzed according to the modified Kjeldahl method [8].

2.1 Sugar analysis methods

Extraction of samples and HPLC analysis conditions was done according to [12]. 10 g of a fruit sample was taken; it was completed with 50 ml of pure water and broken down in the homogenizer. Samples were centrifuged at 6000 rpm and passed through the Whatman No. 42 filter paper. The final volume was adjusted to be acetonitrile: filtrate (6:2, v/v). Samples were kept at -18°C. A refractive index detector (RID) was used in sugar analysis. Conditions for HPLC analysis were adjusted as follows. The method was modified as needed.

Column: Supelco (300mmx4.1mm ID), column temperature: room temperature (18-22°C), mobile phase: Acetonitrile: distilled water (75:25), flow rate: 1.8 m/min, detector: RI, 30°C, injection amount: 20 µL.
The collected data on various parameters were statistically analyzed. Analysis of variance was computed and LSD was used to compare means. The trial statistical evaluation result of data was done using the software package TARIST [2]

3 Results and Discussion

3.1 The effect of poultry manure applications on some physical and chemical properties of soils

At the beginning of onion vegetation, pH, organic matter, and lime contents of field soils at 0-20 cm depth are presented in Table 2. According to this, soil pH is 6.98-7.08, organic matter is between 0.66-0.89%, and lime is between 0.63-0.84%. Field soils are neutral (6.6-7.3), humus ($p<0.01$), and lime (0-2.5) poor (Table 2).
At the beginning of onion vegetation, nutrient element contents of field soils at 0-20 cm depth are given in Table 2. Total N: 0.056-0.110%, available P: 24.16-35.50, K: 97.4-106.7, Ca: 891-1089, Mg: 210-224 and Na: 16.26-42.90 mg kg^{-1} was found. The microelements are Fe: 3.49-3.75, Zn: 1.03-3.03, Mn: 3.68-4.15, and Cu: 0.63-0.67 mg kg^{-1} (Table 3). The difference between the applications in terms of these nutrients was insignificant except for N, P, Na, and Fe. The N, P, Na, and Fe contents of the soils were at the lowest level in the control plots, while the highest dose of poultry manure application was analyzed at the highest value at 60 t ha^{-1} dose ($p<0.01$). Poultry manure application at 60 t ha^{-1} doses and mineral application gave the same results in the Fe content of soils statistically. These results could be explained by the positive effect of poultry manure on improving the nutritional status of soil generally, and also due to mineralization of organic matter. Similarly, [15] stated that the application of chicken manure under greenhouse conditions significantly increased the nitrogen content of the soils. [36] found that organic manure applications to olive-growing soils in 0-20 cm depth N, K, Ca, Mg, Cu, Na content, in addition, in 20-40 cm depth P, K, Ca, Mn, Cu, Na content were affected significantly. [19] observed a significant increase in nitrogen and phosphorus with the addition of chicken manure.

When the fertility of the trial soils was evaluated, N was found to be moderate (0.05-0.1 %); P rich (greater than 3.26 ppm); K (<150 ppm) and Ca (715-1430 ppm) poor; Mg (>114 ppm) well; Fe (2.5-4.5 ppm) deficiency possible; Zn (>1 ppm), Mn (>1 ppm), Cu (>0.2 ppm) seems to be sufficient [9].

