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THE EFFECTS OF NITROGEN (UREA) AND ZINC APPLIED IN DIFFERENT DOSES FROM THE SOIL AND LEAVES ON THE DEVELOPMENT, DRY MATTER AMOUNT AND MINERAL CONTENT OF WHEAT AND CORN PLANTS

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Abstract: This study was carried out to determine the effects of nitrogen and zinc applied in different doses (0.0, 0.5, 1 and 1.5 kg N/ha and 0.0 and 2.5 ppm Zn) to the soil sample taken from Erzurum Atatürk University Faculty of Agriculture Farm land on the dry matter content and mineral content of wheat and maize. It was carried out under greenhouse conditions in 96 pots (2 plants, 2 application methods, 4 nitrogen doses, 2 zinc doses and 3 replications). As a base fertilizer, it was applied to all pots before planting at doses of 1 kg P_2O_5/ha (TSP: 44.0% P_2O_5) and 1 kg K_2O/ha (K_2SO_4: 50.0% K_2O). Considering the applications, Urea and Zinc fertilizers were applied to the soil before planting in soil application, and from foliar application 5 times in every 2 weeks, starting one week after germination in foliar application. 90 days after sowing, the plants were harvested, dried, their dry weights were determined, the necessary analyzes were made and the plant mineral content was determined. According to the results obtained, nitrogen application from the soil was more effective, and the highest dry matter amount and plant height in both plants were obtained from the soil application of 1.5 kg N/ha urea and 2.5 ppm Zn. Depending on the applications, the dry matter increase is 77.5% in wheat and 80.4% in corn in application from soil. In foliar application, the dry matter increase is 11.4% in wheat and 30.6% in corn. A similar change has also emerged in plant height, the plants applied fertilizer from the soil are taller, with an average of 62.5 cm in wheat and 75.5 cm in maize. These values are on average 55.0 cm and 64.0 cm in plants applied foliar fertilizer. The mineral content of the plants applied foliar fertilizer is higher.

Keywords: Dry matter, Urea, Zinc, Dose

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1. Introduction

The rapid increase in world population and needs necessitate increasing agricultural production. It is very difficult, even almost impossible, to increase the existing agricultural lands on earth. Therefore, studies are carried out to buy more products from the unit area. These studies should be carried out using the most appropriate techniques and inputs that will not harm the environment and living things. The reasons for the use of chemical fertilizers can be counted as detecting the missing nutrients in plants, increasing the quality of the products grown, keeping the fertility of the soil at a certain level, and increasing the resistance of the plants under adverse conditions (Guzel et al., 2002, Gucdemir et al., 2008).

Plant production is one of the sources used in human nutrition. E.g; 55.0% of the energy source taken during the feeding period is met from cereals, 18.0% from animal products, 13.0% from legumes and similar products (Ayyıldız, 1982). Wheat cultivation area in the world is 220,417,745 ha and wheat production is 729,012,175 tons and the average yield is 3,310 kg/ha. In Türkiye, the cultivation area is 7.866.887 ha, the production is 22.600.000 tons and the average yield is 2.873 kg/ha. The cultivation area of corn in the world is 184,800,969 ha and its production is 1,037,791,518 tons, with an average yield of 5,620 kg/ha. In Türkiye, the cultivation area is 688.170 ha, the production is 6.400.000 tons and the average yield is 9.300 kg/ha. While wheat ranks first in the world and in Türkiye in terms of cultivation area and production among cereals, it ranks third in corn cultivation area and second in production (TUIK, 2015).

The fact that wheat plays an important role in human nutrition, especially bread, that maize is rich in carbohydrates, fats and digestible proteins in human and animal nutrition, and that maize is used in industry and handicrafts increases the importance of these plants. Corn has found a wide cultivation area in the world due to its short development period among cereal varieties, its high productivity, its suitability for mechanized agriculture, and its cultivation in different ecology and climatic conditions.

