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Full Length Research Paper

Biomass yield dynamics and nutritional quality of alfalfa (*Medicago sativa)* cultivars at Debre Zeit, Ethiopia

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The cultivars were planted on 12 m^2 plots (4 m long and 3 m wide) in randomized complete block design with four replications. The treatments were: FG10-09(F), FG9-09(F), Magna 801-FG(F), Magna 788 and Hairy Peruvian. The leaf and stem yield were determined by harvesting a central section of two adjacent middle rows with a sampling area of 0.2 m^2 (0.5 m length x 0.4 m width). For forage quality analysis, four randomly selected adjacent middle rows with a net area of 3.2 m^2 were harvested. The four replications were pooled into one and properly homogenized and one representative subsample was taken for each cultivar within each cutting cycle. The analysis of variance indicated that; interaction of cultivar and cutting cycle was not significant for leaf and stem yield and chemical composition of the cultivars ($P>0.05$). Similarly, cultivars effect was not significant ($P>0.05$) for leaf and stem yields. Magna 788, Hairy Peruvian and FG9-09(F) had higher leaf and stem yield respectively other than the rest cultivars. Cutting cycles had significant effect ($P<0.05$) on leaf and stem yield. The 8th cycle had higher leaf, stem and total DM yields followed by 7th cycle, while the rest cycles had intermediate and comparable values. On the contrary the leaf to stem ratio was lowest.The effect of cultivar for chemical composition was not significant ($P \geq 0.05$). Cutting cycles had significant effect ($P< 0.05$) for acid detergent fiber, digestible dry matter and cellulose content. Cultivars had higher nutritional value and had lower biomass yield during drier season while higher during wetter season.

Key words; Alfalfa, Leaf and stem yield, chemical composition

Abbreviations: DM, dry matter; DMY, dry matter yield; CP, crude protein; NDF, neutral detergent fiber; ADF, acid detergent fiber; ADL, acid detergent lignin;

INTRODUCTION

Livestock play a crucial role in Ethiopian agriculture. Currently, productivity per animal is very low, and the contribution of the sector to the overall economy is much lower than expected due, among others, to poor nutrition. The larger proportion of livestock feed comes from natural pastures and crop residues that are deficient in important nutrients like protein and energy (Tessema and Barras, 2006). Most of legume forages are a protein source in livestock nutrition and of which, those home grown feeds make farmers less dependent from the purchase of other protein source. The capacity of legumes to fix nitrogen from the air results in high protein contents, particularly in alfalfa (Gosselink, 2004).

Alfalfa is one of the most important forage crops worldwide due to its high forage quality and yield and adaptability to different climatic conditions (Turan *et al*., 2009). It can be used directly for grazing or conserved as silage or hay and is a reliable forage species that could represent a significant contribution to the livestock sector (Borreani and Tabacco, 2006). The herbage DM (dry

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matter) yield and chemical composition of alfalfa depends on cutting cycles and cultivars, among others. Crude protein tends to be lower in aged alfalfa plants while the content of crude fibres increases (Stanaćev *et al*., 2008). It produces more protein per hectare than other legume and grasses; therefore, it is widely used for hay production and as pasture for livestock, especially to ruminants (Monteros and Bouton, 2009).

The intension in alfalfa forage production is on improving fodder yield and quality. This can be improved by increasing the leaf/stem ratio, which could be achieved by selecting genotypes (Cultivars) with having high leaf to stem ratio.(Keoghan, 1982). Evaluation of nutritional status is an important part of experimental assessment since inadequate nutrition increases the risk of health and performance problems (Becvarova *et al*., 2009).

The estimated livestock population of Ethiopia is 38.7 million cattle, 16.1 million sheep, 14.9 million goats, 5.8 million equine and 0.46 million camels (CSA, 2005), despite their productivity is low. The causes for low productivity of livestock in Ethiopia are multifaceted that include poor feed supply among others (Zegeye, 2003). McDonald *et al*. (2002) stated that all straws and related by-products are extremely fibrous, most of them have a high content of lignin and all are of low nutritive value. In connection to this, most dry forages and roughages found in Ethiopia have a crude protein (CP) content of less than 7% which indicates microbial requirement can hardly be satisfied unless supplemented with protein rich feeds (Van Soest *et al*., 1994).