3.2 Residual effect of poultry manure applications on the nutrient content of second crop onion leaves

Residual effects of poultry manure applications on the leaf nutrient content of the onion grown as a second product after the lettuce production are given in Table 4.
According to Table 4, N content in leaf is between 2.09-2.69, P is between 0.14-0.22; K is between 1.89- 2.64; Ca is between 0.93-1.34; Mg is between 0.51-0.67; Na is between 922.9-1193.7; Fe is between 86.36-102.36; Zn is between 16.78-19.92; Mn is between 20.4-25.06; Cu is between 5.58-7.02. The difference among the applications in terms of these nutrients was significant except for K, Na, and Mn amounts. The N, P, K, Ca, Mg, Na, Fe Zn, Mn, and Cu contents of the leaves were at the lowest level in the control plots, while the highest doses (40 and 60 t ha^{-1}) of poultry manure application were analyzed at the highest value. However, the N and Mn contents of the leaves were statistically at the same level with the highest applications of poultry manure and NPK ($p<0.01$).
When the sufficiency levels of nutrient content of onion leaves were investigated, it was seen that P, Zn, Mn, and Cu values were at the deficiency level although N, Ca, and Mg amounts were sufficient. K values in leaves were determined at sufficient levels only in plots where 40 and 60 t ha^{-1} doses of poultry manure were applied [9].
In the research, it is noteworthy that the P, Zn, Mn, and Cu nutrient contents of onion leaves are insufficient while the P content of the soils is high before planting. This may be due to the conversion of available phosphorus in the soil into a fixed form that cannot be taken up by plants during vegetation. On the subject, [27] reported that the phosphorus fixation capacity in alluvial soils of the Aegean region was between 36-89%. It is thought that the important positive correlation that the researchers determined between soil's organic matter and exchangeable Mg x K fixation explains this situation [27]; [14].
In addition, although the Ca content of the soils was poor, it was seen that the amount of Ca in the leaves was sufficient (Table 3, 4). This result may be due to the slow release of organic fertilizers and their effects on the subsequent products. Similarly, although P, Zn, Mn, and Cu are insufficient in the

soil, these elements were found in insufficient amounts in the leaves. This situation can be explained by the antagonistic effects between P and Zn, P and Mn, P and Cu [26]. Thus, [32] stated that the excess nutrient content in the soil does not produce benefits to plants or may even depress the uptake of nutrients as well as crop growth and yield. In the study, it was determined that leaf nutrient content varies significantly according to the varieties of onion except for Fe, Mn, and Cu amounts (Table 5).

It was determined that the N, P, and Zn content of the Burgaz variety is significantly higher than other varieties. Burgaz and Karbeyazı varieties had significantly higher K content than the Şampiyon variety; Karbeyazı and Şampiyon varieties had significantly higher Ca than the Burgaz variety; the Mg content of Şampiyon variety was analyzed higher than the others (Table 5).

However, there was no statistically significant difference between the Şampiyon and Karbeyazı in terms of Mg content. In addition, in terms of Fe, Mn, and Cu content, there was no significant difference between the varieties depending on the applications (Table 5).

3.3 Residual effect of poultry manure applications on the nutrient content of second crop onion bulbs.

The Macro and micronutrient contents of onion bulbs are given in Table 6.

According to Table 6, N is 2.10-2.93, P is between 0.16-0.23; K is between 1.37-1.73; Ca is between 0.10-0.15; Mg is between 0.156-0.183; Na is between 283.9-477.7; Fe is between 26.97-43.19; Zn is between 20.19-25.65; Mn is between 12.37-14.89; Cu is between 4.64-5.96. The ranking of nutrient elements based on their established amount in the examined onion bulbs was N > K > P > Mg > Ca >Na > Fe > Zn >Mn >Zn.

The differences among the applications in terms of these nutrients were significant except for Mg and Cu. The N, P, K, Na, Ca, Na, Zn, and Mn contents of the bulbs were at the lowest level in the control plots ($p<0.01$) (Table 6). On the other hand, the highest K, Ca, Na, and Fe contents in onion bulbs were determined by the residual effect of 40 t ha^{-1} of poultry manure.

Similarly, [52] reported that the K content of onion bulbs increased significantly in cattle manure applications in the first year, but N, P, Ca, Mg, Fe, Zn, Cu, Mn, and Na amounts of onions were not significantly affected by manure applications. [17] stated that in onion bulbs N and P content was increased by N application. Mn, Fe, and Zn contents tended to increase; K, Cu, and Mo contents were not affected. [1] found that increasing the rate of the sheep and chicken manure increased the N content of onion significantly, while P and K contents had low levels. [33] found that the chemical constituents (N, P, K, and total protein) significantly increased by increasing the level of compost application up to 180 kg N/fed in sandy soil. These results may be due to the capacity of soil organic matter to influence a range of functional physical, chemical, and biological properties of soil and to play an important role in nutrient cycling [37].

Generally, varieties of onions growing in the same environment (i.e., same soil and climatic conditions) have significant differences in the mineral composition of the bulbs. It is therefore likely that the source of this variation is genotypic [16].

