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THE EFFECTS OF DIFFERENT NITROGENOUS FERTILIZER SOURCES AND DOSES ON FOOTBALL FIELD GRASS PERFORMANCES

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Abstract: Nitrogen has a huge importance in terms of ensuring the development of roots and shoots in grass and giving plants resistance to diseases. Using the right fertilizer in appropriate doses in the maintenance and repair of football fields is one of the maintenance procedures that increase grass performance. This study was carried out on the football field grass established at Iğdır University Sehit Bulent Yurtseven Campus during the 2020 vegetation period in Iğdır conditions. The research aimed to determine the most suitable fertilizer type and dose for football fields. The experiment was designed with three replications according to the randomized blocks factorial trial design. In the application area, a grass mixture of *Festuca arundinacea* Jaguar 4G 30%, *Festuca arundinacea* Apache 20%, *Festuca arundinacea* Arid III 20%, *Lolium perenne* Belida 15% and *Lolium perenne* Esquire 15% was used. As nitrogenous fertilizer sources, 20-10-10 7SO3, 15-5-20 + 2 CaO + MgO, ammonium sulfate (21% N) and urea (46% N) fertilizers are 0, 2, 4, 6 and 8 g/m ^{2}/ It was administered in monthly doses. In the study, the effects of nitrogen use in fertilization on grass plant height, quality, fresh grass amount, and leaf green tone and leaf texture were observed. As a result of the study, it was determined that the most ideal fertilizer type and dose were 6 and 8 g m^{-2} doses of urea and ammonium sulfate fertilizers.

Keywords: Nitrogen fertilizer type, Grass plants, Grass quality, Football field, Fertilizer dose

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1. Introduction

When grass fields are mentioned, football fields come to mind first. It is important to create a grass cover on football fields that allows the ball to move and prevents football players from getting injured by falling. Just as the types and mixtures of grass used in the football field facility are important, it is necessary to apply the correct fertilizers and doses to ensure continuity, in addition to periodic ventilation and irrigation. The lawns on sports fields require meticulous maintenance. When maintenance is disrupted, sports fields may lose their appearance in a short time and become unplayable (Orçun, 1979).

Nitrogen fertilization in lawns is very important. The formation of abundant green leaves on lawns is desirable due to forming intense cover. Therefore, the presence of nitrogen is important for vegetative green leaf development, and it is needed more than other nutritional elements (Orçun, 1979). Nitrogen has a positive effect on development by accelerating development and increasing the growth rate, especially in wheat crops (Kaçar, 1977). The selection of a durable and successful grass mixture for football fields is directly proportional to the strengths and weaknesses of the species and their ability to adapt to the environment. In the study we conducted in Iğdır province, which shows a 'microclimate' feature in terms of climate, the selected plants are cool climate grass species. The grasses were selected from among the species that are resistant to stepping on, can grow quickly and are durable. *Festuca arundinacea* (reedy ball) has a deep root structure and is highly resistant to heat and drought, in addition to developing in the form of a ball and forming a frequent grass surface. *Lolium perenne* L. *(perennial English grass),* on the other hand, is a fast-growing species and is a species that is highly resistant to running over and wearing off (Anonymous, 2020a). In the study, the effect of different fertilizer forms used in different seasons on the grass quality criteria in a grass area established with a dual grass mixture under Iğdır conditions was examined.

2. Materials and Methods

2.1. Trial Area

The research was established at the Sehit Bulent Yurtseven Campus of Iğdır University in 16 May 2020 with three repetitions according to the factorial trial pattern in the coincidence blocks.