Akman and Topal (2010) investigated the effects of urea application in different forms on yield, yield components and quality in durum wheat. In addition to the 17 kg Diamonyum Fosfat (0.8 kg P_2O_5/ha and 0.3 kgN/ha) fertilizer applied with planting, the researchers applied urea fertilizer equivalent to 10 kg N/da in the spring in seven different ways (control, all on the soil surface during tillering, and all on soil during tillering period). under tillering - 1/2 on the soil surface during tillering, 1/2 on tillering period - 1/2 under soil during tillering period, 1/2 on soil surface during tillering period - 1/ 2 by sprinkling during the earing period and 1/2 by sprinkling during the tillering period - 1/2 by sprinkling during the earing period) to plant height, ear length, ear number, number of grains per ear, grain per ear in "Cort 125" durum wheat variety. They determined the effects on the weight, the number of ears per m^2, the weight of hectoliters, the weight of a thousand grains, the harvest index, the grain yield, the protein ratio, the vitreousness. According to the findings of the researchers, the effect of urea application methods is significant on plant height, spike number, number of grains per spike, thousand grain weight, grain yield, protein content and vitreousness, spike length, grain weight per spike, number of spikes per m^2, hectoliter weight and harvest index was found to be insignificant.

In a study, the effect of ammonium sulphate fertilizer on three different rapeseed cultivars at different doses (0.0, 0.8, 1.2 and 1.6 kgN/ha) on yield and yield components of rapeseed was investigated by applying half of it at planting and the other half during flowering. According to the results of the research, nitrogen doses on plant height, number of side branches attached to the main stem, number of capsules on the main stem, capsule size, number of seeds in the capsule, thousand-grain weight, seed yield, % protein and % oil ratio, plant height, number of capsules on the main stem, The effect of cultivars on the number of seeds in the capsule, seed yield, % protein and % oil was found to be very significant ($P<0.01$) (Baslama, 1999).

Soğut (2005) determined the plant height, fruit number, 100 seed weight, harvest index, parcel yield and seed yield per hectare of some soybean varieties by bacterial inoculation and nitrogen fertilizer application. According to the findings of the researcher, grafting and nitrogen fertilizer application had a significant ($P<0.01$) effect on the investigated plant parameters.

In addition, although the investigated parameters differ according to soybean varieties, it has been revealed that bacterial inoculation is more effective on plant height, fruit number, 100 seed weight, harvest index and yield per hectare.

Karaca and Cimrin (2002) applied different doses of nitrogen (0 and 6 kg N/ha) and phosphorus (0, 0.4, 0.8 and 1.2 kg P_2O_5/ha) to a mixture of barley (25%) and vetch (75%). investigated the effects of plant height, grass yield, hay yield, % protein, plant N, P, K, Ca and Mg content. According to the researchers, the effects of nitrogen fertilizer doses on plant height, green grass yield, hay yield, % protein, nitrogen, phosphorus and potassium content of plants are significant ($P<0.01$), insignificant on calcium and magnesium content, phosphorus doses on plant height, green grass yield The effect on hay yield, % protein, nitrogen, potassium, calcium and magnesium content of plants was insignificant, but the effect on phosphorus content was significant ($P<0.01$).

Polat et al. (2007) conducted a study to determine the effect of different application methods and times on potato yield and tuber size with different nitrogen fertilizers, ammonium sulfate (21% N), ammonium nitrate (32% N) and urea (30 kg N equivalent per decare). 45% N) fertilizers (all of the fertilizer at planting; 1/3 of the fertilizer before planting - 1/3 of the first hoe - 1/3 of the neck filling; 2/3 of the fertilizer to the first hoe - 1/3 of the fertilizer) neck filling; 2/3 of the fertilizer before planting - 1/3 of the first hoe; 1/3 of the fertilizer before planting - 2/3 neck filling; 1/2 of the fertilizer before planting - 1/2' 1st hoe; 1/2 of the fertilizer to the first hoe - 1/2 of the neck filling; 1/2 of the fertilizer to the first hoe - 1/2 of the neck filling; 1/2 of the fertilizer before planting -1/4 1st hoe - 1/4 throat filling; 1/4 of the fertilizer before planting -1/2 of the first hoe - 1/4 neck filling; 1/4 of the fertilizer before planting -1/4 ' first anchor - 1/2 throat filling) were applied.