When the effect of varieties on onion bulb's nutrient content was investigated, it was determined that N, Ca, Fe, and Cu contents of Champion varieties were significantly higher than other varieties ($p<0.01$) (Table 7). P, K, and Na content in bulbs of Şampiyon and Karbeyazı varieties were analyzed higher than the Burgaz variety ($p<0.01$).

In addition, in terms of Mg content, there was no significant difference between the varieties depending on the applications.

3.4 Residual effect of poultry manure applications on sucrose, fructose, and glucose content of second crop onion

Residual effects of poultry manure applications on sucrose, fructose, and glucose content of onion bulbs as a second crop were given in Table 8.

3.4.1 Sucrose: The sucrose contents of onion bulbs changed significantly depending on the applications ($p<0.01$). The highest sucrose content was analyzed in the no-application control plots as 3.33 g/100 ml (Table 8). Sucrose content in the bulbs decreased with applications. Also, [18] reported that Sheep manure treatment had the lowest amount of sucrose in sugar beets compared to the control treatment. Nitrogen caused sugar percentage reduction which influenced sucrose percentage as well. Therefore, the negative impact of manure on sucrose percentage was due to its increasing impact on nitrogen content in the root.

3.4.2 Fructose: Residual effects of poultry and mineral fertilizer applications significantly affected the fructose content of second-crop onion bulbs grown after lettuce ($p<0.01$) (Table 8). The highest fructose values were analyzed in the onion bulbs from the control plots (17.71 g/100 ml) and 20 t ha^{-1}

poultry manure applications (16.89 g/100 ml).

3.4.3 Glucose: Glucose contents of onion bulb samples changed significantly depending on the applications ($p<0.01$). Similar to fructose contents, the highest glucose content was analyzed in the control plots where no treatment was performed (Table 8). This was followed by onion bulb samples taken from the parcels where there was a residual effect of 20 t ha^{-1} poultry manure application. The lowest glucose values were determined in the parcels where there was the residual effect of mineral fertilizer application. Similarly, high nitrogen application to the soil caused a decrease in glucose and fructose in the leaves of cabbage [49]. In spinach and komatsuna leaves, sugar content also increased with decreased nitrogen application [46]. This situation can be considered as the amount of nitrogen applied to the plant increased the vegetative part and product and, accordingly, the dilution of glucose, sucrose, and fructose amounts.
When the effect of all varieties on sucrose, fructose, and glucose content of onion bulbs were investigated, it was determined that the highest sucrose content was in Burgaz (3.53 g 100 ml^{-1}) and that the highest fructose (18.95 g 100 ml^{-1}) and glucose (20.35 g 100 ml^{-1}) contents were in Karbeyazı variety ($p<0.01$) (Table 9).

4 Conclusion

As a result, it was found that the residual effect of poultry manures and onion varieties on nutrient content in leaves and bulbs, and that the sucrose, fructose, and glucose values in bulbs of second crop onion grown after lettuce were significantly affected.
Generally, the highest nutrient contents of leaves and bulbs were obtained with the residual effect of 40 t ha^{-1} doses of poultry manure. The onion variety Burgaz gave more response to the poultry manure as compared with other onion varieties in nutrient content in leaves. The Champion varieties contained higher nutrient values in bulbs.
Organic fertilizers are slow-release fertilizers and their effects on soil fertility were seen in the following years and crops. As observed in our study, it is important to use organic manure consciously, with an environmentalist approach, considering the subsequent effects of organic fertilizers.

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Table 1. Some properties of poultry manure.

pH	8.55	**C/N**	12.1
Total Salt (ms/cm)	2.47	**P (%)**	0.70
Ash 550ºC (%)	79	**K (%)**	1.02
Organic Matter (%)	19.8	**Ca (%)**	1.37
Organic Carbon (%)	11.51	**Mg (ppm)**	3729
Total N (%)	0.95	**Na (ppm)**	1248

Table 2. Some chemical properties of trial soils at the beginning of onion vegetation.

