Nutrient and Botanical Composition of Pasture in Ceylanpınar Agriculture Farm*

Mehmet AVCI[1]✉ Oktay KAPLAN[1] Muğdat YERTÜRK[2] Mustafa ASLAN[3]
[1]Department of Animal Nutrition and Nutritional Diseases, Faculty of Veterinary Medicine, Harran University, Sanliurfa
[2]Department of Animal Sciences, Faculty of Veterinary Medicine, Harran University, Sanliurfa
[3]Department of Biology, Faculty of Arts and Sciences, Harran University, Sanliurfa

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SUMMARY

This study was performed to determine the pasture quality at different vegetation periods (1 April-1 June) in Ceylanpınar Agricultural Farm. Plant length, dry matter yields and nutrient matter [dry matter (DM), crude protein (CP), ether extract (EE), ash, neutral detergent fiber (NDF), acid detergent fiber (ADF), organic matter (OM)] and energy contents were determined at plant samples collected once every two weeks. In this research, organic matter digestibility of pasture (OMD), and digestible organic matter (DOM) and amount of energy obtained per area unit has also been calculated. CP, EE, OMD and energy levels decreased (P<0.05), whereas DM, NDF and ADF levels increased (P < 0.05), in pasture hay because of advancing maturity. The highest level of hay yield in the pasture at third and fourth period of sampling increased DOM and energy yield of pasture to the maximum level at the third period. Dry matter yields, crude protein, OMD, ME and NE_L of pasture in sampling periods of 1st, 2nd, 3rd, 4th and 5th were found as 32.96, 48.62, 66.51, 59.04 and 40.71 kg/decare; 14.88% , 14.08 %, 11.99 %, 9.19 % and 7.18 % ; 67.09 %, 62.24 %, 60.35 %, 58.96 % and 55.95 %; 10.15, 9.42, 9.13, 8.92 and 8.46 MJ/ kg DM; 6.38, 5.88, 5.68, 5.54 and 5.23 MJ/ kg DM, respectively. In conclusion, Ceylanpınar Agricultural Farm Pasture begin to grow old and dry after second period of May because of climate conditions and become insufficiency of nutrients and energy. For this reason, food supplementation is inevitable to grazing animals at the pasture, especially following this period.

***Keywords**: Pasture, botanical composition, nutrient composition, energy content, digestibility, stage of maturity*

Ceylanpınar Tarım İşletmesi merasının besin ve botaniksel kompozisyonu

ÖZET

Bu çalışma, Ceylanpınar Tarım İşletmesi merasının, değişik vejetasyon dönemlerinde (1 Nisan -1 Haziran), kalitesini belirlemek amacıyla yapılmıştır. İki haftada bir toplanan ot örneklerinde bitki boyu, kuru madde verimi, besin madde [kuru madde (KM), ham protein (HP), ham yağ (HY), ham kül (HK), neutral detergent fiber (NDF), acid detergent fiber (ADF) ve organik madde (OM)] ve enerji içerikleri belirlenmiştir. Çalışmada ayrıca, meranın organik madde sindirilebilirliği (OMS) ile birim alandan elde edilen sindirilebilir organik madde (SOM) ve enerji miktarları da hesaplanmıştır. Vejetasyonun ilerlemesine bağlı olarak mera otlarında KM, NDF ve ADF düzeyleri artarken (P< 0.05); HP ve HY düzeyi ile OMS ve enerji düzeyleri azalmıştır (P< 0.05). Meranın kuru ot veriminin, örneklenmenin 3. ve 4. döneminde en üst düzeyde olması, SOM ve enerji verimlerini 3. dönemde maksimum düzeye yükseltmiştir. 1., 2., 3., 4 ve 5. örnekleme dönemlerinde meranın kuru ot verimi sırasıyla 32,96, 48,62, 66,51, 59,04 ve 40,71 kg/dekar; ham protein düzeyi %14.88, %14.08, %11.99, %9.19 ve %7.18; OMS sırasıyla %67.09, %62.24, %60.35, %58.96 ve %55.95; ME değerleri sırasıyla 10.15, 9.42, 9.13, 8.92 ve 8.46 MJ/ kg KM; NE_L değerleri ise aynı sıraya göre 6.38, 5.88, 5.68, 5.54 ve 5.23 MJ/ kg KM olarak belirlenmiştir. Bu çalışmada, Ceylanpınar Tarım İşletmesi merasının, iklim şartlarının da etkisiyle, mayıs ayının ikinci yarısından itibaren hızla kartlaşmaya ve kurumaya başladığı ve dolayısıyla besin maddeleri ve enerji bakımından fakirleştiği; özellikle bu dönemden sonra merada otlayan hayvanlara ek yemleme yapılmasının zorunlu olduğu sonucuna varılmıştır.

