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DETERMINATION OF FEED QUALITY PARAMETERS OF LEAVES AND STEMS OF DIFFERENT ALFALFA GENOTYPES

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Abstract
This research was carried out to determine feed quality parameters of leaves and stems of different alfalfa genotypes. A total of 12 alfalfa genotypes was used as the plant material for the study. Alfalfa plants were harvested at the flowering stage. The plants were dried at 70°C and grinded in a hand-mill with 1 mm sieve for chemical analysis. In leaf, the acid detergent fiber (ADF) content of genotypes varied between 21.62 - 27.40%, the neutral detergent fiber (NDF) content between 33.98 - 39.95%, and crude protein content between 24.68 - 28.45%, whereas in stem ADF content of genotypes varied between 50.99 - 57.72%, NDF content between 66.96 - 76.79 %, crude protein content between 8.46 - 11.00%. The RFV ranged from 159.18 to 197.27% and 53.22 to 67.06% for leaf and stem respectively. The leaf to stem ratio of genotypes ranged from 0.72 to 1.60. Considering current results from different genotypes, genotype has a high effect on feed quality. In addition, the rate of leaf to stems is also effective on feed quality. While the protein ratio of the leaves was higher than the stems, the ADF and NDF contents were found to be lower than the stems. So, in the selection of alfalfa genotypes, attention should be paid to the leaf to stem ratio as well as the yield.

Keywords: Alfalfa, chemical composition, crude protein, leaf to stem ratio.

1. INTRODUCTION

Alfalfa (*Medicago sativa* L.) is one of the most important perennial forage crops in the world and it is used primarily as hay, pasture, or green forage for a wide variety of livestock (Avcı et al., 2018). It can be grown a wide range of climatic and soil conditions. Alfalfa has the high yield potential and feeding values. Alfalfa has high protein content (15-22%) as well as vitamins and minerals (Kumar, 2011). Besides forage yield and quality, alfalfa provides remarkable agronomic and environmental advantages in terms of soil fertility, protection against soil erosion, rate of nitrogen fixation per year (Annicchiarico, 2015).

High feed quality is very important in animal husbandry and “high quality” varieties need to be developed. The leaf to stem ratio is used as a synthetic positive indicator of feed quality because the leaves have higher digestibility than the stems (Annicchiarico, 2015; Grev et al., 2020). At an average harvest maturity, leaves are rich in protein and low in cell wall concentration, therefore, it has a high nutritional value and is highly digestible (Jung et al., 1997; Markovic et al., 2012; Grev et al., 2020). The stems, on the other hand, have low digestibility properties because of high concentrations of cell wall polysaccharides and lignin (Grev et al., 2020). Also, as maturity progresses, stems they somehow lose their digestibility than leaves (Sheaffer et al., 2000). Many

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factors are used to estimate feed quality, such as crude protein ratio, ADF, NDF contents and total digestible nutrient (Avcı et al., 2018). Our objective was to determine some quality parameters of leaves and stems of different alfalfa genotypes at the flowering stage stages.

2. MATERIALS AND METHODS

This study was conducted from 2020, at the Experimental Field of Erciyes University, Kayseri, Turkey. Experimental soils were classified as sandy-loam. Soils had low lime and salt content, poor in organic matter and were slightly alkaline. The long-term average temperature (1980-2019) was 10.7°C. The long-term average annual rainfall was 345.06 mm. Total rainfall during the growing season in March, April, May, and June of 2020 was 190.6 mm. The average temperatures during these months were 7, 10.2, 15.5 and 19.3 °C respectively.

Local populations collected from different locations of Kayseri provience were planted in the field at 1 m intra and inter row spacing in 2019. Experimental area was irrigated with drip irrigation during the growing season. At the flowering stage (more than 60-70% of stem had flowers), selected 12 different single plant were harvested on 16 June 2020. After counted stem number, samples were divided by hand into stem and leaf fractions, weighed and determined leaf to stem ratio. Leaf and samples taken from each plant were oven-dried at 70 °C and ground to pass through a 1 mm screen for chemical analysis. Crude protein, acid detergent fiber (ADF) and neutral detergent fiber (NDF) contents of samples were determined by using near infrared reflectance spectroscopy (NIRS, Foss 6500) with software program coded IC-0904FE. The relative feed value was calculated according to the formula reported by Schroeder (2004).

3. RESULTS AND DISCUSSIONS

There were differences in number of stem, leaf and stem green herbage yield, leaf to stem ratio, crude protein, ADF and NDF contents of genotypes (Table 1 and 2). Number of stem of genotypes ranged from 24 to 74. The average stem number was 48 stems. Leaf and stem green herbage yield varied between 100-650 g/plant, and 115-905 g/plant respectively (Table 1). Leaf-to-stem ratio ranged from 0.72 to 1.60. The average leaf to stem ratio of genotypes was 1.06. Leaf to stem ratio above average was obtained from GnyA, GnyC, GnyD, GnyE, Gny6, Gny75, and Gny114. Avcı et al. (2018) stated that leaf to stem ratio of some alfalfa cultivars varied between 0.71-1.08 and Tucak et al. (2014) found leaf to stem ratio of 22 alfalfa populations/cultivars between 0.880-1.011, which were similar with our data. Rotili et al. (1999) stated that the quality of alfalfa is mainly influenced by leaf to stem ratio and the plant with the leaf to stem ratio of 0.85-1.0 is defined as an ideal plant in terms of quality.