According to the results obtained by the researchers, the highest tuber yield per decare (41.64 kg/ha) is given with all the fertilizer at planting, the highest medium tuber yield (66.11 kg/ha) per decare is the highest tuber yield (22.2 kg/ha) with urea application. kg/ha) all of the fertilizer was given with planting, the least small tuber yield (15.01 kg/ha) was obtained from the fertilizer application, where 1/4 of the fertilizer was applied by planting, 1/2 in the first hoe and 1/4 in the throat filling.Small tuber yield is 183.4 kg/da in ammonium sulfate applied, 17.38 kg/ha in ammonium nitrate applied and 17.29 kg/ha in urea applied. According to the application time, the total tuber yield per decare was between 90.66 and 128.04 kg/ha, and the effect of nitrogen fertilizer application time on tuber yield was found to be significant at the $p<0.01$ level. When nitrogen forms are taken into account, an average of 97.19 kg/ha tuber was obtained from the ammonium nitrate applied plots, 1049.1 kg/ha from the urea applied plots and 1061.8 kg/ha from the ammonium sulfate applied plots. According to their findings, the researchers determined that it would be more appropriate to apply ammonium sulfate fertilizer together with planting at a time.

In a study conducted by Nazar (2012), foliar fertilizers with different nutrient content were applied to four different wheat varieties during tillering and stalking periods. The researcher determined that the grain yield increased depending on the fertilizers applied, and the wheat variety and foliar fertilizers were effective on the grain yield. The effects of zinc applied at increasing dose (control), 0.2, 1.5 mg kg-1 and in different forms (ZnO,

$ZnSO_4.7H_2O$, Zn-EDTA, $ZnCl_2$) on growth, dry matter and zinc content of maize plants were determined in greenhouse conditions. The highest increase in these parameters compared to the control was obtained at 1 and 5 mg kg-1 zinc doses. In general, it was determined that the most effective zinc dose was 1 mg kg-1 and the active form was Zn-EDTA, followed by $ZnCl_2$, $ZnSO_4.7H_2O$ and ZnO forms, respectively (Duymuş et al. 2020).

2. Materials and Methods

Soil samples taken from the farm land of Erzurum Atatürk University, Faculty of Agriculture, from a depth of 0-30 cm were used in the research. The soil sample taken was dried under suitable conditions, crushed and sieved through a 4 mm sieve. The research was carried out under greenhouse conditions in 96 pots and 2.5 kg of soil in each pot. After the necessary fertilizer applications were made in the pots, 10 wheat seeds were planted in the pots where wheat will be planted and 4 corn seeds were planted in the pots in which corn will be planted. After germination, 5 wheat and 2 corn plants were left in the pots. Plants were harvested, dried and dry matter amounts were determined by measuring plant heights after 90 days (Kacar, 1972). After the total nitrogen in the plant is subjected to microkjeldahl method, the plant samples that are wet burned with a phosphorus nitric-perchloric acid mixture, vanadomolybdate is subjected to yellow color method, other elements (K, Ca, Mg, Fe, Mn, Zn and Cu) are wet burned with a nitric-perchloric acid mixture. It was determined by reading in the AAS (Bayraklı, 1987). The pH of the soil sample used in the experiment was 1:2.5 in soil water suspension (McLean 1982), electrical conductivity (Rhoades 1996), lime content (Nelson 1982), organic matter content (Nelson and Sommers 1982), texture (Gree and Hortage 1986), KDK and exchangeable cations (Rhoades 1982b), available phosphorus content (Olsen and Sommers 1982), statistical evaluations were determined using the SPSS 17.0 package program.

3. Results and Discussion

3.1. Some Physical and Chemical Properties of the Research Soil

The pH of the soil sample taken from Erzurum Atatürk University Faculty of Agriculture Farm land and used in the experiment is 7.70, and it is in the class of slightly alkaline, lime content of 5.4%, medium calcareous, organic matter content of 2.1%, and phosphorus content of 5.9 kgP2O5/da. . Its CDK is 24.4 me/100g, exchangeable Ca+Ma 17.2 me/100g, exchangeable K 2.2 me/100g is sufficient, exchangeable Na is 0.6 me/100g (Aydın and Sezen, 1995). Microelements Fe 4.22 ppm, Zn 1.35 ppm, mn 4.74 ppm and Cu 1.19 ppm are at sufficient levels (Lindsay and Norvell, 1978). With an electrical conductivity of 0.75 mmhos/cm, it is salt-free, and the texture class of the trial soil is loam, containing 41.4% sand, 28.3% silt and 30.3% clay (Demiralay, 1993).

