THE EFFECT OF DIFFERENT CUTTING TIMES ON THE MACRO MINERAL CONTENT OF ALFALFA (*MEDICAGO SATIVA* L.) GENOTYPES

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ABSTRACT

This study was conducted to determine the effect of different cutting times on the important macro mineral contents of twenty-four alfalfa (*Medicago sativa* L.) genotypes. For this reason, a field trial was established according to separated plots in randomized blocks design with three replications in the Research Area of Agriculture Faculty of Dicle University, Diyarbakır, Turkey in 2020. The alfalfa genotypes were subjected to three different forage cutting times. The 1st, 2nd and 3rd cuttings were made respectively in the pre-flowering, 10% flowering and full flowering periods of alfalfa genotypes. In terms of all examined macro minerals in the study, there found to be statistically highly significant ($P<0.01$) differences between cutting times, genotypes and genotypes × cutting times interaction. In the research, the macro mineral contents of the genotypes changed between the cutting times as follows; calcium (Ca) 1.41%-1.81%, phosphorus (P) 0.37%-0.50%, magnesium (Mg) 0.31%-0.42% and potassium (K) 1.94%-3.42%. The results of the research revealed that Ca and Mg contents in forages of alfalfa genotypes increased with advancing plant maturity stage, whereas K and P contents decreased. In conclusion, according to the average of the cutting times, Resis (22) cultivar came to fore in terms of Ca content, while many genotypes, sharing the same statistical group, were found superior in terms of P, Mg and K contents.

Key words: Alfalfa forage, calcium content, magnesium content, maturity effect, phosphorus content.

INTRODUCTION

Medicago genus is from the legume family (*Fabaceae*). It contains about 60 species and most of them are annual species, except for a few perennial species (Acıkgöz 2001). Among the member of the genus the best-known one is alfalfa (*Medicago sativa* L.). Due to its high forage yield and quality, alfalfa is called as *"The Queen of Forage Crops"* (Avcıoglu *et al.* 2009; Sayar, 2011), and it is the most widely grown forage crop species in the World (Frame *et al.*, 1998). With its perennial lifespan, alfalfa is of a strong root system (Vasileva and Kostov, 2015), and it is well resistant to different stress conditions such as drought, cold, high temperature, soil and water salinity (Tucak *et al.* 2017; Samir *et al.* 2021).

One of the most important problems of Turkey's animal husbandry is the inability to produce sufficient quality roughage (Sayar *et al.* 2015). And increasing forage crops cultivation in arable agriculture land (Engin and Mut, 2017) and choosing high-yielding forage crops cultivars are of great importance in closing the quality roughage deficit (Sengül et al. 2003;

Sayar et al. 2013). In addition to increasing cultivation area and choosing high-yielding genotypes, it is also important to determine and use of forage crops cultivars having higher forage quality criteria to obtain desired level animal products (Yucel et al. 2012). Since, the livestock are fed with higher quality forage, their milk, meat and other animal products yields would be more than the ones feeding with lower quality forages.

In addition to the used forage crops species and cultivars characters, forage cutting times or phenological status of the plants also has a great effect on the forage quality of the crops. In this direction, numerus studies have been conducted in various forage crop species until now (Kallenbach *et al.* 2002; Aksoy and Nursoy, 2010; Karayilanli and Ayhan, 2016; Atıs *et al.* 2019). Aso, mineral element contents of forages is of great importance in forage quality (McDowell and Arthington, 2005). And most of the minerals enter the animal body through feeds (Mineral, 2022). Forages are the most important feed ingredient in animal nutritions. They have crucial role in supplying the minerals requirement of livestock (Freer et al., 2007). Therefore, knowing minerals content of the forages has importance in animal feeding. Accordingly, the study was held to determine the effect of cutting times on some important mineral contents in alfalfa genotypes.