Therefore to improve availability of livestock feed in terms of quality and quantity it is better to cultivate alfalfa forage that have better biomass yield and nutritional quality. Thus, it is better to see which cultivar can perform in terms of nutritive value and biomass yield across in different cutting cycles, before disseminating the cultivars to the livestock farming community. The objective of the present study was, Therefore, to determine the leaf and stem yield dynamics of five alfalfa cultivars across cutting cycles and to evaluate the chemical composition and DM digestibility of five alfalfa cultivars across cutting cycles.

MATERIALS AND METHODS

LOCATION

The experiment was conducted at Debre Zeit Agricultural Research Centre (Latitude: 08044' N; Longitude: 38038' E) located in East Shewa Zone of Oromia Regional State, Ethiopia. The Center is located at 47km away from the capital Addis Ababa to the East at an altitude of 1900 m above sea level. The average maximum and minimum temperatures of the center are 28.3 and 8.9 °C, respectively, with a mean annual rainfall of 1100mm, having a bimodal pattern. The site is characterized by tepid to cool sub-moist agro-ecology, with dominant soil types consisting of light alfisols/holisols and heavy black soil (vertisols) (EIAR, http://www.eiar.gov.et).

Treatments and Experimental Design

Five selected alfalfa cultivars were grown at forage and pasture research site of the DZARC on finely prepared seed beds. The cultivars were: FG10-09 (F), FG9-09 (F), Magna 801-FG (F), Magna 788 and Hairy Peruvian. The cultivars were planted on 4 July, 2012 on 12 m^2 plots (4 m long and 3 m wide). Each plot consisted of 15 rows arranged length-wise in an east-west direction, with intra-row spacing of 0.2m. A seeding rate of 20 kg/ha was used and diammonium phosphate (DAP) fertilizer was applied at the rate of 100 kg/ha at planting. The plots were laid out in randomized complete block design (RCBD) with four replications. At early stages of seedling development, weeds were controlled through manual weeding followed by hoeing. Subsequent weed and other plot management practices were undertaken when deemed necessary.

Data Collection and Chemical Analysis

Data Collection

The sample was collected to determine DM yield (leaf & stem), leaf proportion, stem proportion & leaf to stem ratio. The leaf and stem yield was determined by harvesting a central section of two adjacent middle rows with a sampling area of 0.2 m^2 (0.5 m length x 0.4 m width). The harvested biomass separating in to leaf and stem and packed to paper bag followed by partitioning the harvested biomass in to leaf and stem fractions, and drying the fractions at 65 ^oC for 72 hrs for determination of partial DM yield. Finally the recorded DM yield data on the plot was changed to per hectare.

For leaf and stem yield and evaluation of chemical composition of selected alfalfa cultivars as influenced by cutting cycle and cultivar difference, required data (1-8th cutting cycles) were extracted from an ongoing project from a forage stand established at DZARC. The harvesting dates were: Cycle 1, Oct. 19, 2012; Cycle 2, Dec. 26, 2012; Cycle 3, Feb. 26, 2013; Cycle 4, April 2, 2013; Cycle 5, May 20, 2013; Cycle 6, June 25, 2013; Cycle 7, Aug. 20, 2013; Cycle 8, Oct. 10, 2013.