***Anahtar Sözcükler:** Mera, botaniksel bileşim, besin madde bileşimi, enerji içeriği, sindirilebilirlik, vejetasyon dönemi*

INTRODUCTION

Sustainable beef production optimizes the use of pasture while reducing the dependence on grain and harvested forage. Cattle, as ruminant herbivores, may be thought of as "solar-powered grass combines," having the ability to convert plant material into high quality beef for human consumption. Raising grain to feed ruminants requires higher fertilizer and pesticide inputs and consequently, is more energy-intensive and possibly more expensive than pasture. Land that is too erodible for annual cropping can be maintained as permanent sod.

Flora, stage of maturity, soil composition, climate, altitude and other managerial factors affect the physical and chemical properties of grassland. Moreover, the determination of the botanical and nutrient compositions of pastures is essential for assessing nutrient intake and the economics of production (16, 4).

Ceylanpınar Agricultural Farm pastures are subjected to very intensive grazing by a number of animals over a limited grazing period (March, April, May and June) due to the short vegetation period. However, animals are fed with diets solely consisting of hay during the winter season. The application of rotational grazing may not be feasible in Ceylanpınar Agricultural Farm because of the physical limitations mentioned. However, a limited number of studies concerning the agronomical characteristics of pastures from a nutritional standpoint in

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Ceylanpınar Agricultural Farm are available.

The objectives of this study were to examine the botanical composition and determine the nutritional value of pasture in Ceylanpınar Agricultural Farm with respect to stages of maturity.

MATERIALS and METHODS

This study was performed in Ceylanpınar Agricultural Farm. Ceylanpınar State Farm lies in the Sanlıurfa province. The mean altitude of these locations ranged from 390 to 470 m, the average temperature and precipitation were 7.1 ºC - 52.8 mm, 6.3 ºC - 88.2 mm, 9.6 ºC - 52.0 mm, 15.9 ºC - 27.6 mm, 23.8 ºC - 16.4 mm in January, February, March, April, May, respectively.

Pasture samples were collected biweekly from seven different locations (Karataş, Güzelyat, Güzelyurt, Gümüşsuyu, Şenkuyu, Mehmet Ağa ve Beyaz kule) during the vegetation period. Samples were collected at each location from 1 April to 1 June, totally five times. Twenty subsamples obtained from 100 cm^2 isolated spaces in close proximity at soil level were harvested and then pooled to represent each sample by location.

To determine their botanical composition, samples were dried at room temperature without disturbing the original structure. Samples obtained at all stages of maturity were analyzed to determine the nutritive value of the pastures. Nutritive value parameters included dry matter (DM), crude protein (CP), ether extract (EE), ash, neutral detergent fiber (NDF), acid detergent fiber (ADF), and organic matter (OM). Samples were dried at 60 °C for 48 h and then ground to pass through a 1 mm screen. Concentrations of DM, CP, EE, ash and OM were determined using the proximate analysis as outlined by AOAC (2), while concentrations of ADF and NDF were determined using the detergent system as described by Georing and Van Soest (26).

Invitro organic matter digestibility (OMD) of pasture samples were analyzed due to Tilley and Terry (23), method modified by Marten and Barnes (15). NRC (19) and equality reported by Ishler et al (8) for determining digestible energy (DE), metabolic energy (ME) and net-energy lactation ($NE_{L)}$ contents were used, respectively. Digestible organic matter (DOM) and amount of energy obtained per area unit has also been calculated.

One-way analysis of variance (ANOVA) was employed to determine the main effects of stage maturity on the nutrient composition of pastures (22).

RESULTS

The botanical compositions of the pastures in the experiments are presented in Table 1. In the study area, steppe vegetation is dominated by Leguminosae, Composıtae, Graminea and Brassıcaceae. The first five families with the highest number of species are Leguminosae 25 (20.8%), Composıtae 24 (20 %), Graminea 24 (20 %), Brassıcaceae 16 (13.3 %), Labıatae 8 (6.6 %).