MATERIAL AND METHODS

The plant materials of the research

In the twenty alfalfa (*Medicago sativa* L.) cultivars and four promising alfalfa lines were used, so totally twenty-four genotypes formed plant materials of the study. The used cultivars were Banat, Basbag, Bilensoy 80, Calfa, Daisy, Diane, Dimitra, Elçi, Emiliana, Escorial, Ezzelina, Iside, La Torre, Nimet, Osjecka 99, Prosementi, Queen, Resis, Riviera vicentina and Sabrina. On the other hand the used promising alfalfa lines, Line-1, Line-2, Line-3 and Line-4, were exclusively developed for using in the rangeland improvement studies.

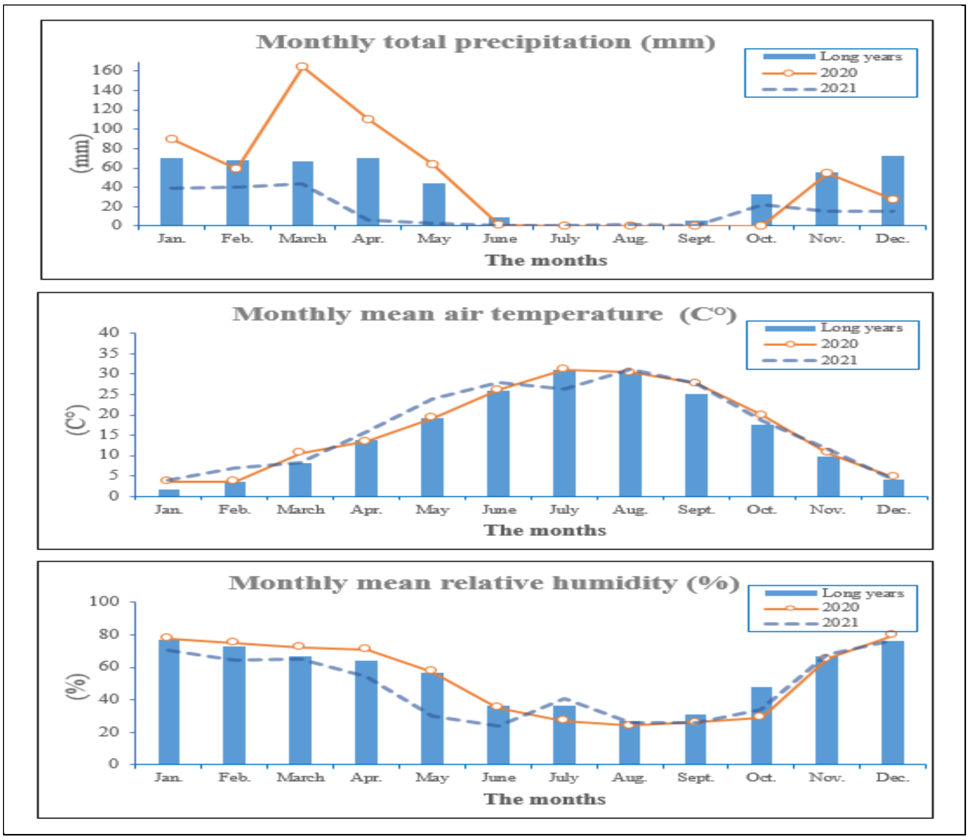

Figure 1. Climatic data of the location in 2020, 2021 and long-term average (1975-2021) at Diyarbakır location, Turkey (TMF, 2021)

The research area

The experiment of the study was conducted in the Experimental Area of Agriculture Faculty of Dicle University in Diyarbakir, Turkey (37°53' N Lat., 40°16' E Long. and 669 m elevation). The field of the research area was flat and almost no erosion effect, and the soil layer had medium deep profile. Soil analysis revealed that the experimental area soils had a clay- loam structure, and were red-brown in color. Furthermore, the organic matter (0.71%) and phosphorus (16.6 kg ha^{-1} P_2O_5) contents of the soil was low, wheares potassium (1260 kg ha^{-1} K_2O) and calcium (10.26%) contents of the soil was high. Owing to relatively high limestone content of the soil, the pH status of the soils was slightly alkaline (pH: 7.24). And the soil was almost without salinity (0.02%).