Chemical composition, and relative feed value (RFV) index determination

At full bloom stage, described as a stage when open flowers emerge on average of 2 or more nodes and no seed pods present (Ball, 1998), four randomly selected

Table 1: Effect of cultivar on leaf, stem, total biomass DM yields and leaf to stem ratio of selected alfalfa cultivars

Cultivar	LY (kg/ha)	SY (kg/ha)	TDMY (kg/ha)	Leaf:stem ratio
FG10-09(F)	670.6	1785.6	2456.3	0.91[a]
FG9-09(F)	959.6	1901.8	2861.5	0.8[ab]
Magna 801-FG(F)	895.7	1516.1	2411.8	0.96[a]
Magna 788	1129.1	1541.6	2670.8	0.96[a]
Hairy Peruvian	753.6	1984.0	2737.6	0.70[b]
SE	139.6	289.8	381.5	0.49

Note: SE, Standard error; LY, Leaf yield; SY, Stem yield; TDMY, Total dry matter yield
Means in a column followed by different superscripts are significantly different (P>0.05)

adjacent middle rows with a net area of 3.2 m^2 were harvested. For forage quality analysis, chopped herbage of the four replications were pooled into one and properly homogenized and one representative subsample was taken for each cultivar within each cutting cycle. The harvested biomass was manually chopped into small pieces using sickle and a subsample of 500 g was taken. The forage sample (0.5 kg) in the experiments was ground to pass through a 1 mm screen using a Wiley mill for chemical composition analysis. The sample was assessed for DM and Ash by the methods of the Association of Official Analytical Chemists (AOAC, 1990). Nitrogen was determined by the micro-Kjeldahl method and CP was calculated as N×6.25.

The NDF, ADF and ADL as well IVOMD values were determined by Using Near Infrared Reflectance Spectroscopy (NIRS) facilities at Holetta Agricultural Research Center, Ethiopia. The IVOMD was determined by the methods of Tilley and Terry (1963) as modified by Van Soest and Robertson (1985) as well Near-infrared reflectance spectroscopy.

The hemicelluloses and cellulose content was calculated as:

Hemi cellulose = NDF – ADF.

Cellulose= ADF-ADL

The index ranks forages relative to the digestible DMI of full bloom alfalfa were calculated according to (Undersander *et al*., 1993).

DDM = Digestible Dry Matter = 88.9 - (0.779 x % ADF)

DMI = Dry Matter Intake (% of BW) = 120 / (% NDF)

RFV = (DDM x DMI) / 1.29

Data Analysis

Analysis of variance procedures was used to analyze the quantitative data to be generated under experimental sets. The General Linear Model procedure of SPSS version 20 was used for data analysis and significant mean differences were declared at P ≤ 0.05 using Tukey. In herbage yield dynamics study, the model used include, the effect of cutting cycle, cultivar and replication. For herbage quality data, the effect of cutting cycle (n = 2) and cultivar (n = 5) was used.

For herbage yield dynamics data, the following model was used:

$Y_{ijk} = \mu + T_i + \beta_j + CC_k + \varepsilon_{ijk}$ i = 1,...,a; j = 1,...,b

Where:

k=1,…..c

Y_{ijk} = an observation in treatment i , block j and cutting cycle k; μ = the overall mean

T_i = the effect of treatment i (n = 5); β_j = the effect of block j (n = 4)

CC_k= the effect of cutting cycle (n = 8); ε_{ijk} = random error with mean 0 and variance σ2 ; a = the number of treatments; b = the number of blocks; c= cutting cycles

For herbage quality, the following model was used:

$Y_{ik} = \mu + T_i + CC_k + \varepsilon_{ik}$ i = 1,...,a; k= 1,...,c

Where:

Y_{ik} = an observation in treatment i, and cutting cycle k; μ = the overall mean

T_i = the effect of treatment i (n = 5); CC_k= the effect of cutting cycle k (n = 2)

ε_{ik} = random error with mean 0 and variance σ2 ; a = the number of treatments; c = the cutting cycles

RESULTS

Effect of Cultivar and Cutting Cycle on Leaf, Stem and Total Biomass Dry Matter Yields