2.2. Climate Characteristics

The monthly average temperature (0 °C), monthly average relative humidity (%) and monthly total precipitation (mm: kg m^{-2}) values for the period in which the experiment was conducted are given in Table 1 (Anonymous, 2020b). According to Table 1, the average total rainfall in Iğdır for many years during the period when the research was conducted was 168.7 mm, and in the year when the experiment was conducted, it was 153.3 mm, and 15.4 mm less precipitation was observed in 2020 compared to many years. According to the precipitation and temperature averages for many years, the average temperature in Iğdır during the research period was 19.4 ℃, the average temperature during the research period of 2020, when the research was conducted, was 19.8 ℃, and the temperature values are similar. While the average relative humidity was 53% compared to the average for many years, it reached 53.3% in 2020.

2.3. Soil Properties

Before October, by being taken a soil sample from a depth of 0-30 cm, physical and chemical analysis was performed, and the results are given in Table 2 (Anonymous, 2020c). When the soil sample taken from the trial area was examined, it was found that the soil had a medium lime content (10.57), slightly alkaline pH (8.38), good potassium level (73.27), phosphorus rich (13.76), medium organic matter levels (2.04%), unsalted total salt content (0.01%) and clay loam structure.

2.4. The Types of the Plants Used the Types and Doses of Fertilizers

In the study, *Festuca arundinacea* Jaguar 4 G 30%, *Festuca arundinacea* Apache 20%, *Festuca arundinacea* Arid III 20%, *Lolium perenne* Belida 15%, *Lolium perenne* Esquire 15% grass mixture was preferred. In the research, four different commercial fertilizers [20-10-10 + 7 SO_3; 15-5-20 + 2CaO + 2 MgO; Ammonium Sulfate (21% N) and Urea (46% N)] were applied as nitrogen fertilizer sources. Five different fertilizer doses (0, 2, 4, 6 and 8 g/m^2/month) were used, one of which was a control.

2.5. Planting and Maintenance Operations

While the test area was being prepared at the Sehit Bulent Yurtseven Campus of Iğdır University, the existing foreign materials were firstly removed from the area, and fine leveling was carried out with the help of a rake after rough leveling of the area was carried out with agricultural machines. The parcel area was determined as 2 m x 1 m = 2 m^2 (Misia, 1991; Hunt and Dunn, 1993). The distance between the parcels is 0.5 m. Purity and germination rates were determined in the laboratory before planting, and the planting rates of grass species were determined (Oral and Açıkgöz, 1999). 8 g/m^2 of pure phosphorus (46% TSP) was given together with the planting process in order to develop the grass roots ideally. 80 g of grass seed mixture was planted by hand to each parcel. After the planting, cover soil (peat) was laid on the seed with a thickness of 1 cm and pressed with a cylinder. The irrigation process was carried out regularly every day in the morning and evening both during the germination and development and structuring stages depending on the varying weather conditions. The weeds in the parcels were removed by hand procedure and the grass was allowed to develop and cover the area. All maintenance operations in the area were carried out periodically and cleaning was carried out 3 weeks (21 days) before each measurement process.

2.6. Experimental Measurement and Research Methods

The plant height was measured with the help of a ruler at 10 separate points of each parcel (Mulvalı, 1999). To determine the leaf width, 10 different leaves were measured and averaged with the help of a caliper in each parcel. A scale of 1-9 (1 yellow, 9 dark emerald green) was used to determine the green leaf color tones (Spanberk et al, 1986). The grass quality was determined according to the 1-9 scale (1 is the worst, 9 is the best grass quality) (Sills and Carrow, 1983; Mehall et al, 1983). The amount of wet grass was expressed as gram/m^2, which was weighed using sensitive measuring instruments.