The research area has a typical continental climate characteristic. In the place, winters are cool and rainy, whereas summers are dry and hot. The long-term annual average (1975-2021) total precipitation is 496.4 mm and the most important part of the precipitation falls in the period between November and May. Monthly total precipitation and average temperature, humidity records of the research site for both the growings years and long years average are given in the Figure 1 (TMF, 2021). When climatic data of research area was examined from Figure 1, the precipitation amount of 2020, in which the experiment was established, was well above the long-term precipitation amount. However, the precipitation amount of 2021, in which the forage cuttings were made, was far below the long-term precipitation amount. Due to the low rainfall amount in 2021, while the mean temperature of this year was higher than 2020, the mean relative humidity value was lower.

The experiment of the study

The field trail was established according to Split-Plots in Randomized Complete Block Design with three replications in 06 April, 2020. In the experiment, alfalfa genotypes were placed in the main plots, while cutting times were taken place in the subplots. In the experiment of the study, each plot consisted of 2 rows in 3 m length and with 30 cm the row spacing. In addition, 60 cm space was left between the plots and 2 m space was left between the blocks.

The investigated traits

In the study, forage cutting of plots of each alfalfa genotypes were made at 3 different times. The 1st forage cutting of the alfalfa genotypes was made on April 15, 2021, during the pre-flowering period of the plants. On the other hand, the 2nd cutting was made on May 05, 2021, at 10% flowering period of the plants. And the last, 3rd, forage cutting was made on May 20, 2021, when the plants were in the full flowering period. The harvested forages from each plot was immediately weighted and the results were converted to hectares. Afterwards, in order to determine the dry forage percentage in the fresh forage, 500 g fresh forage samples taken from each plot were kept in oven at 70 °C for 48 hours. Afterwards the dried forage samples were well ground in a laboratory mill. Calcium (Ca), Magnesium (Mg), Phosphorus (P) and Potassium (K) contents of the ground forage samples were determined in the Dicle University Science and Technology Application and Research Center Laboratory via the Foss Model 6500 NIRS (Near Infrared Reflectance Spectroscopy) analysis device using C-0904FE-Hay and Fresh Forage calibration (Basaran *et al.* 2011; Cınar, 2012; Basbag et al. 2018; Başbag et al. 2021; Sayar et al. 2022).

The statistical analyses

In the study, the statistical analyses of data were made by using the JMP 5.0.1 statistical software package (SAS Institute, 2002), and the least significant difference (LSD) test at the 0.05 probability level (Steel and Torrie, 1960) was used for determining the differences between means.

RESULTS AND DISCUSSION

Results of the research revealed that there were highly significant (P<0.01) differences between the cutting times and alfalfa genotypes means and genotypes × cutting times interaction for calcium (Ca), phosphorus (P), magnesium (Mg) and potassium (K) contents traits in alfalfa. The significantly importance of genotypes × cutting times interactions indicated that changing cutting times significantly affected rankings of the investigated traits in alfalfa genotypes (Table 1, Table 2).

Calcium (Ca) contents of alfalfa genotypes were greatly influenced with different cutting times. Exclusively, Ca contents of alfalfa forage in the last cutting time, 3rd cutting time-full flowering, were found to be considerably higher than the other two early cutting times (Table 1). In agreement with our findings, Marković et al. (2009) reported that Ca content in alfalfa forage increased with the plant maturity stage both in leaves and in stems of the plant. On the other hand, Whitehead and Jones (1969) cited that there was no significant effect of plant maturity stage on Ca content of alfalfa. Meanwhile, the highest forage Ca content was obtained from Resis (22) cultivar (1.81%) in 3rd cutting time, whereas the lowest Ca content was recorded from Dimitra (7) cultivar (1.41%) in 2nd cutting time-10% flowering. In the same time, according to the three cutting times average, the highest Ca content was determined in the Resis (22) cultivar (1.63%) (Table 1). The determined Ca contents of alfalfa genotypes in various cutting times in this study were found to be in a fully consistence with National Research Council (NRC, 2000) findings, but the Ca contents were found to be partially in agreement and partially higher than findings of Kamberi et al. (2013) and Dale and Batal (2016) determined in alfalfa. According to Reuter and Robinson (1997), Ca requirement in lactating sheep is 0.12-0.26% of DM. Additionally, Freer et al. (2007) reported that for a normal animal growth, ranges of Ca content in feeds should be 0.14-0.70% of DM for sheep and 0.20-1.10% of DM for cattle. They also cited that if the Ca ratio in the feeds is above this range, it causes rapid growth in livestock, and if it is low, it causes growth retardation and lower animal product yields. The Ca contents determined in alfalfa genotypes in different cutting times were found to be much higher than this specified references Ca ratios.