The combined analysis of variance showed that the effect of cultivar and the interaction of cultivar by cutting cycle was not significant (P>0.05) for the three measured herbage traits. Thus, the average effects of the cultivars and cutting cycles were presented separately. Though cultivar effect was not significant for DMY as presented in Table 1, while it was significant for leaf to stem ratio (P>0.05). Among the cultivars, Magna 788 had the highest leaf yield while FG10-09(F) exhibited lowest leaf yield and Hairy Peruvian had higher stem yield whereas Magna 801-FG(F) had lowest stem yield. Correspondingly, FG9-09(F) obtained higher total

Table 2: Effect of harvest cycle on leaf, stem, total DM yields and leaf to stem ratio of selected alfalfa cultivars

Cutting cycle	LY(kg/ha)	SY (kg/ha)	TDMY (kg/ha)	Leaf: stem ratio
First	288.0^{b}	330.2^{c}	618.2^{c}	0.95^{b}
Second	417.5^{b}	471.0^{c}	888.5^{c}	1.2^{ab}
Third	480.0^{b}	565.0^{c}	1045.0^{c}	0.86^{b}
Fourth	523.2^{b}	537.9^{c}	1061.1^{c}	0.99^{ab}
Fifth	410.0^{b}	460.8^{c}	870.8^{c}	0.92^{b}
Sixth	314.4^{b}	271.4^{c}	585.9^{c}	1.3^{a}
Seventh	2120.0^{a*}	4525.0^{b}	6645.0^{b}	0.48^{c}
Eighth	2500.7^{a}	6805.6^{a}	9306.4^{a}	0.40^{c}
SE	176.6	366.6	482.6	0.60

Note: SE, Standard error; LY, Leaf yield; SY, Stem yield; TDMY, Total dry matter yield
*, Means in a column followed by different superscripts are significantly different (P<0.05)

Table 3: Chemical composition of the five alfalfa cultivars for 7th and 8th cutting cycles

	Herbage quality traits (%DM)											
Cultivar	**DM**	**Ash**	**CP**	**NDF**	**ADF**	**ADL**	**IVOMD**	**DDM**	**DMI**	**RFV**	**HCL**	**CEL**
FG10-09(F)	91.08	10.47	19.29	37.96	30.94	4.44	69.37	64.79	3.16	181.05	7.02	26.12
FG9-09(F)	90.95	9.525	18.48	36.47	28.59	3.9	68.97	66.62	3.30	170.86	7.87	24.69
Magna801-FG(F)	90.83	9.07	20.30	33.70	26.57	3.43	71.08	68.19	3.57	189.21	7.13	23.14
Magna 788	91.02	9.43	18.51	37.02	28.54	4.02	69.02	66.66	3.24	167.49	8.48	24.52
Hairy Peruvian	91.01	9.73	19.19	37.16	29.97	4.23	69.22	65.55	3.21	163.31	7.19	25.74
SE	0.074	0.606	1.38	1.06	1.770	0.22	0.66	1.37	0.10	14.20	1.23	1.55

Note: SE, Standard error; Means in a column are not significantly different (P>0.05)

biomass DM yield and Magna 801-FG(F) had lowest total biomass DM yield.

The effect of cutting cycle on the four agronomic parameters was presented in Table 2. Cutting cycles had significant effect on measured traits of five alfalfa cultivars (P≤0.05). The 8th cutting cycle had highest leaf yield followed by 7th cutting cycle, while first cutting cycle obtained lowest and comparable leaf yield with the rest cutting cycles. Stem yield was highest on 8th cutting cycle followed by 7th cutting cycle and 6th cutting cycle had lowest and intermediate stem yield with the rest cutting cycles. In the same way, total biomass DM yield was highest in the 7th cutting cycle next to 8th cutting cycle, even as the 6th cutting cycle exhibited lowest and equivalent total biomass DM yield with the rest cutting cycles. The 6th cutting cycle had the highest leaf to stem ratio and comparable value with 2nd and 4th cycles.

