Cilt 12, Sayı 1, Sayfa 136-143, 2023 Volume 12, Issue 1, Page 136-143, 2023

Araştırma Makalesi https://doi.org/10.46810/tdfd.1206130 Research Article

Türk Doğa ve Fen Dergisi
Turkish Journal of Nature and Science
www.dergipark.gov.tr/tdfd

Time-Dependent Change of Plant Nutrients in Italian Grass (*Lolium multiflorum*) after Foliar Fertilization

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(Received: 17.11.2022, Accepted: 10.03.2023, Online Publication: 27.03.2023)

Keywords
Lolium multiflorum,
Algae,
Foliar fertilization,
Plant nutrient

Abstract: This research was carried out in the Keyfoturağı area of Menteşe district of Muğla, Türkiye, in 2021 year to examine the effects of different fertilizer doses with algae on the ryegrass yield and plant nutrient content of Italian grass (*Lolium multiflorum* attain). The fertilizer applications as algae (A: 200 ml) and algae + fertilizer 1 (A+F1: A+500 ml urea, 400 ml $MgSO_4$, 300 ml $ZnSO_4$, 200 ml borax, 100 ml $FeSO_4$, 100 ml $MnSO_4$, 15 ml $CuSO_4$), algae + fertilizer 2 (A+F2: A+625 ml urea, 500 ml $MgSO_4$, 375 ml $ZnSO_4$, 250 ml borax, 125 ml $FeSO_4$, 125 ml $MnSO_4$, 25 ml $CuSO_4$) were applied at different rates to Italian grass plant. Then, the whole plant sample is taken for nine days from the first day and the plants were analyzed for the nutrient contents. According to the results of the research, The wet weight of plant, nitrogen (N), potassium (K), calcium (Ca), magnesium (Mg), sodium (Na), sulfur (S), boron (B), zinc (Zn), copper (Cu), iron (Fe) and manganese (Mn) contents in the plant were found to be statistically significant ($p<0.01$). The highest moisture in A and A+F1 applications, the highest N, Ca, and Mn contents at A+F1 application and the highest S, B, Zn, Cu, and Fe contents at A+F2 application, with the highest K content at A and Na content at control application were determined.

Yaprak Gübrelemesinden Sonra İtalyan Çiminde (*Lolium multiflorum*) Bitki Besin Elementlerinin Zamana Bağlı Değişimi

Anahtar Kelimeler
Lolium multiflorum,
Yosun,
Yaprak gübreleme,
Bitki besin elementi

Öz: Bu araştırma, 2021 yılında Muğla'nın Menteşe ilçesi Keyfoturağı mevkiinde farklı dozlarda yosun ve kimyasal gübrelerin İtalyan çiminde (*Lolium multiflorum* attain) çim verimi ve bitki besin maddesi içeriği üzerine etkilerini incelemek amacıyla yapılmıştır. Yosun (A: 200 ml), yosun + gübre 1 (A+F1: A+500 ml üre, 400 ml $MgSO_4$, 300 ml $ZnSO_4$, 200 ml boraks, 100 ml $FeSO_4$, 100 ml $MnSO_4$, 15 ml $CuSO_4$) ve yosun + gübre 2 (A+F2: A+625 ml üre, 500 ml $MgSO_4$, 375 ml $ZnSO_4$, 250 ml boraks, 125 ml $FeSO_4$, 125 ml $MnSO_4$, 25 ml $CuSO_4$) olarak belirlenen gübreler İtalyan çimi bitkisine uygulanmıştır. Daha sonra ilk günden itibaren dokuz gün boyunca tüm bitki örneği alınmış ve bitkilerin besin içerikleri analiz edilmiştir. Araştırma sonuçlarına göre, bitki yaş ağırlığı ile azot (N), potasyum (K), kalsiyum (Ca), magnezyum (Mg), sodyum (Na), kükürt (S), bor (B), çinko (Zn), bakır (Cu), demir (Fe) ve mangan (Mn) içerikleri istatistiksel olarak önemli bulunmuştur ($p<0.01$). En yüksek nem A ve A+F1 uygulamalarında, en yüksek N, Ca ve Mn içerikleri A+F1 uygulamasında ve en yüksek S, B, Zn, Cu ve Fe içerikleri A+F2 uygulamasında, en yüksek K içeriği A uygulamasında ve en yüksek Na içeriği kontrol uygulamasında belirlenmiştir.