Table 1. Iğdır province climate data

	Total monthly precipitation (mm)		Average temperature (°C)		Average relative humidity (%)	
Months	2020	Many years	2020	Many years	2020	Many years
May	76.1	50.7	18.6	18.0	55.0	52.8
June	15.7	34.0	23.9	22.9	44.7	47.0
July	30.2	14.9	26.7	26.3	48.4	44.3
August	15.3	9.9	24.2	26.3	47.6	45.7
September	1.4	10.1	23.5	21.3	47.7	50.2
October	7.3	28.7	14.5	14.7	62.9	63.9
November	7.3	20.4	7.2	6.0	67.0	67.4
Average	153.3	168.7	19.8	19.4	53.3	53.0

Table 2. The results of the analysis of the test soil

Depth	Lime Ratio (%)	pH	(K) (kg/da)	(P) (kg/da)	Organic Matter (%)	Total Salt (%)	Soil Structure
0-30 cm	10.57	8.38	73.27	13.76	2.04	0.01	Clay loam

Statistical Analysis

The statistical analysis of the experiment was performed using the statistical package program JMP 5.0.1. According to the results of the variance analysis, the differences between the averages of the statistically significant characteristics were compared with the LSD multiple comparison test (Steel and Torrie Dec, 1980).

3. Results and Discussion

The results of the variance analysis of the averages obtained in the research are given in Table 3. As it can be seen in Table 3, the effect of applications on all the studied features was found to be statistically significant.

3.1. Plant Height

When the plant sizes were examined during the summer period, the effects of fertilizer type, fertilizer dose and the interactions of these factors were found to be important at the level of 1%. (Table 3) Plant sizes obtained in different fertilizer types and doses in summer season are given in Table 4. In terms of plant height, 20-10-10 fertilizer was found in the lowest amount with 15.3 cm in the average fertilizer type, and urea fertilizer was found in the highest amount with 21.7 cm. On the other hand, the average fertilizer dose remained the highest with 24.3 cm at an 8 g m^2 fertilizer dose, and the control fertilizer dose remained the lowest with 10.4 cm. In the fertilizer variety and fertilizer dose interactions, the control fertilizer doses remained in the lowest amounts in the fertilizer varieties, while the urea fertilizer was found to be the highest with an 8 g m^2 fertilizer dose of 27.3 cm. Our study shows that the plant height values are like the values of Karakurt (2003).

The effects of fertilizer type, fertilizer dose and the interactions of these factors on plant height values were found to be significant at the level of 1% in the autumn period. (Table 3) Plant sizes obtained from measurements made in the autumn period are given in Table 4. According to Table 5, urea gave the highest plant height values with 24.1 cm in the average fertilizer variety in the autumn period. The 20-10-10 fertilizer remained at the lowest plant height value with 16.6 cm. In the average fertilizer dose, the 8 g m^2 fertilizer dose reached the highest plant height with 27 cm, while the control fertilizer dose was found to be the lowest with 10.3 cm. In the fertilizer variety and dose interactions, 15-5-20 and urea fertilizers were found to have the lowest values with 9.7 cm, 9.7 cm, respectively, and reached the highest height value with 6 and 8 g m^2 doses of urea with 31.4 cm and 30.8 cm, respectively. The values of our study coincide with the values of Zengin (2019) and Gökçe (2019).

As our study has been evaluated in terms of plant height, monthly doses of 8 g m^2 of urea and ammonium sulfate fertilizers in summer and autumn periods has been very effective in the mixtures of *F. arundinacea*, and *L. perenne*. In grass species, plant sizes increased with urea fertilizer, which is used as a nitrogen source in both seasonal conditions and gave the highest values. Especially at a monthly dose of 8 g m^2 of urea, plant sizes showed quite high values.

The results of the study show that the ammonium sulfate and urea fertilizers used in the experiment dissolving quickly in the soil were quickly taken up by plants and stimulated growth. However, the 20-10-10 and 15-5-20 composite fertilizer varieties with controlled release had a slow effect on the lawn performance values.

Table 3. The results of the variance analysis of the research findings

	The amount of age		Plant height		Tint		Grass quality	Leaf width
	F Value		F Value		F Value		F Value	F Value
Source of variation	Y	S	Y	S	Y	S	Y	S
Type of fertilizer (TF)	76.6**	44.1**	91.0**	225.4**	45.5**	51.5**	3.2*	3.5*
Dosage of Fertilizer (DF)	230.4**	163.1**	223.6**	590.0**	101.5**	109.2**	63.5**	117.0**
TF x DF	7.8**	4.5*	8.7**	21.5**	2.5*	8.2**	NS	2.7*

**P<0.01is important in probability limits, *P<0.05 is important in probability limits, NS= insignificant, Y= Summer, S= Autumn.

