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THE EFFECTS OF FORM AND DOSES OF NITROGEN FERTILIZER ON GRASS QUALITY PERFORMANCE AT THE PLANT OF FINE-TEXTURED LAWNS

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Abstract: This study was carried out in Igdir University Sehit Bulent Yurtseven Campus in the vegetation period of 2020 to determine the effects of nitrogenous fertilizer sources and doses on the quality of lawn plants in turfgrass areas. 20-10-10 7 SO_3, 15-5-20 + 2 CaO + 2 MgO, ammonium sulfate (21% N), urea (46% N) fertilizers with nitrogenous fertilizer sources were applied on the parcels in doses of 0-2-4-6-8 g/m^2/month. The effects of fertilizers used after structuring in lawns on plant height, leaf green tone, fresh grass quantity, quality and coating ratios were examined. *Festuca rubra* 40%, *Festuca rubra commutata* 30%, *Festuca rubra trichopylla* 25%, *Poa pratensis* 5%, which are thin textured from cool climate grass species, were used in the mixture. The trial was established according to the factorial trial pattern in coincidence blocks with three repetitions. As a result of the research, ammonium sulfate and 8 g m^{-2} doses were found to be more effective when evaluated for grass quality and performance after structuring in thin-textured grass species.

Keywords: Cool climate, *Festuca rubra*, Urea, Structuring

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1. Introduction

Due to industrialization and urbanization, people need spaces where they can relax, spend time comfortably, get away from city stress and find morale. Nowadays, lawns not only provide people relaxing mentally, but also, they are indispensable for recreational areas, landscaping areas, football, and golf courses where they have a pleasant time. Mixtures to be created by arranging grass species such as *Poa pratensis*, *Festuca rubra* in various proportions can be used in grass areas to be installed for different purposes (Vengris and Torello, 1982). 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 fact that the emerald green colors of the grass always remain vivid, and the quality performance of the grass can remain consistently high depends on the regular intake of the elements it needs. Areas whose maintenance is disrupted lose their desired appearance by surrendering to weeds in a short time. This study aimed to determine the most efficient fertilizer type and dose that can be beneficial to the soil and plants for the grass areas created with great dedication to maintain their appearance for a long time.

2. Materials and Methods

2.1. Description of the Research Area

A total of five mixtures of two species were prepared in the study of adaptation of cool climate and fine textured grass species for grass fields under Igdir conditions. In this mixture, *Festuca rubra* 40%, *Festuca rubra commutata* 30%, *Festuca rubra trichopylla* 25%, *Poa pratensis* 5% were used. The effect of nitrogen form fertilizer and doses on grass quality and performance on the created grass composition was studied. The trial was established on the field at the back of the rectorate building and next to the Faculty of Agriculture of Igdir University between the dates from May 2020 to August 2020. Igdir province is in the south of the Igdir Plain, at an altitude of 850 m above sea level and located northwest of Mount Agri. The research location is 15 km away from the city center of Igdir and has a latitude of 39^0 82” and longitude of 44^0 08” degrees.

In the mixtures used in the grass field facility, *Festuca rubra* and *Poa pratensis* species are provided with irrigation water in general, as precipitation, which is one of the most important climatic features for their development, is not in sufficient quantity at the Igdir location, the water needs of the grass fields during the vegetation period are provided. The relative amount of humidity and temperature are sufficient for plant development during the year (Table 1).

2.2. Soil Properties of the Experiment Area

When the soil sample taken from a depth of 0-30 cm in the test area was examined, the lime ratio was found to be 10.57 (medium), pH 8.38 (alkaline), potassium 73.27 kg da^{-1} (high), phosphorus 13.76 kg da^{-1} (very high), organic matter 2.04% (medium), total salt 0.01% (unsalted), soil structure (clay loam).