Chemical Compositions of Alfalfa Cultivars for the 7th and 8th Cutting Cycles

The effect of cultivar for chemical composition was not significant (P ≥ 0.05) as appeared in Table 3. Thus, all cultivars had comparable value for all the chemical entities assessed. Though not statically significant, all cultivars had greater than 90% and 18% DM and crude protein content respectively. FG10-09(F) had higher ash content (10.47%) than the rest cultivars. Magna 801-FG(F) had higher nutritive value compared with the rest cultivars containing; lower ash (9.07%), NDF, ADF,ADL and higher crude protein (20.3%), IVOMD, DDM ,DMI and RFV contents. Hairy Peruvian had lower RFV (163.31) than the rest cultivars.

Table 4: Chemical composition of cultivars across two cutting cycles

Chemical composition	Seventh	Eighth	SE
DM	90.99	90.97	0.047
Ash	9.31	9.98	0.383
CP	19.44	18.86	0.877
NDF	37.35	35.58	0.670
ADF	30.81^{b}	27.03^{a}	1.119
ADL	4.25	3.76	0.145
IVOMD	69.13	69.93	0.419
DDM	64.89^{b*}	67.83^{a}	0.872
DMI	3.20	3.38	0.064
RFV	170.41	178.36	8.982
HC	6.53	8.54	0.782
Cellulose	26.41^{a}	23.27^{b}	0.983

Note: SE, standard error; *, means in a row followed by different superscripts are significantly different (P<0.05)

Cutting cycles did significantly (P ≤ 0.05) affect Acid detergent fiber, dry matter digestibility and cellulose content as shown in Table 4. The ADF and cellulose content were higher in the 7th cutting cycle despite the fact that DDM was higher in the 8th cutting cycle. The rest chemical compositions are not significant (P> 0.05) and had comparable values. Though the 8th cutting cycle had lower crude protein and higher ash content, but had higher RFV (178.36) than the 7th cutting cycle.

DISCUSSION

Leaf, Stem and Total Biomass Dry Matter Yield of Five Alfalfa Cultivars

The non-significant effect of the interaction between cultivars and cutting cycles for the leaf, stem and total biomass yield traits suggests that the phenotypic performance of the cultivars was independent of harvesting cycles, with genetics of cultivars. The non-significant effect of cultivar for leaf, stem and total biomass DM yield in the present work concurs with the reports of (Ji-shan *et al.*, 2012 and Afsharmanesh, (2009); "Ranger" alfalfa cultivar had herbage forage yield (2.81 t/ha)). The cultivars in the present study had lowest herbage yield when compared with reported literature values, even under drought and unfavorable environmental condition. In the first year of vegetation, in the severe drought conditions Maria *et al.* (2007) reported that a mean yield values of alfalfa is 3 t/ha DM.

Cutting cycles had significant effect for leaf, stem and total biomass DM yield and this in agreement with the finding of (Julier and Huyghe, 1997). According to the study of Neal *et al.* (2006) cutting interval, which directly impacts maturity, had a stronger influence on herbage yield and quality than did cultivars thus, this is in accordance with the present report. Totally, eight harvests were taken at an average cutting interval of 54.6±12.4 days during October 2012 and October 2013, which is in disagreement with work of Sheaffer (2000) that the optimal harvest interval for alfalfa is between 30 to 35 days. The interval between harvests was observed to be longer for wetter months of the year compared to months of low or no rainfall. It was evident that harvests taken during or following the long and short rainy months had comparatively higher leaf yield, stem yield and total dry matter yield, while those taken during months of low or no rainfall had lower herbage yields.

The 6th cutting cycle harvested at the drier season had lower dry matter yield but have high leaf to stem ratio and this correlated with the study of Davodi *et al.* (2011) that dry matter yield was negatively correlated with leaf to stem ratio.

Dynamics of Biomass across Cutting Cycles

A total of eight harvests (October 2012 – October 2013) obtained per year in the current study was low in view of what was usually attainable for alfalfa stands managed under Debre Zeit condition. The dynamics of herbage DM yield trend was increase until eight cutting cycle because moisture availability trigger development of root, tiller and shoot of alfalfa. In this study the herbage DM yield was gradually increase until fourth cutting cycle and This was consistent with the report of Lloveras (2001) who reported the increase in alfalfa dry forage yield from the first cutting (2.77 t/ha) to the second cutting (3.52 t/ha) and decreased in fifth and six cutting cycle. When the wetter season comes the yield increase dramatically in seventh and eighth cutting cycles and it assumed to be season and cutting cycle effect.