1. INTRODUCTION

Soil unfertility processes occur through physical, chemical and biological (loss of biodiversity, loss of organic matter etc.) [1]. One of the important soil problems expressed by the United Nations Food and Agriculture Organization (FAO) is the loss of soil organic matter [2]. Organic matter affects the physical, chemical and biological properties of soils, increasing the cation exchange capacity, infiltration and water holding capacity of the soil, and being the main source of nutrients such as N, P, and S.

Many researchers have reported that chemical fertilizers and organic fertilizers are effective in increasing plant yield and soil properties as physical, chemical and biological. Numerous studies have been conducted on the positive effects of organic fertilizers with applying to the different plant growth [3, 4, 5, 6, 7, and 8].

Considering the effect of leonardite on nutrient contents of rye plant, it was reported that the applications were the positive effect on plant growth and increases the K, Mg, Ca, Mn and Fe contents of plant nutrient [9]. It was also reported that leonardite increases the dry matter and nutrient contents (N, P, K, Ca, Mg, Fe, Cu, Zn, and Mn) in the ryegrass [10].

An experiment was conducted to determine the effect of biostimulants (Algex, Tytanit and Asahi SL) and nitrogen on Italian ryegrass. Algex biostimulant to Italian ryegrass produced the most beneficial response in terms of the share of NDF, ADF, and ADL fractions in the plant dry matter. Increasing nitrogen rates significantly reduced the quantity of analyzed fiber fractions, and increased grass digestibility [11].

It was found that the P, K and Mg concentrations of the plant increased with the application of leonardite-humic acid and humate to grass [12]. When humic material was applied to the grass, taking of N and Ca increased and reported that there was no significant change in P, K and Fe contents, whereas some physical properties of the plant increased and some of them decreased [13].

In a research it was determined that the effect of slurry applied on its own and supplemented with mineral fertilizers or soil conditioners (UGmax and Humus Active) on the yield and some properties of *Lolium multiflorum* (Dukat var.) Interaction of slurry with soil conditioners resulted in a lower yield compared to the plot where slurry was used on its own. The highest total protein content was obtained to *Lolium multiflorum* treated with slurry supplemented with mineral fertilizers [14]. The increasing yield as a response to natural fertilizer applied to grassland was also recorded by Barszczewski et al. [15].

Kotlarz et al. [16] as well as Kasperczyk [17] confirm that the level of nitrogen fertilizer determines total protein content in forage. Many authors point out that total protein content is not always increased in proportion to the applied nitrogen [18, 19, and 20].

In this research, the effects of different fertilizer doses with algae on the ryegrass yield and plant nutrient content of Italian grass (*Lolium multiflorum*) was carried out in the Keyfoturağı area of Menteşe district of Muğla province, Türkiye, in 2021.

2. MATERIAL AND METHOD

This study was carried out in irrigated conditions in the producer area in the Keyfoturağı locality of Menteşe district of Muğla province in 2021. Italian Grass (*Lolium multiflorum*) was use in the study. The experiment on the winter ryegrass plant was established on 16 May 2021 after the first form. The size of each parcel is 100 m x 10 m = 1000 m^2 which completely randomized design with three replicates.

The fertilizer were applied as fertigation and doses given in Table 1. Fertilizer doses were determined by considering the amount of plant nutrients in the ryegrass plant [21], which was analyzed by cutting 5 cm above the soil surface when it was 15 cm before the experiment was established. The second sample in the plant was taken from the plant when it was 30 cm long before the first fertilizer application on 30 May 2021.

The applications of the experiment were planned for searching the effect of organic material (A, algae, DynaMix) and chemical fertilizer doses (F1 and F2) with constant rate of the algae and increasing chemical fertilizer.