Table 1. Igdir province climate data (Igdir Provincial Directorate of Meteorology, 2020)

Year/month	1	2	3	4	5	6	7	8	9	10	11	12	Top.
Total Monthly Precipitation (mm: kg m^{-2})													
2020	7.3	14.1	18.1	83.6	76.1	15.7	30.2	15.3	1.4	7.3	7.3	7.8	284,2
Average Monthly Temperature (^{0}C)													
2020	0.0	1.9	10.6	11.7	18.6	23.9	26.7	24.2	23.5	14.5	7.2	3.2	
Average Monthly Relative Humidity (%)													
2020	65.2	64.5	56.5	64.8	55.0	44.7	48.4	47.6	47.7	62.9	67.0	83.6	

2.3. Material

2.3.1. The types and proportions of grass used in the experiment

Festuca rubra (40%), *Festuca rubra commutata* (30%), *Festuca rubra trichopylla* (25%) and *Poa pratensis* (5%), which are cool climate grass species and selected according to their fine textured characteristics, were used in the mixture. To determine the pure and viable seediness, purity and germination rates were determined in the laboratory before planting, and the planting rates of grass species were determined (Oral, 1998).

2.3.2. Nitrogen-form fertilizers applied in the experiment and their doses

From pure and compositely arranged commercial fertilizers containing nitrogen in different proportions in their content; 20-10-10 + 7 SO3 (20% N), 15-5-20 + 2 CaO + 2 MgO (15% N), ammonium sulfate (21% N) and urea (46% N) varieties were used. According to the increasing nitrogen doses, 0-2-4-6-8 g m^{-2} was applied monthly during the vegetation period.

2.4. Method

2.4.1. The experiment plan and the planting operations

The experiment was set up according to the factorial trial pattern in coincidence blocks, with three repetitions. Before the experiment area was prepared, foreign substances were removed from the area and rough leveling was carried out with agricultural machines. After the fine leveling was made using a rake, the parcels were formed by determining the lines with ropes and piles. The parcel area was established as 2 m x 1 m = 2 m^2 (Misia, 1991; Hunt and Dunn, 1993). The distance between the parcels is set to 0.5 m. Four types of commercial fertilizers containing nitrogen in different proportions were applied to all parcels in 5 different doses consisting of 2, 4, 6 and 8 g to m^{-2}, one of which was a control dose (0 g m^{-2}), with 3 repetitions (3 x 5 x 4 = 60) after the form every month (May, June, July)

The planting process was carried out on May 15, 2020. Pure phosphorus fertilizer is given to the seedbed in the form of TSP granular fertilizer to be 8 g m^{-2} before planting, and it is aimed the grass roots to develop better and start to build up quickly. Planting of seeds was made in a parcel area of 2 m^2 (size: 2 m x 1 m) with 40 g per m^2. For the cover soil, peat was used, which was available as economic conditions permitted and would allow the grass to grow easily. After preparing the cover soil, it was applied to the seed to be 1 cm and pressed with a cylinder. After planting, regular irrigation was carried out with a sprinkler irrigation system until the grass output was ensured to be homogeneous.

Although it depends on the period, climate and daily weather, irrigation was performed every two days afterwards. The weeds formed in the parcels have been purified by physical intervention, and the grass has been completely spread in the area. It is aimed to increase fraternization and structuring by making regular forms. During the 3-month devoted maintenance and control process of the grass, the parcels were cleaned, especially 3 weeks (21 days) before the measurement and weighing process.

2.4.2. The characteristics examined in the research

After the cleaning procedure was carried out in the experiment area on July 4, all observations, measurements, and weighing were carried out 1 time on July 25. The characteristics examined at this stage are the amount of fresh grass, plant height, color tone, grass quality and coverage rate. The variance analyses of the obtained numerical data and LSD multiple comparison tests were performed according to JMP 5.0.1 statistical package program (Steel and Torrie, 1980).

2.4.3. The amount of fresh grass

The fresh grass obtained from the research were weighed with sensitive measuring instruments and the amount was indicated as g.

2.4.4. Plant height

Measurements were made with the help of a ruler from the places determined at 10 separate points of each research parcel, and the plant height was determined as cm (Mulvalı, 1999).

2.4.5. Color tone

The leaf color shades of the plants in the parcel were determined by visual evaluation for the summer season using a scale of 1-9. Accordingly, 1 represented yellow and 9 represented dark emerald green tone (Spangenberk et al., 1986).

2.4.6. Grass quality

The homogeneous image formed by the lawns in the parcels, the evaluation created because of visual examinations such as frequent structuring and weeding was determined by scoring according to the 1-9 scale. On the scale, 1 represented the worst and 9 the best turf quality values (Sills and Carrow, 1983).

