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## Determination of Nutritional Value of Some Legume and Grasses

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**Abstract:** The aim of this study was to determine the nutritional value of legumes and grasses for productivity of livestock. *Vicia sativa*, *Pisum arvense*, *Lathrus sativus*, *Vicia narbonensis*, *Dactylis glomerata*, *Chrysopogon gryllus* and *Festuca ovina* were taken as plant materials from field and rangeland Koseilyas village Tekirdag, Turkey. The results of present examination showed large differences in nutritive value between grass and legumes. The nutritional value and digestibility of forages is related to stages of maturity at harvest, such as vegetative, heading and flowering. It was determined that grasses had lower concentration of CP but higher CF, DM, NDF and ADF concentration than legumes. The highest protein content was determined as 16.35% for *Lathrus sativus*. *Chrysopogon gryllus* had the lowest content of protein (3.85%), but higher CF (39.17%), NDF(77.04%) and ADF(45.27%) values than other species. CF is negatively correlated to CP ( $r=-0.833$ ) and positively correlated to ADF ( $r=0.972$ ) and NDF ( $r=0.912$ ). DM is positively correlated to CF ( $r=0.609$ ), ADF ( $r=0.972$ ), NDF ( $r=0.912$ ) and negatively correlated to CP ( $r=-0.552$ ). There are negative correlations between CP and ADF ( $r=-0.811$ ) and NDF( $r=-0.888$ ) and positive correlated to ash ( $r=0.542$ ). There are negative correlations between ash and NDF ( $r=-0.325$ ), ADF ( $r=-0.439$ ) and there are positive correlations between NDF and ADF ( $r=0.823$ ).

**Key words:** Nutritive value, dry matter yield, crude protein, grasses, legumes

### INTRODUCTION

Trakya region is one of the important agricultural centers due to its ecological condition in Turkey. It constitutes 3% of the total size of Turkey, pasture and rangeland constitutes 5.6%. But, production of rangeland isn't sufficient for livestock production<sup>[1]</sup>.

Approximately 95% cattle population of region is exotic western pure breeds or crossbreeds with native breeds. Importance of feed sources has been increased by this situation. Rangeland and forage plants are of significance for animal husbandry as nutrition sources.

In region, sowing areas of forage crops are not sufficient either. Therefore, deficit of the feed is covered by leftover cereals and concentrate feed. Livestock production has been negatively effected by this situation.

Modern animal husbandry has been practiced comparing with other region of Turkey. But, due to inadequate roughage feed production plays an important role for sufficient nutrition intake of livestock. Therefore, animal husbandry have negatively affected. The aim of this study was to determine the nutritional value of legumes and grasses for productivity of livestock.

Perennial grasses are main and important ingredient of rangeland. Possessing high adaptive ability and resistance they are the main component of mixtures for grazing, hay and silage making for ruminant feeding. Exact estimation of their chemical composition and nutritive value is essential for their effective utilization<sup>[2]</sup>.

The nutrition value of range forage is depend on sward floristic composition<sup>[3]</sup>. The utilization of biomass depends on the composition and nutritive value of biomass, which are both variable parameters. The digestibility and intake of the hay varies significantly depending on the grass type and botanical composition<sup>[4]</sup>.

CP, CF and ash contents of *Dactylis glomerata* were obtained as 13.38, 35.0 and 9.7%, respectively<sup>[5]</sup>. CP, DM and ash contents of *Vicia sativa* were determined as 15.4, 13.68 and 12.7%, respectively<sup>[6]</sup>. CP and CF contents of *Festuca ovina* were determined 12.46 and 28.20%<sup>[7]</sup>.

### MATERIALS AND METHODS

The research was conducted in the field and rangeland Koseilyas village Tekirdag, Turkey, during from mid-April to end of May, in 2003.