Table 4. Average plant sizes obtained in different fertilizer types and doses in summer season (cm)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	10.9 ^{k}	13.3 ^{ij}	14.3 ^{hi}	18.2 ^{g}	19.7 ^{fg}	15.3 ^{d}
15-5-20	9.9 ^{k}	11.6 ^{jk}	15.4 ^{h}	20.9 ^{ef}	23.5 ^{cd}	16.3 ^{c}
Ammonium sulfate	10.2 ^{k}	18.4 ^{g}	22.6 ^{de}	24.1 ^{cd}	26.5 ^{ab}	20.4 ^{b}
Urea	10.7 ^{k}	20.8 ^{ef}	24.3 ^{cd}	25.1 ^{bc}	27.3 ^{a}	21.7 ^{a}
Average	10.4 ^{e}	16.0 ^{d}	19.2 ^{c}	22.1 ^{b}	24.3 ^{a}	

Table 5. Plant sizes obtained in different types and doses of fertilizers in the autumn season (cm)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	11.2 jk	14.7 i	16.4 h	20.7 g	23.7 ef	16.6 d
15-5-20	9.7 k	12.0 j	16.4 h	19.8 g	25.3 cd	17.4 c
Ammonium sulfate	10.7 jk	20.3 g	24.2 de	26.0 c	28.1 b	21.9 b
Urea	9.7 k	22.3 f	26.5 c	31.4 a	30.8 a	24.1 a
Average	10.3 e	17.3 d	20.9 c	24.5 b	27.0 a	

While fertilizers that dissolve quickly in the soil had an immediate effect on the height of the grass, compound fertilizers provided slower growth. For all fertilizer types, as the doses increased, plant heights also increased. Nitrogen positively affected plant height and development in grass (Escapes, 1977).

3.2. Color

When the color shades obtained in the summer season were examined, it was determined that the fertilizer type and fertilizer dose were 1% important, and the interactions of these factors were 5% important (Table 3).

The color performances obtained in different fertilizer types and doses are given in Table 6. According to Table 7, urea and ammonium sulfate fertilizers showed the highest color performance with 8.20 and 8.13 points in the average fertilizer variety in terms of color tone on lawns in the summer season. 20-10-10 fertilizer remained the lowest color performance value with a score of 6.73. In terms of fertilizer dose averages, while the 8 g m ^{2} fertilizer dose had the highest value with 8.42 points, the control fertilizer dose had the lowest green color performance value with 5.42 points. The color values of our study are like the values of Yilmaz and Avcioglu (2002), Kesemen (2008), Salman and Avcioglu (2010), Türk and Sözören (2016), Türk and Kılıç (2017), Abdelkader et al (2018), Köktaş (2019) studies.

The effects of fertilizer type, dose, and interactions on the color values of lawns in autumn were found to be significant at the level of 1% (Table 3). The obtained color tone performance values are given in Table 7.

According to Table 7, it has been found that ammonium sulfate and urea have the highest performances in the averages of fertilizer variety in terms of color shades. The 20-10-10 fertilizer exhibited the lowest performance with a score of 5.80. In terms of fertilizer dose averages, 6 and 8 g m^2 fertilizer doses reached the highest color tone values by receiving 8.25 and 8.08 points, respectively. In the fertilizer type and dose interactions, ammonium sulfate and urea exhibited high performance by receiving the highest score values at fertilizer doses of 2, 4, 6 and 8 g m^2. The control fertilizer dose, on the other hand, had the lowest scores in all fertilizer varieties. Our study values Aslan and Çakmakçı (2004), Zorer et al. (2004), Türk and Kılıç (2017), Abdelkader et al (2018), Zengin (2019), Gökçe (2019) are in line with their values.