2.4.7. Coverage rate

In the experiment area, the plant coverage rate was determined with the help of a frame measuring 50 x 50 cm, the inner area of which was divided into 100 equal parts by a rope. The degree of coverage the area of the plants was calculated with the help of this frame in each parcel by counting the squares of 25 cm^2 and proportioning them to the total (Avcioglu, 1983).

3. Results and Discussion

3.1. Lawn Quality and Performance Values

The numerical data obtained from all parcels are processed as fresh grass quantity, plant height, color tone, grass quality and coverage rate, and it has been made comparisons with similar studies conducted previously.

3.2. The Amount of Fresh Grass

The effects of fertilizer type, fertilizer dose and the interactions of these factors on the amount of fresh grass were found to be significant at the level of 1% (Table 2). The amounts of fresh grass obtained in nitrogen fertilizer forms and doses are given in Table 3.

According to Table 3, in terms of grass yields, ammonium sulfate and urea fertilizer varieties were found in the highest amounts with 800.7 g and 724.7 g values in the average fertilizer varieties, while 20-10-10 and 15-5-20 fertilizer varieties remained in low amounts with 713.3 g and 523.3 g values. In terms of the average fertilizer dose, the 8 g m^{-2} fertilizer dose remained the highest with a value of 1004.2 g, and the control fertilizer dose remained the lowest with a value of 310.8 g. In the interaction of fertilizer dose with fertilizer type, urea fertilizer 8 g m^{-2} fertilizer dose remained the highest with a value of 1200 g, and the control fertilizer dose remained the lowest with values of 273.3 g, 300 g, 303.3 g, 366.6 g, respectively, in all fertilizer types.

3.3. Plant Height

Nitrogen fertilizer forms and fertilizer dose interactions were found to be significant at the level of 1% on the obtained plant height values and the effects of the interactions of these factors were found to be significant at the level of 5% (Table 4).

The ammonium sulfate and urea fertilizers used were taken quickly by plants with their fast dissolution properties in the soil and had a positive effect on growth. 20-10-10 and 15-5-20 compound fertilizer types which oscillate controlled affected grass performance values more slowly. According to the results of the research, fast-dissolving pure nitrogen fertilizers in the soil had an immediate effect on the height of the lawns and enabled them to grow faster than composite fertilizers. For all fertilizer types, as the dose given increased, the height of the plants gradually increased.

According to Table 5, in terms of grass plant height, 15-5-20 fertilizer was found in the lowest amount with an average of 13.2 cm in the fertilizer type averages, while urea fertilizer was found in the highest amount with 16.5 cm. In terms of fertilizer dose averages, the 8 g m^{-2} fertilizer dose was the highest at 22.3 cm, and the control fertilizer dose remained at the lowest value at 9.9 cm. Regarding the interactions between fertilizer type and fertilizer dose, the control fertilizer dose remained the lowest in the fertilizer types with values of 9.3 cm, 9.3 cm, 10 cm, 11 cm, respectively, while the 8 g m^{-2} fertilizer dose of urea fertilizer was found the highest value with 25.6 cm.

3.4. Color Tone

Nitrogenous fertilizer forms and fertilizer doses were found to be significant at 1% level based on the color tone values obtained (Table 6). The color tone performances obtained with nitrogen fertilizer forms and doses are given in Table 7. According to Table 7, urea and ammonium sulfate fertilizers reached the highest color tone performance with 6.3 points in the fertilizer type average in terms of grass color tone, while 15-5-20 and 20-10-10 fertilizers scoring 5.6 and 5.8 points respectively, and remained at the lowest color performance value. In terms of fertilizer dose averages, while the 8 g m^{-2} fertilizer dose reached the highest value with 6.6 points, the control fertilizer dose remained at 5 points, which is the lowest color tone performance value. In terms of fertilizer type and fertilizer dose interactions, while 8 g m^{-2} fertilizer doses of ammonium sulfate and urea fertilizer reached the highest color tone performance with a value of 7 points, control fertilizer doses of all fertilizer types were found to be the lowest color tone performance with 5 points.

According to the research results, the increase in nitrogen dose increased the leaf color tone performance in grass. The lowest color tone scores were obtained from control plots where nitrogen was not applied. The highest values were taken from 8 g m^{-2} nitrogen fertilizer applications. Accordingly, as nitrogen doses increased, a darkening of leaf color tones was detected.