3.2. The Effect of Fertilizer Dose and Fertilizer Application Method on Plant Height and Dry Matter Amount

The changes in plant height depending on the fertilizer application method and fertilizer doses are seen in Table 1 and Figure 1, and the differences in the amount of dry matter are seen in Table 2 and Figure 2. When the plant heights are examined from Table 1 and Figure 1, the plant height in wheat varies between 45 cm and 75 cm in soil application, it is 48.5 cm in the average control and 73 cm in the highest nitrogen dose. Plant height varies between 46 and 66 cm in foliar application, with an average of 48.5 cm in control and 61.5 cm in the highest nitrogen dose. In maize, it varies between 50 and 100 cm in soil application, the average plant height is 54 cm in the control, 94 cm in the highest nitrogen dose, the plant height is between 50-76 cm in the foliar application, the average plant height is 54 cm in the control samples and 73 cm in the highest nitrogen dose was measured. Plant height is 58.5 cm in wheat and 68.7 cm in maize as an average of doses and applications. According to the fertilizer application method in wheat and corn, the average plant height is 67.8 cm in soil application and 59.5 cm in foliar application.

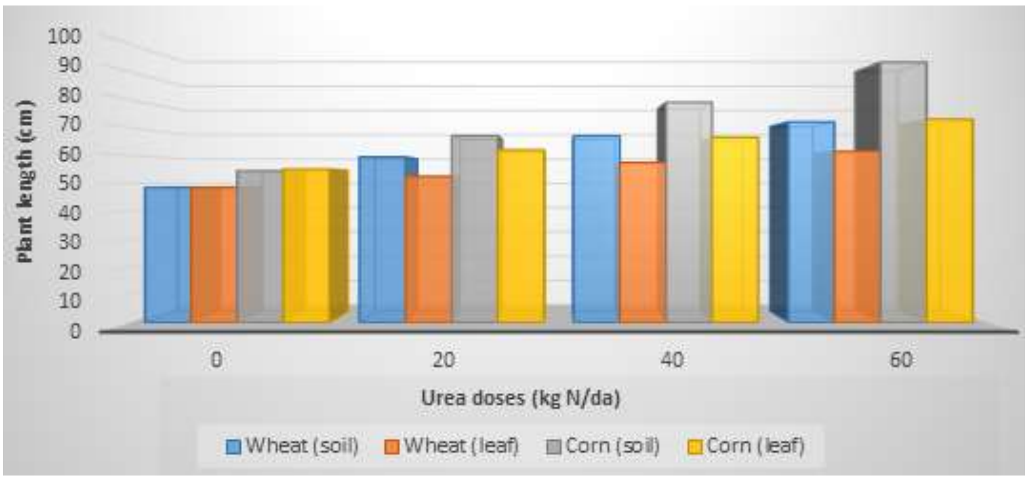

Figure 1. The effect of nitrogen doses and application method on plant height.

Table 1. Effect of nitrogen (Urea) and zinc applied in different doses from soil and leaf on plant length in wheat and corn (cm)

Plant type	Application	Fertilizer Dose		Iteration			
		Urea-N (ppm)	Zinc (ppm)	1	2	3	Mean
Wheat	Soil	0	0.0	45	49	50	48
			2.5	47	53	47	49
		20	0.0	63	57	58	59
			2.5	60	58	62	60
		40	0.0	63	69	66	66
			2.5	72	64	68	68
		60	0.0	70	75	74	71
			2.5	74	73	72	73
		Mean		61.8	62.3	61.2	61.75
	Leaf	0	0.0	49	52	46	49
			2.5	47	46	51	48
		20	0.0	52	50	54	52
			2.5	55	52	52	53
		40	0.0	58	59	54	57
			2.5	60	55	59	58
		60	0.0	57	66	60	61
			2.5	61	60	65	62
		Mean		54.9	55.0	55.4	55.10
Corn	Soil	0	0.0	52	55	55	54
			2.5	60	50	55	55
		20	0.0	62	73	66	67
			2.5	72	65	65	67
		40	0.0	80	75	79	78
			2.5	73	85	82	80
		60	0.0	90	90	98	93
			2.5	92	100	90	94
		Mean		72.6	75.4	73.8	73.90
	Leaf	0	0.0	55	50	57	54
			2.5	53	58	58	56
		20	0.0	59	60	66	62
			2.5	64	55	67	62
		40	0.0	68	70	60	66
			2.5	67	65	70	67
		60	0.0	72	75	70	73
			2.5	74	69	76	73
		Mean		64.0	62.8	65.5	64,10

Therefore, this plant height difference, which occurs depending on the fertilizer doses and the way of fertilizer application, is naturally reflected in the amount of dry matter. While the effect of fertilizer application method and nitrogen doses on plant height was found to be significant (P<0.01), the effect of zinc dose was not significant (Table 3 and 4).