Table 1. Algae and fertilizers used in the experiment and its amounts (g 100 L^{-1} water)

C (Control)	A (Algae, DynaMix)	A+F1 (Algae+ Fertilizers 1)	A+F2 (Algae+ Fertilizers 2)
Only water	200 ml	200 ml algae	200 ml algae
		500 ml urea (46% N)	625 ml urea
		400 ml $MgSO_4$ (9,6% Mg)	500 ml $MgSO_4$
		300 ml $ZnSO_4$ (22% Zn)	375 ml $ZnSO_4$
		200 ml Boraks (11,5% B)	250 ml boraks
		100 ml $FeSO_4$ (17% Fe)	125 ml $FeSO_4$
		100 ml $MnSO_4$ (31% Mn)	125 ml $MnSO_4$
		15 ml $CuSO_4$ (25% Cu)	25 ml $CuSO_4$

To the leaves on 30 May 2021; Control (C), algae (DynaMix, A) and algae + fertilizer 1 (A+F1), algae + fertilizer 2 (A+F2) were applied. A (DynaMix) was applied to 100 L of water in 200 ml, and A+F1 and A+F2 were applied in the ratios given in table 1 to urea, magnesium sulfate, zinc sulfate, borax, iron sulfate, manganese sulfate and copper sulfate. In practice, it was thrown with 25 L of water for each parcel. After the first form, 36 kg of ammonium sulfate and 35 kg of potassium sulfate were irrigated 3 times with a sprinkler irrigation system on 18 May 2021. After the first application, the effect of the applications on the plant nutrients in the ryegrass plant was investigated in the each samples taken by cutting from the soil surface after 9 days. After harvesting on 09 June 2021, the drum mower attached to the tractor, which takes about 100 m^2 in each plot, was determined as kg da^{-1} in wet weight. After 40 days of planting, the harvested ryegrass samples, which were cut 5 cm above the soil surface, were washed with tap water and distilled water, then dried at 70 °C for 48 hours, ground and made ready for analysis.

In leaf samples, total N analysis was performed by kjeldahl method [22], total K, Ca, Mg, Na, S, Cu, Fe, Zn, Mn, B and Mo analyzes were performed in microwave (20 minute at 190 °C and 1600 W at 40 °C) by wet burning method with acid (0.5 g sample +2 ml H_2O_2 + 6 ml HNO_3), filtered with filter paper (whatman no; 42) and made up to 50 ml with distilled water [23] and was analyzed in the ICP-OES.

The data of the applications, leaf sampling times and application x leaf sampling times were statistically analyzed. All data obtained were statistically analyzed using one-way ANOVA with the SPSS statistical software package program (Version 22.0, SPSS Inc., Chicago, IL, USA). Duncan's test ($p < 0.05$ and $p < 0.01$) was performed to evaluate the difference of each treatment. The research design was confirmed a completely randomized design with four replications.

3. RESULTS

The yield data obtained in 0.2% A, 0.2% A+F1, 0.2% A+ F2 and control plots applied to the ryegrass plant were given in Table 2.

Table 2. The wet weights of plant, differences and increases by applications

Applications	Wet weight (kg da^{-1})	Difference in the wet weight	Increase (%)
Control	1736.96	0	0
A	2251.30	515	29.61
A+F1	2241.28	505	29.03
A+F2	2270.14	534	30.69

As can be seen in Table 2, algae (DynaMix) application (0.2%) increased the wet weight of plant by 515 kg da^{-1} (29.61%) compared to the control application. There was no difference between the application of only 0.2% algae and the application of 0.2% A+F1 and F2. Therefore, it can be say more economical to use 0.2% algae (DynaMix) alone. When the data obtained in the study were examined, the significant levels of applications in the Table 3 and 4, the effects of the different days in the Table 5, the fertilizer applications in the Table 6, and interactions between application and time in the Table 7 were given.

Table 3. The significant levels of moisture and macro nutrient contents of ryegrass with applications.

Analyses / Application	Moisture	N	K	Ca	Mg	S
Fertilizer doses	**	**	**	**	ns	**
Time of taking leaf samples	**	**	**	**	**	**
Interaction of fertilizer doses and sampling time	**	**	**	**	*	**

* p< 0.05, ** p< 0.01, ns;

Table 4. The significant levels of micro nutrient contents of ryegrass with applications.

Analyses / Application	Na	B	Zn	Cu	Fe	Mn
Fertilizer doses	**	**	**	**	**	**
Time of taking leaf samples	**	**	**	**	**	**
Interaction of fertilizer doses and sampling time	**	**	**	**	**	**

** p< 0.01, ns; non significant.

3.1. Moisture content

In three of the fertilizer applications, the amount of moisture obtained in the plant was higher than the control group. With high moisture, the plant received more water in the soil and therefore more plant nutrients with all three applications (Table 6). The highest moisture value was obtained in A and A+F1 applications. When we examine the effect of time on moisture, the lowest moisture value on the 1^{st} day and the highest humidity value on the 2^{nd} day were obtained (Table 5). As the number of days increased, the amount of moisture in the plant decreased. When we evaluated the interaction of time x fertilizer applications, except the control application on the 2^{nd} day, the other three applications were in the highest three groups (Table 7).