Table 2. The results of the variance analysis of the amount of fresh grass

Sources of variation	Degree of Freedom	Sum of Squares	Square average	F Value
Block	2	5770.0	2885.0	0.4566
Type of fertilizer	3	626551.7	208850.6	33.05**
Dosage of fertilizer	4	3302826.7	825706.7	130.68**
TF x DF	12	355040.0	29586.6	4.68**
Error	38	240096.7	6318	
General	59	4530285.0		

**F values are important in probability limits of P<0.01.

Table 3. The amounts of fresh grass obtained in nitrogen fertilizer forms and doses (g)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	The average type of fertilizer
20-10-10	366.6 ^{ij}	550.0 ^{gh}	750.0 ^{e}	900.0 ^{cd}	1000.0 ^{bc}	713.3 ^{b}
15-5-20	300.0 ^{j}	450.0 ^{hı}	500.0 ^{gh}	600.0 ^{fg}	766.7 ^{e}	523.3 ^{c}
Ammonium sulfate	303.3 ^{j}	800.0 ^{de}	900.0 ^{cd}	950.0 ^{bc}	1050.0 ^{b}	800.7 ^{a}
Urea	273.3 ^{j}	550.0 ^{gh}	700.0 ^{ef}	900.0 ^{cd}	1200.0 ^{a}	724.7 ^{b}
Average fertilizer dose	310.8 ^{e}	587.5 ^{d}	712.5 ^{c}	837.5 ^{b}	1004.2 ^{a}	
Fertilizer type LSD Value	58.75					
Fertilizer dose LSD Value	66.69					
int. LSD Value	131.39					

Fertilizer type LCD Value = t value x std err. Dif. = 2.02439 x 29.0249 = 58.75; Fertilizer dose LCD Value = t value x std err. Dif. = 2.02439 x 32.4508 = 66.69; Fertilizer type x Fertilizer dose LSD value = t value x std err. Dif. = 2.02439 x 64.9016 = 131.39.

Table 4. Results of variance analysis for plant height

Sources of variation	Degree of Freedom	Sum of Squares	Square average	F Value
Block	2	5.03	2.5	1.32
Type of fertilizer	3	232.9	77.6	40.81**
Dosage of fertilizer	4	1101.8	275.5	144.77**
TF x DF	12	108.9	9.1	4.77*
Error	38	72.3	1.9026	
General	59	1520.9		

*The F value is important at the probability limits of P<0.05; **The F values are important at the probability limits of P<0.01.

Table 5. Plant height obtained in nitrogen fertilizer forms and doses (cm)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	The average type of fertilizer
20-10-10	9,3 ^{k}	12,0 ^{ij}	17,0 ^{f}	20,0 ^{cd}	22,0 ^{bc}	16,1 ^{b}
15-5-20	9,3 ^{k}	11,6 ^{ij}	13,0 ^{hi}	14,3 ^{gh}	17,6 ^{ef}	13,2 ^{c}
Ammonium sulfate	11,0 ^{ijk}	17,6 ^{ef}	19,6 ^{de}	21,3 ^{cd}	24,0 ^{ab}	18,7 ^{a}
Urea	10,0 ^{jk}	12,0 ^{ij}	15,6 ^{fg}	19,3 ^{de}	25,6 ^{a}	16,5 ^{b}
Average fertilizer dose	9,9 ^{e}	13,3 ^{d}	16,3 ^{c}	18,8 ^{b}	22,3 ^{a}	
Fertilizer type LSD Value	1,02					
Fertilizer dose LSD Value	1,14					
int. LSD Value	2,28					

Fertilizer type LCD Value = t value x std err. Dif.. = 2,02439 x 0.50367 = 1.02; Fertilizer dose LCD Value = t value x std err. Dif. = 2.02439 x 0.56312 = 1.14; Fertilizer type x Fertilizer dose LSD value = t value x std err. Dif. = 2.02439 x 1.12624 = 2.28.