When the amount of plant dry matter was examined from Table 2 and Figure 2, it was revealed that there were significant differences depending on the fertilizer application method. In wheat, the amount of dry matter in soil application varies between 7.25 and 17.80 g/pot depending on nitrogen doses, and between 7.19 and 8.87 g/pot in foliar application. In maize, on the other hand, the amount of plant dry matter in soil application varies between 8.14 and 21.70 g/pot, depending on the nitrogen doses, and between 8.21 and 13.13 g/pot in foliar application. This change in the direction of increase in the amount of wheat dry matter provides an increase of 39.5% at a dose of 0.5 kgN/ha, 125.0% at a dose of 1 kgN/ha and 145.4% (on average 77.5%) at a dose of 1.5 kgN/ha, compared to the control samples in soil application. Compared to the control, dry matter increased by 7.2% at 0.5 kgN/ha, 14.9% at 1 kgN/ha and 23.4% (mean 11.4%) at 1.5 kgN/ha. In the study conducted by Erdem (2011) Zn was applied to different corn varieties and it was stated that there was a significant increase in the dry matter amount of the corn plant as a result of the application. It has been stated that the nitrogenous fertilizer types applied to the soil increase the dry matter content of both wheat and corn plants (Kızılgöz and Sakin 2011).

Table 2. Effect of nitrogen (Urea) and Zinc applied in different doses from soil and leaf on dry matter amount of wheat and corn plants (g/pot)

Plant type	Application	Fertilizer Dose		Replications			
		Urea-N (ppm)	Zinc (ppm)	1	2	3	Mean
		0	0,0	7,25	7,10	7,33	7,23
			2,5	7,06	7,38	7,40	7,28
		20	0,0	9,91	10,34	9,69	9,98
			2,5	11,01	9,65	10,10	10,25
	Soil	40	0,0	15,68	16,48	16,23	16,13
			2,5	15,72	17,11	16,70	16,51
W		60	0,0	17,84	17,07	18,16	17,69
h			2,5	18,62	16,88	18,21	17,90
e		Mean		12,88	12,77	12,98	12,87
a		0	0,0	7,22	7,44	6,86	7,17
t			2,5	7,00	7,28	7,31	7,20
		20	0,0	7,32	7,43	7,88	7,53
			2,5	7,55	7,98	8,05	7,86
	Leaf	40	0,0	8,41	7,69	8,17	8,09
			2,5	8,72	8,50	8,05	8,42
		60	0,0	8,95	8,67	8,69	8,77
			2,5	9,55	8,51	8,83	8,96
		Mean		8,09	7,94	7,98	8,00
		0	0,0	8,33	7,69	8,22	8,08
			2,5	8,11	8,50	8,98	8,19
		20	0,0	10,66	13,74	12,62	12,34
			2,5	14,10	12,11	11,89	12,70
	Soil	40	0,0	16,06	17,85	17,13	17,10
			2,5	18,21	18,01	16,96	17,76
		60	0,0	20,19	22,54	21,18	21,30
C			2,5	23,07	20,96	22,30	22,11
o		Mean		14,85	15,18	14,79	14,94
r		0	0,0	7,78	8,35	8,38	8,17
n			2,5	8,10	7,98	8,70	8,26
		20	0,0	10,30	11,03	9,87	10,40
			2,5	11,21	10,84	10,77	10,94
	Leaf	40	0,0	11,25	11,34	12,12	11,57
			2,5	10,93	13,38	12,32	12,21
		60	0,0	13,46	12,22	12,78	12,82
			2,5	15,06	12,12	13,17	13,45
		Mean		10,88	10,53	10,76	10,72