When our research was examined in terms of color tone, it was observed that plant color performance has quite high values in areas where urea is applied in summer season and ammonium sulfate and urea are applied 8 g m^2 per month in autumn season. However, it has been found that monthly doses of 2 g m^2 and 4 g m^2 fertilizers show similar performance.

The results of our study show that increases in nitrogen doses have improved leaf color performance in lawns.

Table 6. Color shades obtained in different types and doses of fertilizers in the summer season (points)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	5.67 g	7.33 cde	7.00 de	7.67 cd	8.00 bc	6.73 c
15-5-20	4.67 h	7.00 de	6.67 ef	7.33 cde	8.00 bc	7.13 b
Ammonium sulfate	5.33 gh	8.67 ab	8.67 ab	9.00 a	9.00 a	8.13 a
Urea	6.00 fg	8.67 ab	8.67 ab	9.00 a	8.67 ab	8.20 a
Average	5.42 d	7.75 c	7.92 bc	8.25 ab	8.42 a	

Table 7. Color shades obtained in different types and doses of fertilizers in the summer season (points)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	4.00 c	6.00 b	5.67 b	8.67 a	8.67 a	5.80 c
15-5-20	4.33 c	6.00 b	6.33 b	6.33 b	6.00 b	6.60 b
Ammonium sulfate	4.00 c	8.67 a	8.67 a	9.00 a	8.67 a	7.80 a
Urea	4.33 c	8.67 a	8.67 a	9.00 a	9.00 a	7.93 a
Average	4.17 c	8.67 a	7.33 b	8.25 a	8.08 a	

Table 8. Grass qualities obtained in different types and doses of fertilizers in the summer season (points)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	7.00	7.33	8.33	8.67	8.67	7.53 b
15-5-20	6.67	7.00	8.00	8.67	9.00	7.67 ab
Ammonium sulfate	6.33	7.00	7.33	8.67	9.00	7.87 ab
Urea	5.67	7.33	7.00	8.67	9.00	8.00 a
Average	6.42 d	7.17 c	7.67 b	8.67 a	8.92 a	

Table 9. Grass qualities obtained in different types and doses of fertilizers in the autumn season (points)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	6.33 d	8.33 abc	8.00 bc	8.67 ab	9.00 a	8.07 a
15-5-20	5.33 e	8.33 abc	8.00 bc	8.67 ab	9.00 a	7.87 ab
Ammonium sulfate	5.00 ef	7.67 c	7.67 c	8.67 ab	9.00 a	7.60 b
Urea	4.33 f	7.67 c	8.67 ab	8.67 ab	8.67 ab	7.60 b
Average	5.25 c	8.00 b	8.08 b	8.67 ab	8.92 a	

The lowest color scores were obtained from the control groups in the summer season, and the highest values were taken from the 8 g m^2 N applications. When N, which forms the structure of chlorophyll in chloroplasts, increases, the number of chlorophylls also increases (Orçun, 1979). With the increase of N doses, darkening and increase in leaf color tones were observed.

3.3. Grass Quality

When the lawn quality data were examined in the summer season, as the fertilizer dose was found to be 1% and the fertilizer variety effects were found to be 5% significant, the interaction between the two was not found to be significant (Table 3). The grass quality performances obtained in different fertilizer types and doses are given in Table 8.

When Table 8 was examined, urea fertilizer reached the highest lawn quality performance with 8.0 points in terms of lawn quality in the averages of fertilizer types in summer season. It was found that the 20-10-10 fertilizer was the lowest performance value with a score of 7.53. In terms of fertilizer dose averages, while 6 and 8 g m^2 fertilizer doses showed the highest performance with 8.67 points and 8.92 points respectively, the control fertilizer dose exhibited the lowest performance with 6.42 points. In our study, the grass quality values were found similar study values of Zorer et al. (2004), Avcioglu and Geren (2012), Abdelkader et al. (2018), Köktaş (2019).