Treatment	**pH**	**O. M. (%)**	**$CaCO_3$ (%)**
0	7.06	0.66	0.63
NPK	7.00	0.89	0.84
20 t ha^{-1}	7.08	0.83	0.69
40 t ha^{-1}	6.98	0.72	0.72
60 t ha^{-1}	7.02	0.79	0.66
LSD	ns	Ns	ns

**: p<0.01 *: p<0.05 n.s.: not significant

Table 3. Macro-micro nutrient contents of trial soils at the beginning of onion vegetation.

Treatment	**N (%)**	**P (%)**	**K (%)**	**Ca (%)**	**Mg (%)**	**Na (mg kg^{-1})**
0	0.056 c	24.16 b	100.6	1056	224	16.26 d
NPK	0.090 b	34.56 a	98.0	1023	215	27.96 bc
20 t ha^{-1}	0.076 b	27.59 b	97.4	986	210	23.90 cd
40 t ha^{-1}	0.081 b	24.72 b	80.9	891	220	32.13 b
60 t ha^{-1}	0.110 a	35.50 a	106.7	1089	218	42.90 a
LSD	0.018**	5.92**	ns	Ns	ns	8.15**

Treatment	**Fe**	**Zn**	**Mn**	**Cu**

	(mg kg^{-1})	(mg kg^{-1})	(mg kg^{-1})	(mg kg^{-1})
0	3.38 b	1.06	3.68	0.64
NPK	3.75 a	1.19	4.03	0.63
20 t ha^{-1}	3.49 ab	1.16	4.13	0.67
40 t ha^{-1}	3.49 ab	3.03	4.04	0.65
60 t ha^{-1}	3.75 a	1.09	4.15	0.63
LSD	0.368*	ns	ns	ns

**: p<0.01 *: p<0.05 n.s.: not significant

Table 4. Residual effect of poultry manure on the nutrient content of onion leaf as the second crop.

Treatment	N	P	K	Ca	Mg	Na
	(%)	(%)	(%)	(%)	(%)	(mg kg^{-1})
0	2.09 d	0.14 c	1.89 c	0.93 c	0.51 b	922.9 b
NPK	2.69 a	0.19 ab	2.48 ab	1.25 ab	0.63 a	948.8 b
20 t ha^{-1}	2.29 c	0.18 b	2.19 b	1.11 b	0.59 ab	1071.2 ab
40 t ha^{-1}	2.39 bc	0.19 ab	2.53 a	1.34 a	0.67 a	1155.0 a
60 t ha^{-1}	2.47 b	0.22 a	2.64 a	1.29 a	0.61 a	1193.7 a
LSD	0.126**	0.028**	0.337**	0.124**	0.099**	199.4**

Treatment	Fe	Zn	Mn	Cu
	(mg kg^{-1})	(mg kg^{-1})	(mg kg^{-1})	(mg kg^{-1})
0	86.36 b	16.78 b	23.20	5.58
NPK	102.36 a	19.07 a	24.51	5.99
20 t ha^{-1}	97.72ab	19.92 a	20.99	7.02
40 t ha^{-1}	100.51ab	19.75 a	25.06	6.22
60 t ha^{-1}	93.57ab	19.89 a	20.40	6.10
LSD	14.89*	1.25**	ns	ns

**: p<0.01 *: p<0.05 n.s.: not significant

Table 5. Effect of variety on the nutrient content of onion leaves as the second crop.

Variety	N	P	K	Ca	Mg
	(%)	(%)	(%)	(%)	(%)

Burgaz	2.56 a	0.20 a	2.45 a	1.08 b	0.55 b
Karbeyazı	2.48 b	0.19 ab	2.40 a	1.19 a	0.61 ab
Şampiyon	2.12 c	0.17 b	2.19 b	1.29 a	0.65 a
LSD	0.049**	0.026**	0.185**	0.118**	0.096**

Variety	**Fe**	**Zn**	**Mn**	**Cu**
	(mg kg^{-1})	**(mg kg^{-1})**	**(mg kg^{-1})**	**(mg kg^{-1})**
Burgaz	92.37	20.37 a	21.50	6.48
Karbeyazı	94.55	18.68 b	23.74	6.01
Şampiyon	101.39	18.21 b	23.25	6.06
LSD	ns	1.227**	ns	ns

**: p<0.01 *: p<0.05 n.s.: not significant

Table 6. Residual effects of poultry manure on the nutrient content of onion bulbs as second crop.