The mean chemical compositions and energy (DE, ME, NE_L) contents of the pastures are given in Table 2. Stage of maturity affected concentrations of DM, CP, EE, ash, NDF, ADF and OM for pastures in the Ceylanpınar Agricultural Farm (Table 2). DM, NDF, ADF and OM concentration gradually increased by the end of the harvest season. CP, EE, and energy concentration decreased as stage of maturity advanced. DM yield, in-vitro OMD, DOM yields and energy yields of pasture plant harvested at different stages are shown in table 3. Digestible organic matter (DOM), SE, ME and NE_L yields increased until third period and, decreased at following periods.

Table 1a. Botanical composition of pasture in Ceylanpınar Agriculture Farm

Gramineae (20.0 %)	***Leguminosae (20.8 %)***	***Compositae (20.0 %)***
Aegilops speltoides	*Alhagi mannifera*	*Achillea biebersteinii*
Avena barbata	*Astragalus aduncus*	*Achillea wilhelmsii*
Avena eriantha	*Astragalus lonigerus*	*Crepis kotschyana*
Avena sterilis	*Astragalus ancistrocarpu*	*Carlina lanata*
Avena sativa	*Astragalus allepicus*	*Filago vulgaris*
Avena wiestii	*Astragalus oocephalus*	*Filago pyramidata*
Bromus madritensis	*Astragalus vexillaris*	*Centaurea balsamita*
Bromus pumilio	*Astragalus elbistanicus*	*Centurea rigida*
Bromus squarrprosus	*Hippocrepis unisilaquosa*	*Centaurea hyalolepis*
Bromus suquarrosus	*Hymenocarpus circinatus*	*Cousinia stenocephala*
Bromus tectorum	*Lens ervoides*	*Gundelia tornefatti*
Hordeum murinum.	*Lens culinaris*	*Anthemis austriaca*
Hordeum geniculatum	*Lathyrus pseudo-cicera*	*Echinops viscosus*
Hordeum spontaneum	*Lathyrus bleharicarpus*	*Echinops orientalis*
Poa bulbosa	*Onobrychis crista-galli*	*Scorzonera pungens*
Aegilops biuncialis	*Onobrychis kotschyana*	*Hedypnois cretica*
Alopecurus utriculatus	*Onobrichis oxyodonta*	*Crepis foetida*
Phalaris paradoxa	*Trifolium purpureum*	*Carduus pycnocephalus*
Crithopsis delileana	*Trifolium dasyurum*	*Scorzonera papposa*
Vulpia persica	*Trifolium resupinatum*	*Trapagopon buphthalmoides*
Lolium rigidum	*Trifolium sylvaticum*	*Carthamus persicus*

Table 1b. Botanical composition of pasture in Ceylanpınar Agriculture Farm

Rostraria cristata	*Trigonella mesopotamica*	*Scorzonera kotschyi*
Sorgum halepense	*Medicago orbicularis*	*Rhagadiolus angulosus*
Criphopsis delileana	*Lotus aegaeus*	*Anthemis austraica*
Brassicaceace (13.0 %)	***Labiatae (6.6 %)***	***Umbelliferaceae (5.0 %)***
Alyssum strictum	*Phlomis kurdica*	*Bubleurum alleppicum*
Alyssum hirsutum	*Phlomis bruguieri*	*Pimpinella corybosa*
Erysimum hirschfeldioides	*Teucrium pruninosum*	*Erygium billardieri*
Matthiola longipetale	*Salvia ceratophylla*	*Daucus guttatus*
Erysimum hirschfeldies	*Salvia palaestine*	*Eryngium glomeratum*
Sisymbrium septulatum	*Salvia branchyantha*	*Scandix stellata*
Sisymbrium altissimum	*Ziziphora capitata*	***Boraginaceae (4.1 %)***
Arabis aucheri	*Teucrium polium*	*Anchusa azure*
Lepidium latifolium	***Caryophyllaceae (5.0 %)***	*Buglossoides tenuiflora*
Chrisocamela velutina	*Arenaria acerosa*	*Onosma allepicum*
Capsella bursa-pastoris	*Ankyropetalum gypsophiloides*	*Alkana hirsutissima*
Iberis acutiloba	*Cerastium dichotomum*	*Heliotropium myosotoites*
Sinapsis alba	*Dianthus zonatus*	***Geranıaceae (1.6 %)***
Sinapsis arvensis	*Dianthus strichus*	*Erodium cicutarium*
Clypeola jonthlaspi	*Gypsophila pilosa*	*Geranium rotundifolium*
Sterigmostemum sulphureum	***Linaceae (0.8 %)***	***Papaveraceae (1.6 %)***
Hypericaceae (0.8 %)	*Linum mucronatum*	*Papaver rhoes*
Hypericum capitatum		*Papaver hybridum*