Calcium (Ca) is one of the important mineral for animal health. Approximately, 99% of calcium takes places in the structure of bones and teeth in the animal body, the remaining 1% of Ca takes part in important tasks of animal body, such as enzyme activity, blood coagulation, membrane permeability, secretion of certain hormones and nerves stimulation (McDowell, 1992; Spears, 1994). However, Ca deficiency causes softening and weak bones in young animal, though it causes bone deformations in older ones. It also causes thinner eggshells in poultry (Basbag et al., 2011; Sayar, 2016). Moreover; Spears (1994) reported that Ca deficiency leads to regression in animal growth and decreasing in milk yield.

The study results showed that phosphorus (P) content of alfalfa genotypes was greatly affected with changing cutting times. Average P content of alfalfa genotypes for 1st, 2nd and 3rd cutting times were determined as 0.48%, 0.47% and 0.42% respectively (Table 1). This results obviously indicated that there was inverse relationship between plant maturity stage and P contents of alfalfa genotypes. Similarly, Whitehead and Jones (1969) and Minson (1990) reported that P content of forages declined with advancing plant maturity. Furthermore, Reid et al. (1970) cited that decreasing P content of alfalfa decreased at 0.056 g P/kg DM/day. Freer et al. (2007) reported that continuously using of phosphorus for plant growth led to decreasing of this mineral in forages with advancing plant maturity stage. On the other hand; the means of P content of alfalfa genotypes were ranged from 0.37% to 0.50% among the alfalfa genotypes and the cutting times. According to the mean of the cutting times, there were statically many alfalfa genotypes having higher P content, whereas the lowest P content was recorded in Sabrina (24) cultivar (Table 1). According to reported in many scientific studies 0.25% P content in forage dry matter is sufficient for the livestock needs (NRC, 2000; McDowell and

Arthington, 2005; Márquez-Madrid, 2017). Accordingly, the determined P contents in alfalfa genotypes in different cutting times were found to be sufficient for livestock requirements (Table 1).

Table 1. Calcium (Ca) and phosphorus (P) contents (%) at different cutting times of alfalfa (*Medicago sativa* L.) genotypes[+]