3.2. Nitrogen content

The amount of nitrogen in the plant, which was low in the first days, reached the highest value in the 9^{th}, 6^{th} , 7^{th} and 8^{th} days, respectively (Table 5). There was approximately 52.2% nitrogen content increased between day 1 and day 8. This may be due to 500 g 100 L^{-1} urea fertilizer in practice. While the lowest nitrogen amount was obtained with A application to ryegrass plant, the highest nitrogen amount was obtained in A+F1 application (Table 6).

A most regular distribution was not determined in the time x fertilizer interaction. The highest nitrogen value was obtained in the A+F1 application on the 8^{th} day, and the lowest in the A application on the 2^{nd} day (Table 7).

3.3. Potassium content

When we look at the potassium in the plant in general according to the days, the potassium amount, which was high in the first days, decreased with the increase in the number of days. The highest potassium value was obtained on the 1st day, and the lowest value was obtained on the 9th day (Table 5). When we evaluated the effect of the applied fertilizers on the amount of potassium, the A application reached the highest potassium concentration compared to the control and provided an increase of approximately 28%. The order of decrease in potassium amount continued as A+F2, A+F1 and control (Table 6).

In the sampling time x fertilizer type interaction, the highest potassium content was obtained with the A application on the 1st day, while the lowest potassium was obtained in the control application on the 4th, 6th and 9th days and in the A application on the 7th day (Table 7).

Similar to our study, Ren et al. [24] stated that nitrogen applications increased the potassium content in ryegrass leaves from 3.0% to 3.2%. DeConti et al. [25] determined that the copper and iron fertilizers they applied to the ryegrass plant increased the potassium content of the plants from 0.85% to 2.0%, and Yolcu et al. [9] reported that barn manure, zeolite and leonardite applied to ryegrass significantly increased potassium content in the above-ground parts of the plant.

3.4. Calcium content

The highest calcium value was obtained on the fourth day, and the lowest calcium ratio was obtained on the 3rd, 7th, 8th and 9th days, while the highest value was obtained on the 1st day (Table 5). When we evaluated the effect of fertilizers on calcium amount, the highest amount of calcium was obtained in A+F1 application, and the lowest in A and A+F1 applications (Table 6). In the time x fertilizer interaction, the highest value was obtained in the 4th day A+F1 application and the lowest value was obtained in the 7th day A+F2 application (Table 7).

Working on a similar subject, Ren et al. [24] reported that the calcium content in ryegrass leaves increased from 0.39% to 0.49% with nitrogen applications. DeConti et al. [25] stated that Cu and Fe fertilizers applied to ryegrass increased the calcium content of plants (from 0.60% to 0.66%). In another study, Yolcu et al. [9] reported that organic materials applied to ryegrass significantly increased the calcium in the plant.

3.5. Magnesium content

The effect of fertilizer applications on the amount of magnesium element in the plant was determined as the highest on the 1st day and the lowest on the 9th day, and a decrease of 33% occurred (Table 5). The effect of fertilizer doses was not found to be statistically significant (Table 3). Only three different groups were formed in the time x fertilizer type interaction (Table 7). There was a 48.57% decrease between the highest magnesium value and the lowest.

Ren et al. [24] reported that N increased the magnesium content in ryegrass leaves from 0.23% to 0.27%. DeConti et al. [25] reported that Cu and Fe increased in the magnesium content of the ryegrass plant from 0.17% to 0.23%. Yolcu et al. [9] also reported that organic materials applied to ryegrass significantly increased the magnesium in the plant.

3.6. Sulfur content

It was determined that the effect of fertilizer applications on the amount of sulfur in the plant decreased by 95.94% at the highest level on the 1st day and at the lowest level on the 5th and 6th days (Table 5).

In the A+F2 application, the highest sulfur content was determined in the control group and the lowest sulfur content (Table 6). This may be due to the presence of sulfur in the sulphate form in the applied fertilizers. In the time x fertilizer type interaction, the largest amount of sulfur was obtained in the A application on the 1st day. The lowest sulfur content was determined in all doses of the 5th and 6th days in the same group (Table 7).