The effects of fertilizer dose on grass quality values in the autumn season were found to be significant at the level of 1%, the effects of fertilizer type and factor interactions were found to be significant at the level of 5% (Table 3). Lawn quality performances of different fertilizers and doses are given in Table 9. When Table 9 was examined, it was seen that 20-10-10 fertilizer showed the highest lawn quality performance with 8.07 points in the averages of fertilizer type. Ammonium sulfate and urea fertilizers had the lowest quality performance with a score of 7.6. In the average fertilizer dose, 6 and 8 g m^2 fertilizer doses reached the highest values with 8.67 and 8.92 points respectively, and the control fertilizer dose had the lowest value with 5.25 points. While urea fertilizer showed the lowest performance with 4.33 points of the control dose in the fertilizer type and fertilizer dose interactions, 20-10-10, 15-5-20 and ammonium sulfate fertilizers exhibited the highest performance with 8 g m^2 fertilizer doses receiving 9.0 full points. The values of our study are compatible with the values of Abdelkader et al. (2018), Köktaş (2019), Zengin (2019), Gökçe (2019), Özaydın (2019).

Nitrogen has increased the color performance of plants, especially in grass fields, and enabled their rapid development. In terms of grass quality, it can be said that high doses of nitrogen sources increase performance values. It was found that the grass quality received high values in the plots where 6 g m^2 and 8 g m^2 urea and ammonium sulfate fertilizers were used monthly.

3.4. Leaf Width

When the leaf width data for the summer period were examined, the effects of fertilizer type, fertilizer dose and the interactions of these factors were found to be insignificant (Table 3). The most leaf values obtained in different fertilizer types and doses during the summer period are given in Table 10.

The leaf width values obtained in our study were insignificant in terms of all factors and were among the thin leaves according to the Beard (1973) classification. The values obtained were close to the values of Kesemen (2008), Türk and Sözören (2016), Türk and Kılıç (2017), but were found to be slightly lower.

In the leaf width values obtained in the autumn season, the type of fertilizer was found to be 5%, the effects of fertilizer dose and interactions were found to be significant at the level of 1% (Table 3). Leaf width values obtained from different fertilizer types and doses are given in Table 11.

Table 10. Leaf width obtained in different types and doses of fertilizer in summer season (mm)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	0.84	0.73	1.23	1.08	1.11	1.00
15-5-20	0.99	0.94	1.32	1.37	1.33	1.19
Ammonium sulfate	1.43	1.48	1.34	1.42	1.44	1.42
Urea	1.51	1.41	1.41	1.40	1.42	1.43
Average	1.19	1.14	1.32	1.32	1.33	

Table 11. Leaf width obtained in different types and doses of fertilizers in the autumn season (mm)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	2.10 ^{i}	2.33 ^{fgh}	2.58 ^{cd}	2.49 ^{de}	2.43 ^{ef}	2.39 ^{b}
15-5-20	2.06 ^{i}	2.36 ^{fgh}	2.65 ^{bc}	2.51 ^{de}	2.73 ^{ab}	2.46 ^{a}
Ammonium sulfate	2.10 ^{i}	2.30 ^{gh}	2.40 ^{efg}	2.71 ^{ab}	2.77 ^{ab}	2.46 ^{a}
Urea	2.07 ^{i}	2.26 ^{h}	2.39 ^{efg}	2.75 ^{ab}	2.82 ^{a}	2.46 ^{a}
Average	2.08 ^{e}	2.31 ^{d}	2.51 ^{c}	2.61 ^{b}	2.69 ^{a}	

According to Table 11, the 15-5-20, ammonium sulfate and urea fertilizers reached the highest leaf width values with 2.46 mm in the average fertilizer variety in the autumn season. The 20-10-10 fertilizer had the lowest leaf width with 2.39 mm. In the average fertilizer dose, the 8 g m^2 fertilizer dose reached the highest leaf value with 2.69 mm, while the control fertilizer dose was found to be the lowest with 2.03 mm. In the fertilizer type and dose interactions, the urea 8 g m^2 fertilizer dose was found to be the highest with a leaf value of 2.82 mm, while the control doses of all fertilizer types were found to be at the lowest leaf width values. While the values of our study were consistent with the values of Türk and Sözören (2016), they remained slightly below the values of Türk and Kılıç (2017).