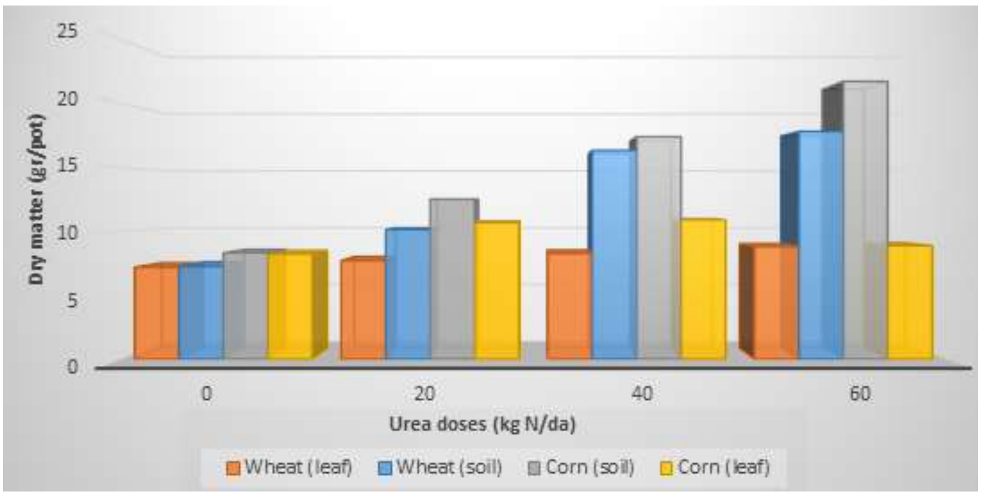

Figure 2. The effect of nitrogen doses and application method on the amount of plant dry matter.

Table 3. The effect of fertilizer doses on plant height and dry matter amount depending on the fertilizer application method and plant type

Plant Height (cm)				Dry matter (g/pot)			
Dose	n	Mean±St. Error	P	Dose	n	Mean±St. Error	P
0 ppm	24	51,67±0,876[a]	0,000	0 ppm	24	7,74±0,123[a]	0,000
20 ppm	24	60,29±1,285[b]		20 ppm	24	10,26±0,386[b]	
40 ppm	24	67,54±1,731[c]		40 ppm	24	13,46±0,770[c]	
60 ppm	24	75,00±2,476[d]		60 ppm	24	15,38±1,020[d]	
Total	96	63,63±1,219		Total	96	11,71±0,447	
0 ppm	48	63,18±1,71[a]	0,703	0 ppm	48	11,52±0,62[a]	0,676
2,5 ppm	48	64,12±1,75[a]		2,5 ppm	48	11,89±0,65[a]	

Table 4. The effect of fertilizer application method and plant type on plant height and dry matter amount

	Plant Type		Application	
	Wheat	Corn	Soil	Leaf
Plant Height (cm)	58,52±1,238[a]	68,73±1,834[b]	67,77±1,999[a]	59,48±1,129[b]
Dry matter (g/pot)	10,44±0,578[a]	12,98±0,635[b]	13,93±0,710[a]	9,49±0,304[b]
n	48	48	48	48

Dry matter increase in corn was 50.8%, 109.4% and 161.4% (average 80.4%) in soil application, 29.9%, 32.6% and 59.9% (average 30.6%) dry matter increase in foliar application, respectively. The average amount of plant dry matter in terms of doses and applications is 10.44 g/pot in wheat and 12.98 g/pot in corn. According to the fertilizer application method in wheat and corn, the average plant dry matter amount is 13.93 g/pot in soil application and 9.49 g/pot in foliar application. Considering the fertilizer doses and applications, the dry matter increase was 44.0% in wheat compared to the control, while it was 57.0% in maize, and the dry matter increase in maize was higher. The average dry matter increase is 79.0% in soil fertilizer applied plants and 23.2% in foliar applied plants. As the nitrogen dose increased, the dry matter content increased. Soil application was more effective in increasing dry matter. While the effect of nitrogen doses and application methods on the amount of plant dry matter was found to be significant, the effect of the zinc dose was not found to be significant (Tables 3 and 4).

3.3. The Effect of Fertilizer Doses and Fertilizer Applications on Plant Mineral Content

The changes in the mineral content of the plants caused by the different doses of urea and zinc fertilizers applied to wheat and corn plants from the soil and leaves are seen in Table 5. When the mineral content of the plants is examined from Table 5, the plant mineral content varies depending on the fertilizer dose and application method. Generally, depending on the application of increasing doses of nitrogen, the nitrogen content of the plants in the wheat plant contained an average of 1.72% N, while the plants applied 0.5 kgN/ha nitrogen were 1.97% N, the plants applied 1 kgN/ha 2.13% N and the plants applied 1.5 kgN/ha nitrogen. The control samples contained 2.42% N, while the control samples contained 1.52% N on average, 1.67% N on 0.5 kgN/ha nitrogen, 1.80% N on 1 kgN/ha nitrogen and 2.00% N on 1.5 kgN/ha nitrogen applied. While the nitrogen content of the experimental plants increased as the nitrogen dose increased, the concentration of other elements (P, K, Ca, Mg, Fe, Mn, Zn, Cu) in the plant tissue showed a decrease. The increase in the nitrogen content of the plant tissue can be attributed to the application of nitrogen fertilizer, and the change in the direction of decrease in other elements can be attributed to the relative decrease of these elements in the plant tissue as a result of the plant growth and dry matter increase resulting from the application of nitrogenous fertilizer.