Looking at the previous studies, the copper and iron fertilizers applied to the ryegrass plant caused a significant increase in the sulfur (from 0.21% to 0.36%) content [25]. It was reported that the organic materials applied to ryegrass significantly increased the sulfur in the above-ground parts of the plant [9].

3.7. Sodium content

Sodium element was determined at the lowest level in 2 days and at the lowest level in 8th and 9th days (Table 5). There was a 75.2% decrease between the highest and lowest sodium elements. While the highest sodium amount was determined in the control group, the sodium amount decreased with fertilizer application. The highest was determined in the control group and the lowest in the A+F2 application (Table 6).

Between the time and fertilizer type interaction, the highest values were determined in the control application on the 4th, 3rd, 2nd and 1st days, respectively, while the lowest values were determined in the 9 th day with A application (Table 7).

3.8. Boron content

In the ryegrass plant, the highest boron element was obtained on the 1st day and the lowest on the 4th day (Table 5). In 0.2% DynaMix + Fertilizer 2 application, the highest application was followed by A+F1, A and control groups, respectively, with a decrease (Table 6). In the time and fertilizer type interaction, the highest boron was determined in the 1st day A+F2 application and the lowest in the 1st and 4th day control group. The presence of boron fertilizer in Fertilizer 1 and 2 applications resulted in higher boron content in these plots (Table 7).

According to Yolcu et al. [9] reported that barn manure, zeolite and leonardite applied to ryegrass significantly increased the tubing in the above-ground parts of the plant.

3.9. Zinc content

Zinc element concentration was determined to be the highest on the 1st day and the lowest on the 7th day (Table 5). Between the two times, there was a 51.07% reduction. In the A+F2 application, this highest application was followed by the A+F1, control and A application (Table 6).

In the interaction of time x fertilizer type, the highest amount of zinc was determined in the 1st day A+F2 application and the lowest in the 7th day control group. The use of zinc sulphate fertilizer containing zinc element in Fertilizer 1 and Fertilizer 2 applications increased zinc in these applications (Table 7).

Yolcu et al. [9] also reported that barn manure, zeolite and leonardite applied to ryegrass increased the zinc content in the above-ground parts of the plant.

3.10. Copper content

The effect of the applications on the amount of copper depending on time was determined at the highest level on the 1st day and at the lowest level on the 6th day (Table 5). In the A+F2 application, this highest application was followed by the A+F1, A and control application. The use of copper sulphate fertilizer in Fertilizer 1 and Fertilizer 2 applications increased the copper element in these applications (Table 6).

In the time x fertilizer type application, the highest copper amount was determined in the 1st day in the A+F2 application, and the lowest in the 5th and 9th days control group (Table 7). According to Yolcu et al. [9] reported that barn manure, zeolite and leonardite applied to ryegrass increased the copper content in the above-ground parts of the plant.

3.11. Iron content

While the highest amount of iron was obtained on the first day, the lowest value was obtained on the 7th day (Table 5). In the A+F2 application, this highest application was followed by the A+F1, A and control application. The use of ferrous sulphate fertilizer in Fertilizer 1 and Fertilizer 2 applications increased the concentration of iron element in these applications (Table 6).

Between the application of time and fertilizer variety interaction, the highest iron content was determined in the 1st day A+F2 application in the control group on the 6th day and the lowest iron content in the 9th day 0.2 A+F1 application (Table 7). According to Yolcu et al. [9] reported that barn manure, zeolite and leonardite applied to ryegrass significantly increased the iron content of the above-ground parts of the plant.

3.12. Manganese content

The highest manganese concentration was determined on the 1st day and the lowest on the 7th day in the ryegrass plant of the treatments (Table 5). In the A+F1 application, this highest application was followed by the A+F1, A and control application (Table 6).

The use of manganese sulfate fertilizer in F1 and F2 applications increased the concentration of manganese in these applications. In the application of time x fertilizer variety, the highest manganese content was determined in the 1st day A+F2 application and the lowest manganese content were determined in the 7th day A+F2, the 9th day A+F1 and the 8th day A applications (Table 7).

Ren et al. [24] stated that nitrogen applications caused an increase of up to 10 mg kg^{-1} (from 22 mg kg^{-1} to 32 mg kg^{-1}) manganese content in ryegrass leaves. According to Yolcu et al. [9] reported that barn manure, zeolite and leonardite applied to ryegrass significantly increased the manganese content in the above-ground parts of the plant.