Treatment	**N**	**P**	**K**	**Ca**	**Mg**	**Na**
	(%)	**(%)**	**(%)**	**(%)**	**(%)**	**(mg kg^{-1})**
0	2.10 e	0.16 b	1.37 c	0.10 c	0.156	283.9 d
NPK	2.93 a	0.23 a	1.59 ab	0.12 b	0.183	448.4 ab
20 t ha^{-1}	2.32 d	0.20 a	1.49 bc	0.11 bc	0.182	402.9 bc
40 t ha^{-1}	2.54 c	0.22 a	1.73 a	0.14 a	0.178	477.7 a
60 t ha^{-1}	2.68 b	0.21 a	1.52 bc	0.15 a	0.178	390.8 c
LSD	0.128**	0.033**	0.174**	0.014**	ns	57.038**

Treatment	**Fe**	**Zn**	**Mn**	**Cu**
	(mg kg^{-1})	**(mg kg^{-1})**	**(mg kg^{-1})**	**(mg kg^{-1})**
0	32.29 c	20.19 b	12.37 b	5.25 b
NPK	41.94 ab	25.65 a	14.89 a	5.78 a
20 t ha^{-1}	26.97 abc	22.49 ab	13.71 ab	5.42 ab

40 t ha^{-1}	43.19 a	23.99 ab	13.56 ab	5.96 a
60 t ha^{-1}	36.11 bc	21.86 ab	13.33 ab	4.64 b
LSD	6.823**	5.024*	1.863*	ns

**: p<0.01 *: p<0.05 n.s.: not significant

Table 7. Effect of variety on the nutrient content of onion bulb as second crop depending on residue effect of poultry manure.

Variety	**N**	**P**	**K**	**Ca**	**Mg**	**Na**
	(%)	**(%)**	**(%)**	**(%)**	**(%)**	**(mg kg^{-1})**
Burgaz	2.37 c	0.17 b	1.34 b	0.12 b	0.171	325.2 a
Karbeyazı	2.47 b	0.22 a	1.61 a	0.12 b	0.175	501.2 b
Şampiyon	2.71 a	0.23 a	1.67 a	0.13 a	0.179	375.9 b
LSD	0.065**	0.029**	0.099**	0.008**	ns	69.055**

Variety	**Fe**	**Zn**	**Mn**	**Cu**
	(mg kg^{-1})	**(mg kg^{-1})**	**(mg kg^{-1})**	**(mg kg^{-1})**
Burgaz	26.94 c	21.19 b	11.61 b	4.78 b
Karbeyazı	39.19 b	22.69 ab	16.83 a	4.73 b
Şampiyon	48.18 a	24.61 a	12.28 b	6.73 a
LSD	3.721**	2.09**	0.845**	0.825**

**: p<0.01 *: p<0.05 n.s.: not significant

Table 8. Residual effects of poultry manure on sucrose, fructose, and glucose content of onion bulbs as a second crop.

Treatment	**Sucrose**	**Fructose**	**Glucose**
	(g 100 ml^{-1})	**(g 100 ml^{-1})**	**(g 100 ml^{-1})**
0	3.33 a	17.71 a	22.13 a
NPK	2.29 b	12.09 b	11.70 c
20 t ha^{-1}	2.56 b	16.89 a	19.68 a
40 t ha^{-1}	2.69 ab	12.16 b	13.93 bc

60 t ha^{-1}	2.12 b	13.03 b	15.55 b
LSD	0.715**	1.752**	2.670**

**: p<0.01 *: p<0.05 n.s.: not significant

Table 9. Effect of variety on sucrose, fructose, and glucose content of onion bulbs as second crop.

Variety	**Sucrose**	**Fructose**	**Glucose**
	(g 100 ml^{-1})	**(g 100 ml^{-1})**	**(g 100 ml^{-1})**
Burgaz	3.53 a	14.61 b	18.30 b
Karbeyazı	2.37 b	18.95 a	20.35 a
Şampiyon	1.89 b	9.57 c	10.55 c
LSD	0.472**	0.774**	1.373**

**: p<0.01 *: p<0.05 n.s.: not significant

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