Table 6. The results of the variance analysis of the color tone

Sources of variation	Degree of Freedom	Sum of Squares	Square average	F Value
Block	2	0.03	0.015	0.14
Type of fertilizer	3	4.98	1.66	13.62**
Dosage of fertilizer	4	23.23	5.81	47.64**
TF x DF	12	2.10	0.18	1.44^{NS}
Error	38	4.633333	0.122	
General	59	34.983333		

**F values are important at P<0.01 probability limits, NS=F value is insignificant.

Table 7. Color shades obtained in nitrogen fertilizer forms and doses (points)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	The average type of fertilizer
20-10-10	5.0	5.3	6.0	6.3	6.3	5.8 [b]
15-5-20	5.0	5.0	6.0	6.3	6.0	5.6 [b]
Ammonium sulfate	5.0	6.0	7.0	6.6	7.0	6.3 [a]
Urea	5.0	6.0	6.6	6.6	7.0	6.3 [a]
Average fertilizer dose	5.0 [d]	5.6 [b]	6.4 [a]	6.5 [a]	6.6 [a]	
Fertilizer type LSD Value	0.258					
Fertilizer dose LSD Value	0.29					
int. LSD Value	0.58					

Fertilizer type LCD Value = t value x std err. Dif... = 2.02439 x 0.1275 = 0.258; Fertilizer dose LCD Value = t value x std err. Dif. = 2.02439 x 0.14255 = 0.29; Fertilizer type x Fertilizer dose LSD value = t value x std err. Dif = 2.02439 x 0.28511 = 0.58.

3.5. Grass Quality

The effects of nitrogenous fertilizer forms on the obtained grass quality values were not found to be significant, while the effects of fertilizer dose were found to be significant at the 1% level. The interaction between the two was found to be significant at the 5% level (Table 8).

The grass quality performances obtained with nitrogen fertilizer forms and doses are given in Table 9.

According to Table 9, in terms of grass quality, urea and ammonium sulphate fertilizers reached the highest grass quality performance with 7.8 points in the fertilizer type average, as it has been detected that 20-10-10 and 15-5-20 fertilizers had a low grass quality performance value with 7.4 points. In terms of fertilizer dose averages, the 8 g m^{-2} fertilizer dose reached the highest grass quality performance with 9 points, while the lowest grass quality performance was determined with 5.2 points at the control fertilizer dose. In terms of fertilizer type and fertilizer dose interactions, 8 g m^{-2} doses of all fertilizer types reached the highest value with 9 points, and the control dose had the lowest values with 5, 5.3, 5.3 and 5 points, respectively.

3.6. Coverage Rate

The effects of fertilizer dose on the obtained leaf width values were found to be significant at the 1% level, while the effects of the interactions of these factors were found to be insignificant (Table 10).

The coverage rates obtained with nitrogen fertilizer forms and doses are given in Table 11.

According to Table 11, all fertilizer types reached the highest values in terms of coverage rates with averages of 88.7, 88.1, 87.5 and 86.6 (%), respectively. In terms of fertilizer dose averages, 8 g m^{-2} fertilizer dose reached the highest value with 94.6%, and the control fertilizer dose reached the lowest value with 70.4%. In terms of fertilizer dose and fertilizer type interactions, ammonium sulfate and urea fertilizers had the highest value with 95%, while the control doses of all fertilizer types had the lowest values with 70, 70.3, 70.7 and 70.7 (%), respectively.

Table 8. The results of the variance analysis of the grass quality

Sources of variation	Degree of Freedom	Sum of Squares	Square average	F Value
Block	2	0.3	0.15	0.52
Type of fertilizer	3	2.4	0.8	2.76[NS]
Dosage of fertilizer	4	122.9	30.73	105.82**
TF x DF	12	7.77	0.65	2.23*
Error	38	11.0	0.29	
General	59	144.4		

*The value of F is important at the probability limits of P<0.05, **F values are important at P<0.01 probability limits, NS=F value is insignificant.