Regarding the subject from previous studies, Fortún et al. [26] showed that humic acid applications obtained from different sources and methods to the ryegrass plant which in the above-ground parts increased the total macro element contents of the plant from 10% to 11.5%, and the micro element contents in total from 260 mg kg^{-1} to 720 mg kg^{-1}.

The results were obtained in our research that was observed that organic (algae) and inorganic fertilization increased the macro and micro element contents of *Lolium multiflorum* plant. The moisture of plant and macro and micro element contents (nitrogen, potassium, calcium, sodium, sulfur, boron, zinc, copper, iron and manganese) were found statistically significant ($p<0.01$).

The increasing of wet weight of plant was found as 30.69% by fertilizer application (in A+F2). The macro and micro elements, N, K, Ca, Mg, S, B, Zn, Cu, Fe, and Mn contents, were increased as 4.4% (in A+F1), 38.46% (in A), 3.03% (in A+F1), 8.7% (in A+F2), 45.22% (in A+F2), 205.55% (in A+F2), 212.87% (in A+F2), 50.29% (in A+F2), 18.32% (in A+F2), and 43.94% (in A+F1), respectively.

The effect of sampling time (Table 5), applied foliar fertilizer (Table 6) and the interaction of time x fertilizer doses (Table 7) on plant nutrients in plant samples taken for nine days after A, A+F1 and A+F2 fertilizers applied foliar to ryegrass plant during one harvest were interpreted in order below Tables. Levels in the Tables 5-7 explained that were no connected by the same letters were significantly different at p< 0.01 by Tukey's honestly significant difference test.

Table 5. The moisture and element contents of ryegrass in the different days

Day	Moisture	N	K	Ca	Mg	Na	S	B	Zn	Cu	Fe	Mn
			%					mg kg^{-1}				
1	79.84f	0.43f	2.87a	0.72ab	0.30a	2730.42b	4444.51a	1.68a	24.85a	6.97a	52.24a	24.73a
2	84.06a	0.50e	2.59b	0.69b	0.26ab	3106.26a	3683.15b	1.17b	21.39b	4.66b	50.03b	20.64b
3	82.26b	0.60d	2.37d	0.61c	0.23bc	2266.55cd	3276.13d	1.08c	19.65c	4.66b	38.72f	18.68d
4	82.53b	0.43f	2.44c	0.76a	0.24bc	2488.76bc	3393.15c	0.75f	15.43f	4.03c	39.65e	19.23c
5	81.53c	0.48ef	2.55b	0.72ab	0.25abc	2093.63d	180.35h	0.93d	16.84d	3.51e	40.96c	18.39e
6	81.33cd	0.76b	1.96f	0.68b	0.24bc	2552.46b	183.39h	0.98d	16.15e	3.47e	34.83h	17.60f
7	81.10d	0.89a	1.86g	0.56c	0.21c	1820.03d	2844.96f	0.83e	12.69h	3.71d	31.69ı	13.78h
8	81.06d	0.90a	2.19e	0.58c	0.22bc	1018.22f	3059.05e	0.93d	15.34f	3.54e	35.48g	14.63g
9	80.48e	0.70c	1.78h	0.8c	0.20c	769.46f	2602.34g	0.94d	14.89g	3.63d	40.40d	14.62g

Table 6. The means of moisture and element contents of ryegrass with fertilizer doses

Application	Moisture	N	K	Ca	Mg	Na	S	B	Zn	Cu	Fe	Mn
C	80.83c	0.68b	1.82d	0.66ab	0.23	3418.65a	2079.88d	0.72c	11.97c	3.42d	38.32d	14.61d
A	82.07a	0.46c	2.52a	0.64b	0.23	1685.92b	2560.19c	0.74c	11.30d	3.70c	38.91c	15.63c
A+F1	82.20a	0.71a	2.35c	0.68a	0.23	1809.62b	2858.21b	1.19b	21.13b	4.71b	39.20b	21.03a
A+F2	81.20b	0.67b	2.47b	0.64b	0.25	1461.72c	3020.40a	1.48a	25.48a	5.14a	45.34a	20.87b

Table 7. The interaction between time and fertilizer doses on the moisture and element contents of ryegrass