In the experiment, *Vicia sativa*, *Pisum arvense*, *Lathyrus sativus*, *Vicia narbonensis*, *Dactylis glomerata*, *Chrysopogon gryllus* and *Festuca ovina* were collected as plant materials from the field and rangeland Koseilyas village Tekirdag, Turkey. These forage crops are extremely important for animal husbandry in Trakya region.

Analysis of soil samples taken from the experimental field showed that organic matter content (0.83-1.33%) was low. The annual precipitation of Tekirdag is 617.1 mm and the yearly average temperature is 13.7°C.

Samples were dried at 70°C for 48 h<sup>[8]</sup>. Nitrogen was measured using the Kjeldahl technique<sup>[9]</sup> and Crude Protein (CP) was calculated by the formula: CP: Nx6.25. Acid Detergent Fibre (ADF) and Neutral Detergent Fibre (NDF) were measured using the procedure of Van Soest<sup>[10]</sup>. Dry matter digestibility (DM) was calculated using the formula of Oddy *et al.*<sup>[11]</sup>: DMD: %: 83.58-0.824ADF+2.626 N%. DMD values were used to calculate digestible energy (DE/kcal kg<sup>-1</sup>) using the regression equation of Fomesbeck *et al.*<sup>[12]</sup>: DE (m cal kg<sup>-1</sup>): 0.27+0.0428 (DMD). Crude Fibre (CF) and ash were measured using method of Akyildiz<sup>[13]</sup>. The existence of differences in species chemical composition was determined by TARIST statically package<sup>[14]</sup>.

## RESULTS AND DISCUSSION

There were significant differences between the species in terms of CP, Ash, ADF, NDF. Differences between species were tested by the LSD test (Table 1).

The results of present examination showed large differences in nutritive value between grass and legumes. It was determined that grasses had lower concentration of CP but higher CF, DM, NDF and ADF concentration than legumes (Table 1).

NDF content varied between 40.35-77.04% and ADF content varied 27.69-45.27% (p<0.01).

The highest NDF was 77.04% from *Chrysopogon gryllus* while lowest NDF was 40.35% from *Pisum arvense*. Similar results have been reported by Coleman *et al.*<sup>[15]</sup>.

Besides, ADF content of grasses higher than legumes. Since grasses have hollow stems, they might contain relatively more fibrous tissues in them than other species, the degree of lignin reinforcement of cell walls of grasses may exceed that of other plant species<sup>[3]</sup>. Crowder<sup>[16]</sup> also reported lower contents of ADF and hemicelluloses in legumes than in grasses. ADF and NDF content of *Dactylis glomerata* were obtained 37.69 and 65.31%. Similar data for *Dactylis glomerata* (350.5 and 589.6 g kg<sup>-1</sup>) were reported by Naydenova *et al.*<sup>[17]</sup>.

In this investigation, CP ranged from 3.85 to 16.35%. In present result, crude protein ratio of legume species was obtained higher than grass species. According to

Arzani *et al.*<sup>[3]</sup> CP content of legume species was generally higher than the other species.

The highest CP content was determined as 16.35% for *Lathyrus sativus*. *Chrysopogon gryllus* had the lowest content of CP (3.85%), but higher CF, NDF and ADF values than other species.

It might be CF ratio was higher while CP ratio was lower than that other species due to lower leaves ratio. Todorova *et al.*<sup>[4]</sup> found that CP content of *Chrysopogon gryllus* varied from 9.11 to 15.18%. El-Shatnawi and Mohawesh<sup>[18]</sup>, Ganskopp and Bohnert<sup>[19]</sup>, Arzani *et al.*<sup>[3]</sup> reported that stems have higher fibre content and as a result lower CP and DM. In addition to, a decrease in the leaf /stem ratio and a decline in the nutritive value of the stem component have been shown to be responsible for the decline in forage quality with age<sup>[20]</sup>.

Peas had higher Crude Protein (CP) and DOMD but lower Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) than wheat<sup>[21]</sup>.