Table 9. Grass qualities obtained in nitrogen fertilizer forms and doses (points)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	The average type of fertilizer
20-10-10	5.0 [f]	6.7 [e]	7.7 [cd]	8.7 [ab]	9.0 [a]	7.4
15-5-20	5.3 [f]	5.7 [f]	8.0 [bcd]	9.0 [a]	9.0 [a]	7.4
Ammonium sulfate	5.3 [f]	7.3 [de]	8.3 [abc]	9.0 [a]	9.0 [a]	7.8
Urea	5.0 [f]	8.0 [bcd]	8.0 [bcd]	9.0 [a]	9.0 [a]	7.8
Average fertilizer dose	5.2 [d]	6.9 [c]	8.0 [b]	8.9 [a]	9.0 [a]	
Fertilizer type LSD Value	0.40					
Fertilizer dose LSD Value	0.45					
int. LSD Value	0.89					

Fertilizer type LCD Value = t value x std err. Dif. = 2.02439 x 0.19676 = 0.40; Fertilizer dose LCD Value = t value x std err. Dif. = 2.02439

x 0.21998 = 0.45; Fertilizer type x Fertilizer dose LSD value = t value x std err. Dif.= 2.02439 x 0.43996 = 0.89.

Table 10. The results of the variance analysis of the coverage rate

Sources of variation	Degree of Freedom	Sum of Squares	Square average	F Value
Block	2	42.2	21.1	1.9
Type of fertilizer	3	34.8	11.6	1.04^{NS}
Dosage of fertilizer	4	4923.9	1231	110.6**
TF x DF	12	77.7	6.5	0.6^{NS}
Error	38	423.1	11.1	
General	59	5501.7		

**F values are important at P<0.01 probability limits, NS=F value is insignificant.

Table 11. Coverage rate obtained in nitrogen fertilizer forms and doses (%)

	Dosage of fertilizer					
Type of fertilizer	0	2	4	6	8	The average type of fertilizer
20-10-10	70.0	89.0	92.3	94.3	94.7	88.1
15-5-20	70.3	83.3	92.0	94.0	93.7	86.6
Ammonium sulfate	70.7	87.7	94.7	95.7	95.0	88.7
Urea	70.7	88.7	89.7	93.3	95.0	87.5
Average fertilizer dose	70.4 ^{c}	87.2 ^{b}	92.2 ^{a}	94.3 ^{a}	94.6 ^{a}	
Fertilizer type LSD Value	2.47					
Fertilizer dose LSD Value	2.76					
int. LSD Value	5.52					

Fertilizer type LCD Value = t value x std err. Dif. = 2.02439 x 1.21843 = 2.47; Fertilizer dose LCD Value = t value x std err. Dif. = 2.02439 x 1.36224 = 2.76; Fertilizer type x Fertilizer dose LSD value = t value x std err. Dif.= = 2.02439 x 2.72448 = 5.52.

4. Conclusion

When evaluated as the amount of fresh grass, it was observed that ammonium sulfate fertilizer showed its effect with an increasing trend between the doses of 0-2 g m^{-2}. This dose keeps plant growth at the desired level and is recommended for economic and ecological benefits.

Looking at the results of plant height values, it is seen that ammonium sulfate fertilizer is more effective, but doses of 2 and 6 g m^{-2} are recommended for the desired development in grass areas.

When the fertilizer dose averages were examined in terms of leaf color, 8 g m^{-2} doses of ammonium sulfate and urea fertilizers (with 6.6 points) exhibited the highest performance. The same fertilizer varieties have 4 g m^{-2} doses (6.4 points) of performance and are recommended because they have values close to the highest performance in terms of lawn color.

When examined in terms of grass quality, it was found that the higher the nitrogen dose, the higher the grass quality performance. The grass quality reached the highest values in all parcels where monthly doses of 6 g m^{-2} and 8 g m^{-2} were used. It has been found that the dose of 4 g m^{-2} of urea fertilizer has an above average value, and it is recommended because it exhibits the desired performance for this type of fertilizer.

When evaluated in terms of coverage rate, it has been understood that ammonium sulfate fertilizer is more prominent than other fertilizers. When the values of 4 g m^{-2} of urea and ammonium sulfate fertilizers were examined, it was found that the coverage rates were more than 90%, and ammonium sulfate fertilizer is recommended considering the economic and ecological benefits.

When all the results are evaluated, 6 and 8 g m^{-2} doses of ammonium sulphate fertilizer are recommended for structuring of grass plants in alkaline soils in a short time in Igdir ecological conditions and continuing the development by achieving the desired color, texture, structure, and quality features and also balancing the pH values of the soil by considering both economic and ecological benefits.

Author Contributions

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

	C.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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