Day	App.	Moisture	N	K	Ca	Mg	Na	S	B	Zn	Cu	Fe	Mn
1	**C**	82.95fg	0.37no	1.74o	0.61ek	0.25ab	5196.01b	2640.2lm	0.46t	11.26t	4.42g	42.87h	13.95tu
	A	78.26v	0.19pq	3.69a	0.69ag	0.29ab	847.33mq	5337.5a	0.95ık	12.61r	6.16d	56.49b	16.95jk
	A+F1	83.69cd	0.48km	2.79de	0.81ab	0.29ab	1904.27gj	4745.0c	2.48b	36.54c	8.05b	51.54c	31.59b
	A+F2	74.45w	0.68hı	3.26b	0.75ae	0.35a	2974.09de	5055.3b	2.84a	38.97a	9.25a	58.07a	36.44a
2	**C**	82.35 hl	0.40lm	1.88no	0.76ad	0.27ab	5433.65ab	2667.2lm	0.61qs	12.85r	3.48lm	52.40c	15.31nq
	A	84.70ab	0.11q	3.17b	0.64dj	0.22ab	648.11nq	3465.3gı	0.60rs	10.37w	3.26no	40.25jk	16.75jk
	A+F1	84.92 a	0.73gh	2.56fg	0.67bh	0.25ab	3015.21de	4266.9d	1.46e	26.33e	5.42e	50.29d	25.78c
	A+F2	84.25ac	0.75fg	2.73df	0.70ag	0.30ab	3328.08d	4333.2d	2.01d	36.01d	6.47c	57.16ab	24.73d
3	**C**	80.64qs	1.02ab	1.77o	0.65cı	0.26ab	5864.17a	2780.2l	0.57rt	13.40q	4.25gı	41.11ıj	16.94jk
	A	84.14bc	0.42lm	2.99c	0.62dk	0.20b	560.08oq	3254.2jk	0.74oq	10.36w	4.29gı	30.74p	15.14or
	A+F1	82.35 hl	0.57ıj	2.26ıj	0.52hk	0.22ab	2155.69fh	3344.1ık	0.74oq	17.70k	3.90j	34.10n	17.79ı
	A+F2	81.90 jn	0.40lm	2.44gh	0.65cı	0.22ab	486.26pq	3726.0f	2.26c	12.14r	6.21d	48.91e	24.86d
4	**C**	81.00 or	0.55jk	1.34p	0.80ab	0.27ab	6007.26a	2479.1m	0.46t	11.64s	4.33gh	34.64n	14.54st
	A	82.30 hl	0.50kl	2.90cd	0.81ab	0.21b	890.31lq	3424.2hj	0.77np	10.97tu	4.11ı	39.18jl	19.23g
	A+F1	83.47de	0.39mn	2.62ef	0.82a	0.26ab	2643.28ef	4004.1e	0.94ıl	19.56ı	4.13hı	46.40f	24.68d
	A+F2	83.33ef	0.27op	2.90cd	0.60fk	0.22ab	414.21pq	3665.2fg	0.81lo	19.53ı	3.55lm	38.39l	18.48h
5	**C**	81.37np	0.39mn	2.63ef	0.72af	0.22ab	787.02mq	166.1p	0.81lo	10.74uv	2.68s	34.86n	16.04lm
	A	82.69gh	0.50kl	2.13ıl	0.67bh	0.25ab	4379.25c	152.0p	0.67pr	12.78r	3.41mn	38.24l	15.57mo
	A+F1	80.41rs	0.55jk	2.68ef	0.79ac	0.24ab	1479.20ıl	184.1p	1.06gı	19.01j	3.62kl	44.23g	20.69f
	A+F2	81.67lmo	0.43lm	2.77de	0.69ag	0.27ab	1729.03hk	219.3p	1.19fg	24.84f	4.32gh	46.52f	21.25f
6	**C**	79.64u	1.02ab	1.26p	0.60fk	0.24ab	4461.75c	119.2p	0.51st	9.89x	2.83rs	26.70s	14.68qs
	A	82.45hk	0.28op	2.16ık	0.68ah	0.23ab	2046.05fı	180.2p	0.78mp	11.90s	2.94qr	34.01n	16.92jk
	A+F1	82.50hı	0.87cd	2.29hı	0.79ac	0.26ab	2441.32eg	225.0p	1.50e	23.94g	4.28gı	42.19hı	22.07e
	A+F2	80.72ps	0.88cd	2.12ıl	0.65cı	0.23ab	1260.73kn	209.1p	1.11fh	18.85j	3.82jk	36.42m	16.74jk
7	**C**	80.36rt	0.72gh	2.06km	0.62dk	0.18b	481.30pq	2552.6m	0.92jl	9.08y	3.02qr	31.27op	12.73v
	A	80.15su	1.03ab	1.27p	0.56gk	0.26ab	5095.82b	2479.1m	0.50st	11.11t	3.11oq	36.16m	13.32uv
	A+F1	81.74lmn	0.96ac	2.27hj	0.56gk	0.21b	979.01lp	3563.0fh	0.90jn	15.71m	5.55e	28.40q	16.50kl