In terms of leaf texture, summer season values were found to be lower than autumn values. Fungal disease has developed in *L.perenne* species due to the increase in temperature in the summer season and the humidity of the vegetation environment and losses have occurred in this species. *F. arundinacea* species, which has a wide leaf width, was dormant in vegetation, therefore leaf tissue values were determined to be higher in autumn than in summer. While the leaf tissue remained thin in the control groups, it was found that the leaf tissue was large in the parcels given nitrogen.

It is thought that the reason for the low values is that the leaves that germinated immediately after planting did not fully reach the inherited leaf tissue values.

It is thought that the reason why our values differ slightly is because the width of the leaf may vary depending on environmental factors. In our study, while *F. arundinacea* is included in the mixture, it was used as a plain in Kılıç and Türk's study. In addition, studies have recently been carried out on the *F. arundinacea* species to obtain a variety with small palms. The varieties used in our study should be evaluated as varieties that have been improved in terms of leaf blades.

3.5. The Amount of Fresh Grass

When the amounts of fresh grass were examined in the summer period, the effects of fertilizer type, fertilizer dose and the interactions of these factors were found to be significant at the level of 1% because of the variance analysis. The Duncan test was applied, and the differences were revealed (Table 3). The results of the analysis of the amount of plant fresh grass obtained in different types and doses of fertilizer in the summer season are given in Table 12.

According to Table 8.a, urea and ammonium sulfate fertilizer varieties were found in the highest amounts with 1045 g and 1011 g values in terms of fresh grass yields in the average fertilizer variety, while the 20-10-10 and the 15-5-20 fertilizer varieties remained in the lowest amounts with 679 g and 733 g values. In the average fertilizer dose, while 8 g m^2 fertilizer dose accounted for the highest fresh grass yield with a value of 1283 g, the control fertilizer dose remained at the lowest amount with a value of 328 g. In the fertilizer variety and fertilizer dose interactions, the urea was the highest with a dose of 8 g m^2, while the control fertilizer doses remained in the lowest amounts in all fertilizer varieties. The values of our study show similarities with the values of Hosaflioglu (2009), Kaş (2010), Ozaydin (2019), Koçak (2019).

When the fresh grass data in the autumn period were examined, the effects of fertilizer type and fertilizer dose were found to be significant at the level of 1% and the effects of their interactions were found to be significant at the level of 5% (Table 3). The amounts of fresh grass obtained in different fertilizer types and doses in the autumn season are given in Table 13.

According to Table 13, ammonium sulfate and urea fertilizers in lawns had the highest yield values with 771 g and 813 g in terms of fresh grass values in the autumn period. The 20-10-10 fertilizer gave the lowest fresh grass value with 506 g.

Table 12. The amount of fresh grass obtained in different types and doses of fertilizers in the summer season (g)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	310 j	517 i	600 i	750 h	1217 cd	679 b
15-5-20	347 j	517 i	767 h	933 fg	1100 dc	733 b
Ammonium sulfate	320 j	833 gh	1233 cd	1283 bc	1383 ab	1011 a
Urea	327 j	983 ef	1217 cd	1253 bc	1433 a	1045 a
Average	328 e	713 d	954 c	1055 b	1283 a	

Table 13. The amount of fresh grass obtained in different types and doses of fertilizers in the autumn season (g)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	Average
20-10-10	227 k	257 jk	300 jk	697 gh	1050 bc	506 c
15-5-20	320 jk	383 j	533 i	767 e-h	983 cd	597 b
Ammonium sulfate	327 jk	727 fgh	810 efg	897 de	1127 ab	771 a
Urea	313 jk	633 hi	840 ef	1017 bc	1263 a	813 a
Average	297 e	500 d	621 c	837 b	1106 a	