Table 2. Nutrient composition (%) and energy content (MJ/kg KM) of pastures in Ceylanpınar Agriculture Farm.

	I	II	III	IV	V
DM	27.92±0.52^{e}	38.27±0.58^{d}	54.67±0.93^{c}	71.43±0.70^{b}	88.27±0.36^{a}
Ash	10.16±0.18^{a}	10.30±0.18^{a}	10.14±0.14^{a}	9.81±0.18^{ab}	9.40±0.15^{b}
OM	89.84±0.18^{b}	89.69±0.18^{b}	89.86±0.14^{b}	90.19±0.18^{a}	90.60±0.15^{a}
CP	14.88±0.24^{a}	14.08±0.24^{b}	11.99±0.15^{c}	9.19±0.21^{d}	7.18±0.09^{e}
EE	5.42±0.10^{a}	4.54±0.12^{b}	3.50±0.05^{c}	2.26±0.07^{d}	2.29±0.05^{d}
NDF	58.80±0.63^{d}	60.30±0.52^{d}	62.35±0.53^{c}	67.50±0.37^{b}	70.52±0.44^{a}
ADF	25.19±0.37^{d}	25.97±0.29^{cd}	27.66±0.23^{c}	39.35±0.90^{b}	44.73±0.52^{a}
DE	12.38±0.63^{a}	11.48±1.08^{b}	11.13±0.71^{bc}	10.88±1.05^{bc}	10.32±1.07^{c}
ME	10.15±0.52^{a}	9.42±0.89^{b}	9.13±0.59^{bc}	8.92±0.86^{bc}	8.46±0.88^{c}
NE_L	6.38±0.35^{a}	5.88±0.60^{b}	5.68±0.40^{bc}	5.54±0.58^{bc}	5.23±0.59^{c}

a,b,c,d,e: means in the same parameter with different letters are significantly different (P<0.05).

Table 3. Dry matter yield, organic matter digestibility, DOM and energy yields of pastures in Ceylanpınar Agriculture Farm.

	I	II	III	IV	V
Plant length, cm	9.04±0.26^{d}	14.39±0.51^{c}	21.21±0.64^{a}	20.30±0.36^{a}	17.36±0.35^{b}
DM yield, kg/da	32.96±1.85^{c}	48.62±2.24^{b}	66.51±2.35^{a}	59.04±2.31^{a}	40.71±1.04^{c}
OMD, %	67.09±3.42^{a}	62.24±5.87^{b}	60.35±3.87^{bc}	58.96±5.68^{bc}	55.95±5.79^{c}
DOM yield, kg/da	20.52±0.61^{d}	32.62±0.53^{b}	41.14±0.81^{a}	34.81±1.06^{b}	22.78±0.75^{c}
DE yield, MJ/da	378±11.28^{d}	602±9.69^{b}	740±15.02^{a}	642±19.55^{b}	420±13,75^{c}
ME yield, MJ/da	310±9.25^{d}	493±7.95^{b}	607±12.32^{a}	527±16.03^{b}	344±11.27^{c}
NE_L yield, MJ/da	194±6.27^{d}	310±5.39^{b}	378±8.34^{a}	327±10.86^{b}	213±10.57^{c}

a,b,c,d: means in the same parameter with different letters are significantly different (P<0.05).

DISCUSSION

Plant senescence plays an important role in determining forage availability. Samples for examining botanical composition of pastures were harvested only at the final stage of the vegetation because the Gramineae bloom was earlier than the Leguminoseae in a mixed flora setting (14).