Genotypes	Calcium (Ca) (%)				Phosphorus (P) (%)			
	1st Cutting (Pre-Flowering)	2nd Cutting (50% Flowering)	3rd Cutting (Full Flowering)	Mean	1st Cutting (Pre-Flowering)	2nd Cutting (50% Flowering)	3rd Cutting (Full Flowering)	Mean
1-Banat	1.47 s-y	1.45 v-z	1.52 j-s	1.48 ı-j	0.47 d-j	0.49 a-e	0.40 r-w	0.45 c-g
2-Basbag	1.54 h-n	1.48 p-x	1.53 j-q	1.52 f-h	0.48 a-f	0.48 a-h	0.41 p-v	0.46 b-f
3-Bilensoy	1.47 s-y	1.51 k-t	1.65 c-d	1.54 d-f	0.49 a-e	0.47 b-h	0.42 o-t	0.46 a-e
4-Calfa	1.47 q-x	1.42 y-z	1.51 l-u	1.47 j	0.49 a-e	0.50 a-c	0.42 o-u	0.47 a-c
5-Daisy	1.50 m-v	1.50 l-v	1.65 c-d	1.55 d-e	0.48 a-f	0.47 c-ı	0.39 u-w	0.45 e-g
6-Diane	1.51 l-u	1.47 r-y	1.69 b-c	1.56 c-d	0.50 a-c	0.47 b-h	0.42 o-t	0.46 a-e
7-Dimitra	1.53 j-p	1.41 z	1.56 g-k	1.50 g-ı	0.47 d-j	0.49 a-d	0.39 t-w	0.45 c-g
8-Elci	1.48 p-x	1.49 o-x	1.60 d-g	1.52 e-g	0.49 a-e	0.47 b-h	0.42 o-t	0.46 a-e
9-Emiliana	1.48 p-x	1.47 q-x	1.60 d-h	1.52 f-h	0.48 a-f	0.48 a-g	0.42 n-s	0.46 a-e
10-Escorial	1.50 n-v	1.45 u-z	1.57 f-j	1.51 g-ı	0.49 a-e	0.48 a-h	0.43 l-q	0.47 a-d
11-Ezzelina	1.50 m-v	1.48 o-x	1.55 g-m	1.51 f-h	0.47 b-h	0.50 a	0.45 h-n	0.48 a
12-Line-1	1.47 r-y	1.46 t-z	1.54 ı-o	1.49 h-j	0.49 a-e	0.47 c-ı	0.41 q-v	0.46 b-f
13-Line-2	1.47 r-y	1.48 p-x	1.56 g-l	1.50 g-ı	0.49 a-e	0.46 e-k	0.40 s-w	0.45 d-g
14-Line-3	1.45 v-z	1.52 j-r	1.53 j-p	1.50 g-ı	0.50 a-b	0.44 ı-o	0.42 o-u	0.45 b-f
15-Line-4	1.45 u-z	1.49 o-x	1.53 j-q	1.49 h-j	0.50 a-b	0.46 f-l	0.43 m-r	0.46 a-e
16-Iside	1.52 j-s	1.48 p-x	1.60 d-h	1.53 d-g	0.47 d-j	0.48 a-h	0.44 j-o	0.46 a-e
17-La Torre	1.46 t-z	1.45 v-z	1.52 j-r	1.48 ı-j	0.50 a-c	0.49 a-e	0.42 o-u	0.47 a-c
18-Nimet	1.52 k-s	1.53 j-q	1.72 b	1.59 b-c	0.45 g-m	0.46 f-l	0.41 p-v	0.44 f-g
19-Osjecka 99	1.48 p-x	1.49 n-w	1.59 e-ı	1.52 f-h	0.48 a-h	0.48 a-f	0.45 h-n	0.47 a-b
20-Prosementi	1.43 x-z	1.49 n-w	1.62 d-f	1.52 f-h	0.50 a-b	0.47 d-j	0.44 k-p	0.47 a-c
21-Queen	1.57 g-k	1.47 r-y	1.64 c-e	1.56 c-d	0.45 g-m	0.48 a-g	0.42 o-t	0.45 c-g
22-Resis	1.52 j-r	1.55 g-m	1.81 a	1.63 a	0.49 a-d	0.46 e-k	0.38 v-w	0.45 e-g
23-Riviera vicentina	1.49 n-w	1.44 w-z	1.54 h-n	1.49 h-j	0.48 a-g	0.49 a-d	0.41 p-v	0.46 a-e
24-Sabrina	1.60 d-g	1.54 h-n	1.63 d-e	1.59 b	0.47 d-j	0.47 d-j	0.37 w	0.44 g
Mean	1.49 B	1.48 C	1.59 A		0.48 A	0.47 B	0.42 C	
CV (%)	1.97				3.93			
LSD (%5)								
Cutting times	0.009**				0.005**			
Genotypes	0.031**				0.017**			
Genotypes × Cutting times	0.053**				0.028**			

+, means with different letters in the same column are significantly different ($P < 0.05$); significant at; **, $P \leq 0.01$

There were highly significant differences among the cutting times in terms of magnesium (Mg) content of alfalfa. Furthermore, it was observed an increasing in forage Mg content with advancing plant maturity stage. Accordingly, average Mg content in forage dry matter of alfalfa were recorded as 0.32%, 0.35% and 0.37% for the 1st, 2nd and 3rd cutting times respectively. Meanwhile, according to the three cutting times average, Mg concentration in alfalfa genotypes were ranged from 0.33% to 0.37%. Moreover, it was determined that Mg content of Diane (6), Emiliana (9), Iside (16), Prosementi (20), Queen (21) and Riviera vicentina (23) alfalfa cultivars were found to be higher than the other genotypes. In contrast, the lowest Mg content was determined in Banat (1) and Line-2 (13) genotypes (Table 2). In accordance with our findings, Peters et al. (2005) reported that Mg content alfalfa was ranged from 0.29% to 0.44% based on different soil pH and K treatments and locations. Additionally, it was reported that %0.1 Mg content in forages was adequate to avoid abnormalities caused by mg deficiency in livestock (ARC, 1980; Spears, 1994; NRC, 2000, McDowell and