The N, P, K, Ca, Mg, Fe, Mn, Zn and Cu contents of the plants applied fertilizer from the soil as an average of doses in the wheat plant are 2.05%, 0.22%, 3.13%, 0.59%, 0.23%, 87.1 ppm, 67.8 ppm, 60.5, respectively. ppm and 14.4 ppm, N, P, K, Ca, Mg, Fe, Mn, Zn and Cu contents of plants applied foliar fertilizers were 2.07%, 0.23%, 3.17%, 0.62%, 0.24%, 93.3 ppm, 72.0 ppm, 62.5 ppm and 15.0 ppm, respectively. N, P, K, Ca, Mg, Fe, Mn, Zn and Cu contents of the plants applied fertilizer from the soil as the average doses in the corn plant were 1.73%, 0.21%, 3.00, 0.47%, 0.16%, 69.8 ppm, 61.1 ppm, 50.2, respectively. ppm and 13.5 ppm, N, P, K, Ca, Mg, Fe, Mn, Zn and Cu contents of plants applied foliar fertilizer are 1.77%, 0.23%, 3.06%, 0.49%, 0.18%, 74.6 ppm, 63.1 ppm, 52.8 ppm and 14.1 ppm, respectively.

The N, P, K, Ca, Mg, Fe, Zn, Mn and Cu contents of the plants applied foliar fertilizer are slightly higher. This increase in dry matter mineral content is probably related to the amount of dry matter obtained. In a soil where corn plants are grown 0; 2.5; 5,0 and 10.0 µg g-1 doses of Zn were applied and it was stated that the concentrations of Fe, Mn and Cu in plant green parts decreased statistically significantly (Taban ve Alpaslan, 1996). It was stated that there was a decrease in green part phosphorus (P) concentrations, and increases and decreases in potassium (K) concentrations of wheat and corn plants applied Zn (Torun et al., 2019).

Table 5. Effect of nitrogen (Urea) and zinc applied in different doses from soil and leaf on mineral content of wheat and corn