Evidence shows that alfalfa could be harvested at shorter intervals, around 30 days, with higher number of cuts achieved during the dry months of the year under irrigated conditions, which indeed is lower than an interval of around 54.6±12.4 days recorded in the present study. The interval between harvests in the current study was longer during wetter months compared to dry months, and this could be explained by the fact that when light conditions do not trigger transition from vegetative to reproductive growth, shoots remain in the vegetative stages of development (Gramshaw *et al.,* 1981; Sheaffer *et al.,* 1988; Gramshaw *et al.,* 1993) thereby delaying the predetermined stage of biomass removal which in here was full bloom stage (Ball, 1998). Găvan (2013) reported that, cool and wet conditions could delay the flower to open, hereby delay full bloom stage and on the other side NDF content of the forage is continues to increase and it is in disagreement with this study.

Low leaf, stem and total DM yield for the dry months of the year in this study clearly suggests the significant role of moisture availability in growth and development of alfalfa crop which concurs with the claims of (Sammis, 1981) and the water deficit was high, affecting the yield level (Maria, *et al*., 2007).

In this regard, water deficiency was reported to diminish shoot growth rate through a variety of mechanisms, among which the following were reported in the literature: reduced shoot elongation rate, decreased inter node length, slow rates of leaf development and reduced leaf area expansion (Durand *et al.,* 1989; Grimes *et al*., 1992 and Brown *et al.,* 2009). In the present study, leaf to stem ratio was higher during the drier months of the year and this in line with what was documented by other works (Carter and Sheaffer 1983; Halim *et al.,* 1989), who indicated a negative effect of water deficiency on stem growth than on leaf area, leading to higher leaf to stem ratios for stands grown under water stress. During rainy and at the end of rainy season the leaf, stem and total DM yield of alfalfa cultivars was very high comparing with dry season, but had lower leaf to stem ratio.

Herbage Nutritive Value

Cultivars effect was not significant for chemical composition of alfalfa (P >0.05) which in agreement with the findings of (Ji-shan *et al*., 2012) and in disparity with that of others (Katić *et al.,* 2008 , Milić *et al*., 2011 and Diriba *et al*., 2014*).* High quality alfalfa was reported to contain >19 % CP, <31% ADF, <40 % NDF and > 151 % RFV (Redfearn and Zhang H, 2011). Moreover, alfalfa forage quality values at full bloom stage contain CP >16, ADF < 41, NDF <53 and RFV >100 (Dunham, 1998).

In the current study, the DM content of alfalfa cultivars had higher yields (above 91%), greater than what was reported by Martin *et al*. (1988), however, Kamalak *et al*. (2005) reported alfalfa hay contain 93.2% DM and that had higher DM doesn’t mean had higher crude protein content. The present work revealed ash content ranges from 9.07-
10.47 which in agreement with the study of (Giger-Riverdin, 2000; Kamalak *et al*., 2005; Preston, 2010).

Currently, FG10-09(F), Magna 801-FG (F) and Hairy Peruvain had higher CP content which is above 19%, but FG9-09(F) and Magna 788 had below threshold level according to the report of (Redfearn and Zhang, 2011) and Dunham (1998). According to the report of Collins (1988) and NAS (1978)*;* corn silage has 10% CP, 4% lignin, 51% NDF and 28% ADL but this study revealed that, alfalfa had higher crude protein content than corn silage; on the contrary had higher lignin content. .

Hairy Peruvain had lower leaf to stem ratio other than the rest cultivars, despite higher and comparable CP content with FG10-09(F) and Magna 801-FG (F) as appreciated in Table 1. This result differed from with the report of (Julier *et al.,* 2001 and Katic *et al.,* 2005*)* that alfalfa nutritive value is identified with protein content which depends on the share of leaves in DM yield which in its turn is positively correlated with protein content. Had low leaf to stem ratio does not necessarily mean the cultivar had less CP content.