Arthington, 2005; Márquez-Madrid et al., 2017). Accordingly, it was determined that the Mg contents determined in different cutting times in alfalfa genotypes were quite above this indicated value.

Table 2. Magnesium (Mg) and potassium (K) contents (%) at different cutting times of alfalfa (*Medicago sativa* L.) genotypes[+]

Genotypes	Magnesium (Mg) (%)				Potassium (K) (%)			
	1st Cutting (Pre-Flowering)	2nd Cutting (50% Flowering)	3rd Cutting (Full Flowering)	Mean	1st Cutting (Pre-Flowering)	2nd Cutting (50% Flowering)	3rd Cutting (Full Flowering)	Mean
1-Banat	0.31 w-x	0.35 j-p	0.33 q-w	0.33 j	3.12 a-ı	3.37 a-d	2.19 q-t	2.89 b-f
2-Basbag	0.34 n-t	0.36 h-n	0.33 q-w	0.34 f-j	2.99 f-j	3.05 e-ı	2.40 n-r	2.81 d-g
3-Bilensoy	0.31 v-x	0.37 e-k	0.39 c-e	0.36 c-e	3.19 a-g	3.05 e-ı	2.40 n-r	2.88 b-f
4-Calfa	0.32 s-x	0.34 m-s	0.34 n-t	0.34 ı-j	3.22 a-g	3.42 a	2.38 n-r	3.01 a-c
5-Daisy	0.33 p-v	0.34 m-s	0.33 q-w	0.34 ı-j	3.07 d-ı	3.11 a-ı	2.33 o-r	2.84 c-f
6-Diane	0.33 p-v	0.36 h-n	0.42 a	0.37 a	3.12 a-ı	3.02 f-j	2.12 r-t	2.75 f-g
7-Dimitra	0.31 v-x	0.33 q-w	0.36 g-m	0.34 ı-j	3.22 a-g	3.40 a-b	2.18 q-t	2.93 b-e
8-Elci	0.32 s-x	0.37 e-j	0.38 d-ı	0.36 c-e	3.26 a-f	3.19 a-g	2.19 q-t	2.88 b-f
9-Emiliana	0.32 t-x	0.36 h-n	0.40 a-c	0.36 a-d	3.15 a-ı	3.19 a-g	2.38 n-r	2.91 b-f
10-Escorial	0.33 r-x	0.35 j-p	0.37 e-j	0.35 d-h	3.21 a-g	3.15 a-ı	2.45 m-q	2.94 b-e
11-Ezzelina	0.33 q-w	0.37 f-l	0.38 d-h	0.36 b-e	3.07 d-ı	3.40 a-b	3.02 f-j	3.16 a
12-Line-1	0.34 o-u	0.37 f-l	0.36 g-m	0.36 c-f	3.26 a-f	3.01 f-j	2.36 n-r	2.88 b-f
13-Line-2	0.32 u-x	0.35 k-q	0.33 p-v	0.33 j	3.23 a-g	3.05 e-ı	2.40 n-r	2.89 b-f
14-Line-3	0.34 m-s	0.35 l-r	0.34 o-u	0.34 g-j	3.37 a-d	2.86 ı-l	2.74 j-m	2.99 b-d
15-Line-4	0.34 m-s	0.36 ı-o	0.34 n-t	0.35 e-ı	3.20 a-g	2.87 h-l	2.65 k-n	2.90 b-f
16-Iside	0.33 q-w	0.37 e-j	0.38 c-g	0.36 a-d	3.08 c-ı	3.14 a-ı	2.61 l-o	2.94 b-e
17-La Torre	0.32 s-x	0.34 m-s	0.36 h-n	0.34 g-j	3.33 a-e	3.23 a-g	2.52 m-p	3.03 a-b
18-Nimet	0.31 x	0.36 ı-o	0.39 c-f	0.35 d-h	3.00 f-j	2.94 g-k	2.28 p-r	2.74 f-g
19-Osjecka 99	0.31 w-x	0.37 f-l	0.40 b-d	0.36 c-e	3.12 a-ı	3.24 a-g	2.63 l-o	3.00 a-c
20-Prosementi	0.32 s-x	0.37 e-j	0.42 a-b	0.37 a-b	3.41 a	3.10 b-ı	2.20 q-t	2.90 b-f
21-Queen	0.32 s-x	0.37 f-l	0.40 a-c	0.36 a-c	2.98 f-j	3.19 a-g	2.25 p-s	2.80 e-g
22-Resis	0.33 r-x	0.35 l-r	0.39 c-e	0.35 c-g	3.38 a-c	3.23 a-g	1.94 t	2.85 c-f
23-Riviera vicentina	0.33 r-x	0.37 f-l	0.39 c-f	0.36 a-d	3.16 a-h	3.34 a-e	2.36 n-r	2.95 b-e
24-Sabrina	0.32 t-x	0.35 j-p	0.35 l-r	0.34 h-j	2.95 g-j	3.03 f-j	1.96 s-t	2.65 g
Mean	0.32 C	0.35 B	0.37 A		3.17 A	3.15 A	2.37 B	
CV (%)	3.71				6.52			
LSD (%5)								
Cutting times	0.004**				0.061**			
Genotypes	0.011**				0.175**			
Genotypes × Cutting times	0.021**				0.304**			