	A+F2	82.16ım	0.84ef	1.84no	0.49k	0.18b	724.00nq	2785.2l	1.02hj	14.87o	3.16op	30.92p	12.56w
8	C	81.25nq	0.97ac	2.25ıj	0.68ah	0.23ab	1129.27ko	3380.1hk	1.56e	15.20n	3.08oq	32.32o	14.88pr
	A	81.78kn	0.63hj	2.26ıj	0.51ık	0.18b	384.27pq	2260.2n	0.57rt	10.48vw	2.86rs	34.74n	12.22w
	A+F1	79.69tu	1.07a	1.95ln	0.54gk	0.18b	871.44lq	2595.6lm	0.69or	14.00p	3.57lm	26.01s	14.20st
	A+F2	81.53mo	0.95bc	2.29dı	0.59fk	0.29ab	1687.92hk	4000.3e	0.88kn	21.67h	4.67f	48.86e	17.23ıj
9	C	77.95v	0.68gı	1.43p	0.50jk	0.18b	1407.44jm	1934.3o	0.57rt	13.67q	2.72s	48.72e	12.43w
	A	82.16ım	0.48km	2.10jl	0.62dk	0.19b	322.06q	2489.0m	1.05hı	11.08t	3.16op	40.42j	14.61rs
	A+F1	81.00or	0.78eg	1.72o	0.61ek	0.20b	797.16mq	2796.2l	0.91jm	17.37l	3.87j	29.63pq	15.94ln
	A+F2	80.80ps	0.85de	1.89mo	0.60fk	0.22ab	551.18oq	3189.9k	1.22f	17.45kl	4.78f	42.82h	15.51mp

4. DISCUSSION AND CONCLUSION

In general, when the element contents of the above-ground parts of the ryegrass plant were taken into account with 9-day foliar fertilization applications, nitrogen increased in the plant mostly on the 7th and 8th days, whereas most of the other elements, namely K, Mg, S, B, Zn, Cu, Fe and Mn contents, increased on the 1st day. It has been understood that most of plant nutrient content increased on the 1st day was more fast uptake by algae application with chemical fertilizer. Results show that the nitrogen uptake in the fertilizer form examined in the ryegrass plant and within the 9-day period after the application is understood to be intensified on the 7th and 8th days. However, it was determined that the content of K and Mg elements was higher on the 2nd day, and the Ca and Mg elements were also higher on the 5th day.

The sodium content in plant was found to be the highest in the control application, and it was determined that the fertilizer applications decreased the sodium content. It has been found that sodium has the lowest content as a result of A+F2 application, that is, this application reduces the Na content. When examined as days, it was observed that the Na content was the highest on the 2nd day, and the sodium concentration was high on the 1st, 4th and 6th days. It is also understood that with these applications, it may be possible to reduce the sodium intake of the plant in the soils have high sodium.

As result, the contents of most of the nutrients (S, B, Cu, Fe and Mn) and the moisture content of the plant were found to be at the lowest levels of the ryegrass plant in the unfertilized (control) plots. Among the fertilizer applications, it was understood that the application of algae extract (A) increased the moisture content and K content of the plant. It was observed that Fertilization 1 (A+F1) applications with algae extract (A), which is one of the added fertilizer applications, caused an increase in the moisture content, N, Ca and Mn contents of the plant. It was understood that Fertilization 2 (A+F2) applications together with algae extract (A), which is one of the added and incremental fertilizer applications, also caused an increase in the S, B, Zn, Cu and Fe contents of the plant.

As a conclusion, it was observed that algae and chemical fertilizer applications with algae were applicable in *Lolium multiflorum* plant, increased plant fresh weight and plant nutrient intake, and it was recommended as an available method.

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