According to the results reported currently, cultivar difference was not significant for lignin and cellulose content which agrees with findings of Milić *et al*. (2011) and Diriba *et al* (2014) where the cultivars evaluated did not significantly differ in their ADL content. This work revealed the alfalfa cultivars had lower NDF, ADF and ADL content compared with the finding of (Dien *et al*., 2006, Yu *et al*., 2003, INRA, 2006 and Homolka *et al*., 2008). The ideal NDF level in alfalfa hay for dairy cows is 40 % (%DM). Since NDF levels below 40% are to low and the hay have high rates of passage through the rumen; resulting in inefficient dry matter conversion. The NDF levels greater than 40 % begin to slow rate of passage, creating a gut-fill effect. Higher gut-fill results in lower DM intake; and DM intake drives milk production (Găvan *et al*., 2013).

All cultivars had lower ADF value less than 31%; it indicates that the cultivar had better nutritive value compared with the result of Mustafa *et al*. (2010) and lower NDF compared with the report of Canbolat *et al. (2006)*.

According to the discovered of Kallenbach *et al*. (2002); Canbolat *et al.* (2006) and Mustafa *et al*. (2010), this finding had higher DDM and and DMI value ranging from 64.79-68.19% and 3.16-3.57 respectively. Digestibility of organic matter had a negative correlation with NDF, ADF and hemicelluloses (Čerešňáková *et al*., 1996). Furthermore, in this study, Organic matter digestibility of selected alfalfa cultivars ranges from 68.97-71.08% and, which in accordance with the finding of (INRA, 2007) that, Organic matter digestibility of alfalfa ranges from 55 % to 77 % and it depends on growth stage, cutting frequency, harvesting season.

The CP, cell wall components, and IVOMD and indices like RFV are commonly used to assess the potential of a feed (El-Waziry, 2007 and Pinkerton, 2005). In the present study, even if they didn’t have significant effect; variation among the cultivars was observed for CP, detergent fibers, hemicellulose and cellulose implying the possibility of selecting suitable plant protein sources for designing appropriate feed supplementation strategies. Relative forage quality (RFV) is an index used for legumes based on potential intake and fiber digestibility (Undersander and Moore, 2002). The index is used to price forage and to allocate forage to appropriate ruminant livestock performance levels. Accordingly, feeds with RFV index higher than 100 are considered to be of higher quality compared to full bloom alfalfa hay and those with a value lower than 100 are of lower value (Dunham, 1998). In the current study alfalfa cultivars evaluated had a RFV ranging from 163-189 and this was apparently above the threshold level of 151 according to the revealed of (Redfearn and Zhang, 2011).

CONCLUSION AND RECOMMENDATIONS

Alfalfa is the most essential nutritive forage for livestock feed. It can be harvested up to eight cycles per year under Debre Zeit environmental condition. The current result indicated that, yield was low as compared with other researches and documents.

Moreover, in this study, the effect of cultivars had not significant effect on leaf, stem and total biomass DM yield of selected alfalfa cultivars. Cutting cycles had significant effect on leaf and stem DM yields and herbage total DM yields of selected five alfalfa cultivars. Harvest taken during wetter season; the 8th cutting cycles had higher herbage yields followed by 7th cutting cycle than the other cutting cycles. All cultivars had higher chemical composition compared with the other researches and documents.

Therefore, based on the study results, the following recommendations are forwarded:

These alfalfa cultivars can be maintained productivity up to 8th cutting cycle

Magna 801-FG (F) give prioritize for dissemination to the livestock farming community because it has higher nutritional value than the rest cultivars

For a sustainable alfalfa based feeding system use of irrigation scheme is advisable because it increase the biomass yields.

It needs further research after the 8th cutting cycle to know at which cutting cycle will decrease the yield and quality of cultivars.

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