+, means with different letters in the same column are significantly different ($P < 0.05$); significant at; **, $P \leq 0.01$

Potassium (K) content of alfalfa genotypes showed decreasing with advancing forage maturity. While K content mean of the 1st cutting times was determined as 3.17%, the means of the 2nd and 3rd were determined as 3.15 and 2.37% respectively. The decreasing K content with plant maturity can be attributed with consumption of this element for the plant growth. In accordance with our findings, Smith (1960), Clanton (1980) and Spears (1994) reported that K content of forages declined with advancing forage maturity. Meanwhile, genotypes × cutting times interaction was found to be highly significant ($P<0.01$) in terms of K content in alfalfa genotypes. Besides, K content means ranged from 1.94% to 3.42% among alfalfa genotypes and the cutting times. In partial agreement with our findings, Peters et al. (2005) reported that K content in alfalfa was ranged from 1.73% to 2.96% based on different soil pH and K treatments and locations. As a reason for the partial disagreement between the findings, the differences in the used genotypes, the soil K contents and the other ecological conditions can be shown. On the other hand, according to the three cutting times average, K content of Calfa (4), Ezzelina (11), La Torre (17) and Osjecka 99 (19) cultivars were found to be higher than the other alfalfa genotypes. However, the lowest K content was determined in the Sabrina (24) cultivar. The National Research Council (NRC, 2000) suggested that K content of forages should be at least 0.65% in dry matter (DM). Additionally, Tajeda et al. (1985) cited that for livestock requirements K content of forages shouldn't under the 0.80% of DM. In Fact, K contents determined in the alfalfa genotypes in different cutting times were found to be quite above the references data, and the K contents found to be sufficient to meet potassium requirements of livestock (Table 2).

CONCLUSIONS

Results of the study showed that the cutting times significantly affected calcium (Ca), phosphorus (P), magnesium (Mg) and potassium (K) contents of alfalfa genotypes. Accordingly, advancing plant maturity led to increasing in Ca and Mg contents, while decreasing was determined in P and K contents in alfalfa forages. Additionally, it was determined that the Ca, Mg, P and K contents detected in alfalfa genotypes at all cutting times were found to be sufficient for animal requirements. Finally, according to the cutting times average, many alfalfa genotypes came to fore due to their higher P, Mg and K contents, while only Resis (22) alfalfa cultivar came to fore in terms of Ca content.

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