In the study area, steppe vegetation is dominated by Leguminosae, Composıtae, Graminea and Brassıcaceae. The highest number of species were Leguminosae 25 (20.8%), Composıtae 24 (20 %), Graminea 24 (20 %), Brassıcaceae 16 (13.3 %), Labıatae 8 (6.6 %). In an earlier study conducted in a larger district area, the proportions of the Gramineae and Leguminosae were found as 54 % and 30 %, respectively (12). This imbalance in the proportion of Gramineae and Leguminosae may adversely affect nitrogen fixation in the soil and, consequently, may reduce soil fertility and the nutritive value of pastures (7).

DM increased by stage of maturity (Table 3). The average DM concentrations were found as 27.92 %-88.27 % for the district (Table 2), which is consistent with the results of other studies (3, 17). At the third harvest and thereafter, the elevation of DM concentration may be due to plant maturation and cell wall lignification (16, 6).

The average ash concentration was found as 10.16 % and 9.40 %. Ash concentration decreased gradually by stage of maturity. These results were in agreement with the results of other surveys (3, 13). The lack of a stage of maturity effect on ash concentration could be related to the lack of change in OM concentration by stage of maturity since OM concentration is inversely related to ash concentration.

CP concentration decreased from 14.88 % to 7.18 % during the experimental period (Table 3). In fact, tropical grasses are notoriously low in protein (20). Other reports (16, 18, 1) also support that the concentration of CP decreases by advancing stage of maturity suggesting that animals should be supplemented with protein sources, especially towards the end of the grazing season. The younger forage contains a lot of crude protein and also has high digestibility, all of which means good animal performance. The quality of pasture forage, for grazing or hay production, is affected by several factors, such as maturity, soil fertility, temperature and moisture. It may also be mentioned that Oslen (20) found that pasture in Uganda did not give a high yield response in crude protein similar to grasses grown in the humid tropics, the reason-presumably being lack of rain in some periods (27).

ADF and NDF increased by advancing stage of maturity (24). The ADF and NDF content of pasture were lower during the early grazing season than during the late grazing season, reflective of seasonal temperature changes. These findings are consistent with measurements of Kanneganti et al. (9). Content of ADF and NDF investigated in this study were also supported by the other studies (10, 11, 13). In general, the fat in forages decreased with advancing maturity. In this study, however, there was a linear decrease in EE concentration, which is consistent with the literature (25).

There was an increase in the dry matter yields and plant length of the pastures until third harvest then decrease with advancing stages of maturity (Table 3). Dry matter yield obtained in this study were between 32.96-66.51 kg/decare. These findings are lower than results obtained in Kars and Van (11, 10).

Dry matter yield, organic matter digestibility, DOM and energy yields of pastures are shown in table 3. OMD at the periods of 1, 2, 3, 4 and 5 were found as 67.09%, 62.24%, 60.35%, 58.96% and 55.95%.

With regard to these parameters, the highest value was obtained in the first period. But, when OMD and DM yield was considered together the lowest DOM yield was 20.52 kg/da, in the first period. The highest DOM yield was 41.14 kg/da, in the third period. DOM yield decreased due to vegetation progresses following third period. According to 1, 2, 3, 4 and 5 th periods, SE contents of grass samples were 12.38, 11.48, 11.13, 10.88 and 10.32 MJ/kg DM; ME values were 10.15, 9.42, 9.13, 8.92 and 8.46 MJ/kg DM; NE_L values were 6.38, 5.88, 5.68, 5.54 and 5.23 MJ/kg DM, respectively. Energy contents of pasture samples differed due to vegetation period. The highest energy content was at the first, followed by 2, 3, 4, and 5 th periods. The lowest energy content was at the fifth period samples. As shown in table 3, SE, ME and NE_L yields increased until third harvest period and, decreased following this period. The lowest energy yield was obtained at first vegetation period, while the highest was at the third period. This decrease could be explained as consumption of young leaves by animals (14, 18). Especially, hot temperatures and lack of moisture caused slow growth (5). In fact, it has been reported that when daily average temperature is above 86 F, the forage quality of grasses decline (6). Similar results have been reported by Karsli et al (10).

In conclusion, Ceylanpınar Agricultural Farm Pasture begin to grow old and dry after second period of May because of climate conditions and become insufficiency of nutrients and energy. For this reason, food supplementation is inevitable to grazing animals at the pasture, especially following this period.

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