In terms of fertilizer dose averages, the highest efficiency was achieved with 1106 g at an 8 g m2 fertilizer dose, while the control fertilizer dose remained at the lowest level with 297 g. The urea fertilizer received the highest amount of fresh grass with 1263 g at a dose of 8 g m^2. While the values of our study were found to be like Gökçe (2019) values, they were found to be higher than Rich (2019) values.

The fresh grass values determined in our studies in terms of the amount of fresh grass, came out higher than the values of Zorer et al. (2004). One of the reasons for this is that the period from cleaning to evaluation methods in our study (three weeks) is longer than in the studies of Zorer et al (2004). Another reason is that the species used in the mixture are species with a fast-developing hereditary structure, the types used by Zorer et al. are that they have a slow-developing hereditary structure. Also, the high percentage of the fast-growing F. arundinacea species in the mixture (70%) is one of the reasons. Our study shows similarities with the values of Hosaflioglu (2009) study. In the study conducted by Akdeniz and Hosaflioglu (2016) under Iğdır conditions, the values of the amount of fresh grass found were found to be higher than the values of our study. It is thought that this difference is also caused by maintenance and environmental factors. While the summer values of our study are similar to the study values of Kaş (2010), Ozaydin (2019) and Koçak (2019), the autumn values correspond to the values of Gökçe (2019).

4. Conclusion

The highest performance values for football fields under Iğdır conditions were obtained in pure nitrogen of ammonium sulfate and urea fertilizer varieties in 6 and 8 g m^2 fertilizer doses. Football fields are areas that are often worn out and destroyed because of stepping over. Besides that, the deformation of the grass tissue in these areas is tolerated quickly, a rapid development of the grass should be ensured again. In our study, monthly doses of 6-8 g m^2 of pure nitrogen of ammonium sulfate and urea fertilizers are recommended to ensure the rapid development of the grass and to cover the damages. Ammonium sulfate and urea fertilizers showed a faster effect in terms of nitrogen element compared to the composite fertilizer varieties included in the study. As a matter of fact, ammonium sulfate and urea fertilizers soon after application quickly came to the form that the plant will benefit from in the soil, became effective in the grass, and manifested itself in the strong development of vegetative structure such as trunk and leaves. As a matter of fact, shortly after the application of ammonium sulphate and urea fertilizers, vegetative revolutionary strong groups such as stems and leaves, which were effective in the separation of forms that would benefit from the beginning in the general soil, proved themselves. However, the effect of the 20-10-10, the 15-5-20 composite fertilizers on the development of vegetative structure has remained weak since it takes longer to reach the form that the plant will use in the soil, especially in terms of nitrogen element.

According to the data of this study, in the football grass fields where pressure and wearing off are intense, ammonium sulfate and urea fertilizer types of nitrogen which are quickly taken up by plants from the soil are needed for the species that are under heavy pressure to recover and for the vegetation to always remain uniformly green.

For football fields that are not under much pressure or worn out little under Iğdır conditions, it is recommended to apply a dose of pure nitrogen 2 g m^2 of ammonium sulfate and urea fertilizers to maintain a dark color tone and give the desired grass quality. A dose of 2 g m^2 of pure nitrogen of these fertilizers on football fields was especially sufficient to preserve the green color texture. It has already been concluded that a dose of 2 g m^2 of pure nitrogen will be sufficient in these fertilizer

varieties, since the wear and tear by pressure is also low. By applying fertilizer in lower doses, the amount of fresh grass and plant height values were lower, contributing to savings in labor, time, and other costs. It is very important to carry out fertilization as much as necessary to prevent environmental pollution in an ecological sense.

Author Contributions

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

	M.M.	İ.H.
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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