Crude protein content of alfalfa genotypes ranged from 24.68% to 28.45% for leaf and from 8.46% to 11% for stem (Table 2). Mean crude protein content of genotypes was 26.66% and 9.92% for leaf and stem respectively. GnyC, Gny6, Gny29, Gny55 and Gny75 had above average crude protein for both leaf and stem. Leaf crude protein content was higher than stem, which was in line with the findings of Sheaffer et al. (2000) and Markovic et al. (2012). In the previous researches, crude protein content for alfalfa was found as 28.3 and 9.3% for leaf and stem by Jung et al. (1997); 11.84 -26.12% and 0.40 - 8.04% for leaf and stem respectively by Nan et al. (2019). Sheaffer et al. (2000) determined the protein content in leaves and stems of alfalfa as 28.4-30.4% and 11.3-11.5% in the early flowering harvest regimes and 26.4-27.8% and 9.6-10.2% in the late flowering harvest regimes in three locations.

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Table 1. Number of stem, leaf and stem green herbage yield (g/plant) and leaf to stem ratio of some alfalfa genotypes at the flowering stage

Genotypes	Number of Stem	Green Herbage Yield		Leaf to Stem Ratio
		Leaf	Stem	
GnyA	50	340	295	1.15
GnyC	60	495	310	1.60
GnyC1	24	170	215	0.79
GnyD	44	345	320	1.08
GnyE	41	360	230	1.57
Gny6	48	260	245	1.06
Gny29	70	650	905	0.72
Gny55	38	495	550	0.90
Gny75	74	330	305	1.08
Gny76	25	100	115	0.87
Gny114	47	200	180	1.11
Gny125	51	295	390	0.76
Mean	**48**	**337**	**338**	**1.06**

Table 2. Crude protein (%),acid detergent fiber (ADF, %), neutral detergent fiber (NDF, %), and relative feed value (RFV, %) in leaves and stems of some alfalfa genotypes at the flowering stage

Genotypes	Crude protein		ADF		NDF		RFV	
	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem
GnyA	26.1	10.30	22.96	55.92	36.19	69.59	182.54	60.61
GnyC	26.9	10.34	23.56	53.62	37.47	70.98	175.14	61.77
GnyC1	26.58	9.08	21.99	56.21	35.68	75.27	187.11	55.75
GnyD	25.91	8.46	24.65	57.72	37.09	76.79	174.80	53.22
GnyE	25.1	10.65	27.40	51.78	39.08	67.37	160.80	67.06
Gny6	27.31	9.86	23.77	56.84	38.38	72.93	170.59	56.92
Gny29	27.24	11.00	22.28	50.99	35.01	68.71	190.10	66.58
Gny55	27.82	9.73	22.10	55.43	36.97	74.46	180.37	57.12
Gny75	28.45	10.86	21.62	52.86	33.98	68.38	197.27	64.92
Gny76	25.81	9.55	22.79	56.41	34.70	72.10	190.73	58.00
Gny114	24.68	9.58	26.87	52.81	39.72	66.96	159.18	66.35
Gny125	28.00	9.65	23.67	54.57	39.95	70.13	164.07	61.53
Mean	**26.66**	**9.92**	**23.64**	**54.60**	**37.02**	**71.14**	**177.72**	**60.82**

The ADF content of genotypes ranged from 21.62 to 27.40% and 50.99 to 57.72%, for leaf and stem respectively, whereas NDF content ranged from 33.98 to 39.95% and 66.96 to 76.79 for leaf and stem respectively. On average, the ADF and NDF were 23.64 and 37.02 % in leaf, and were

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54.60 and 71.14 % in stem, respectively. Crude protein was greater in leaf than in stem, whereas ADF and NDF were lower in leaf than in stem. Similarly, Sheaffer et al. (2000) reported ADF and NDF concentrations as 17.1-18.6% and 20.5-22% for leaf and as 52.3-56 % and 61.6-65.8% for stem respectively.

The RFVs of genotypes ranged from 159.18 to 197.27% and 53.22 to 67.06% for leaf and stem respectively. According to alfalfa hay quality standards RFV>151 was classified in high-quality forages (Markovic et al., 2010). RFV in leaves of all genotypes were higher than this value and the RFV of leaves was greater than stems. Grev et al. (2020) reported that leaf fractions in alfalfa had higher forage nutritive value compared to stem fractions across all maturities.

4. CONCLUSIONS

There were differences in number of stem, leaf to stem ratio, and leaf and stem nutritional qualities of genotypes. Leaf-to-stem ratio ranged from 0.72 to 1.60. Leaves accumulated high contents of CP. ADF and NDF were lower in leaves than in stems. And also leaves had higher RFV. Further examination of the cloned genotypes over multiple cuttings and years is necessary to fully understand their superior traits.

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