P	A	Fertilizer Dose				%				ppm		
T	p	N, ppm	Zn, ppm	N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
		0	0.0	1.71	0.25	3.23	0.64	0.26	96,4	73.6	66.9	15,9
	S		2.5	1.72	0.24	3.18	0.63	0.27	95.1	75.3	65.4	16.2
	o	20	0.0	1.99	0.22	3.13	0.61	0.24	89.3	71.8	62.6	15.3
	i		2.5	1.97	0.22	3.15	0.60	0.24	91.2	69.0	61.3	15.1
	l	40	0.0	2.15	0.21	3.09	0.58	0.22	83.6	64.8	60.5	13.7
			2.5	2.07	0.22	3.12	0.57	0.22	85.2	66.6	59.2	13.7
W		60	0.0	2.40	0.20	3.08	0.55	0.20	78.9	60.2	54.7	12.6
h			2.5	2.38	0.20	3.07	0.54	0.18	77.2	61.1	53.2	12.7
e		Mean		2.05	0.22	3.13	0.59	0.23	87.1	67.8	60.5	14.4
a		0	0.0	1.73	0.25	3.23	0.64	0.27	98,7	75.1	67.7	16.4
t	L		2.5	1.70	0.26	3.20	0.63	0.27	96.4	73.4	65.5	15.8
	e	20	0.0	1.97	0.24	3.18	0.64	0.25	94.3	74.5	64.2	15.5
	a		2.5	1.95	0.23	3.16	0.63	0.24	92.9	72.9	63.8	15.6
	f	40	0.0	2.15	0.23	3.19	0.62	0.24	93.5	71.3	60.4	14.3
			2.5	2.14	0.22	3.15	0.61	0.23	94.2	70.9	61.3	14.6
		60	0.0	2.45	0.22	3.13	0.60	0.22	89.3	69.7	59.2	13.9
			2.5	2.46	0.21	3.12	0.59	0.22	87.0	68.2	58.1	13.7
		Mean		2.07	0,23	3.17	0.62	0.24	93.3	72.0	62.5	15.0
		0	0.0	1.51	0.24	3.13	0.52	0.20	75.6	66.6	56.1	14.8
	S		2.5	1.52	0.23	3.08	0.51	0.19	78.2	65.4	53.4	14.5
	o	20	0.0	1.69	0.22	3.03	0.50	0.17	74.8	63.8	52.5	14.3
	i		2.5	1.68	0.22	3.05	0.48	0.16	70.9	64.0	51.8	13.5
	l	40	0.0	1.75	0.20	2.99	0.45	0.15	65.5	59.7	50.2	12.7
			2.5	1.77	0.21	2.94	0.45	0.14	68.6	59.3	48.2	13.1
		60	0.0	1.96	0.18	2.88	0.43	0.14	63.2	55.8	44.9	12.5
C			2.5	1.94	0.18	2.91	0.42	0.13	61.6	54.2	44.5	12.6
o		Mean		1.73	0,21	3.00	0,47	0.16	69.8	61.1	50.2	13,5
r		0	0.0	1.53	0.25	3.11	0.53	0.20	79.3	66.9	55.7	14.4
n			2.5	1.50	0.24	3.13	0.51	0.20	77.4	65.8	54.9	15.0
	L	20	0.0	1.67	0.24	3.08	0.51	0.18	76.7	64.8	54.6	14.5
	e		2.5	1.65	0.24	3.07	0.51	0.17	73.9	63.3	53.5	14.4
	a	40	0.0	1.85	0.23	3.09	0.48	0.16	75.5	62.5	51.8	14.0
	f		2.5	1.84	0.23	3.02	0.47	0.17	70.7	61.6	52.2	13.6
		60	0.0	2.05	0.20	2.98	0.46	0.16	73.0	59.7	50.3	13.7
			2.5	2.07	0.21	3.00	0.45	0.16	70.2	60.2	49.4	13.2
		Mean		1.77	0.23	3.06	0.49	0.18	74.6	63.1	52.8	14.1

4. Conclusion

According to the results of the research, nitrogen application from the soil was more effective on the plant height and dry matter amount as the average doses. The height of the plants applied fertilizer from the soil is taller, with an average of 62.5 cm in wheat and 75.5 cm in maize. These values are on average 55.0 cm and 64.0 cm in plants applied foliar fertilizer. The difference in plant height was naturally reflected in the amount of dry matter. The highest amount of dry matter and plant height in both wheat and maize were obtained from the soil application of 15.0 kgN/da urea and 2.5 ppm Zn. Depending on the applications, the dry matter increase is 77.5% in wheat and 80.4% in maize in soil application, while the dry matter increase in foliar application is 11.4% in wheat and 30.6% in corn, the average dry matter increase is 44.5% in wheat and 58.5% in corn. The effect of nitrogen doses and application methods on plant height and dry matter amount was found to be significant. The effect of zinc application on both plant height and dry matter amount was found to be insignificant. On the other hand, foliar fertilizer application was more effective on plant mineral content. -The mineral content of the plants applied foliar fertilizer is higher than the ones applied from the soil, although it is not very obvious.

When we look at the data obtained from the experiment, it is more important to apply macro (N, P, K, Ca, Mg, etc.) nutrients to the plants from the soil rather than the leaves turned out to be appropriate. Therefore, macronutrients must be applied from the soil. The insignificant effect of zinc application on dry matter and plant height can be attributed to the sufficient zinc (1.35 ppm) content of the trial soil and the suitability of soil pH (7.70) and lime content (5.4%).

It has been concluded that it is economical and beneficial to apply fertilizer from soil, but micro (Fe, Zn, Mn, Cu, B, Mo etc.) nutrients can be applied from leaves in problematic soils (highly calcareous, high pH, coarse textured, organic soils).

Author Contributions

The percentage of the author(s) contributions is present below. All authors reviewed and approved final version of the manuscript.

	E.Y.	A.A.
C	50	50
D	50	50
S	50	50
DCP	50	50
DAI	50	50
L	50	50
W	50	50
CR	50	50
SR	50	50
PM	50	50
FA	50	50

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The authors declared that there is no conflict of interest.

Ethical Consideration

Ethics committee approval was not required for this study because of there was no study on animals or humans.

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