Dry matter content carried from 92.67 to 94.58% (p<0.05). Dry Matter (DM) ratio of grass species was higher than legume species. *Dactylis glomerata* had the highest content of DM (94.58%) while lowest content was obtained as 92.67% from *Vicia narbonensis*.

Ash content varied from 4.17 to 7.83%. The highest ash content was obtained from *Lathyrus sativus* and lowest for *Chrysopogon gryllus*. Ash content of *Festuca ovina* and *Vicia sativa* were 6.40 and 6.75%. Turhan *et al.*<sup>[7]</sup> pointed out that ash content of *Festuca ovina* was averages 16.22%. Tan and Celen<sup>[8]</sup>, found that ash content of *Vicia sativa* was 11.07%. The results on *Vicia sativa* and *Festuca ovina* value were lower than Tan and Celen<sup>[8]</sup>, Turhan *et al.*<sup>[7]</sup>. Because, the chemical composition and digestibility of forages is often related to stages of maturity at harvest, such as vegetative, heading and flowering<sup>[22]</sup>.

Crude fibre ranged from 22.62 to 39.17% (Table 1). The highest CF was determined for *Chrysopogon gryllus* as 39.17%. The lowest CF was obtained for *Vicia narbonensis* as 22.62%. Crude fibre of grasses were highest than legumes. Kilic *et al.*<sup>[23]</sup> suggested that CF content required over 20% of DM for successful feeding.

According to these results, CF is negatively correlated to CP (r=-0.833) and positively correlated to ADF (r=0.972), to NDF (r=0.912). DM is positively correlated to CF (r=0.609), to ADF (r=0.533), to NDF (r=0.704) and negatively correlated to CP (r=-0.552) (Table 2).

There are negative correlations between CP and ADF (r=-0.811) and NDF(r=-0.888) and positive correlated to Ash (r=0.542).

According to, El-Shatnawi and Mohawesh<sup>[18]</sup>, Ganskopp and Bohnert<sup>[19]</sup>, there are negative correlations

Table 1: Chemical composition of some legume and grasses

	Family	NDF%	ADF%	CP%	DM%	Ash%	CF%
<i>Vicia sativa</i>	Leguminosae	44.38d	27.69g	14.25b	93.86a-c	6.75c	22.63e
<i>Pisum arvense</i>	Leguminosae	40.35e	34.69de	10.81d	93.16cd	6.37d	27.03d
<i>Lathyrus sativus</i>	Leguminosae	40.76e	34.06e	16.35a	93.04cd	7.83a	27.68d
<i>Vicia narbonensis</i>	Leguminosae	42.41de	29.63f	11.73c	92.67d	5.74e	22.62e
<i>Dactylis glomerata</i>	Gramineae	65.31c	37.69c	7.63e	94.58a	7.44b	32.66c
<i>Festuca ovina</i>	Gramineae	71.28b	39.39b	7.80e	94.14ab	6.40d	34.46b
<i>Chrysopogon gryllus</i>	Gramineae	77.04a	45.27a	3.85f	94.24ab	4.17f	39.17a
LSD		2.328**	1.203**	0.627**	0.949*	0.196**	1.087**

Means with the same letter(s) are not significantly different at the same 0.05 significance level, \*p<0.05, \*\* p<0.01

Table 2: Correlation between nutritional value of plant species

	DM	CP	Ash	NDF	ADF
CF	0.609*	-0.833**	-0.190	0.912**	0.972**
DM	-	-0.552*	-0.102	0.704**	0.533*
CP		-	0.542*	-0.888**	-0.811**
Ash			-	-0.325	-0.439
NDF				-	0.823**

\* 0.05, \*\*0.01

between CP and ADF and positive relationships between CP and DM. In contrast, there are negative correlations between CP and DM<sup>[24]</sup>. Consequently, changes in the concentration of crude protein and crude fibre were correlated with species composition of the vegetation.

There are negative correlations between ash and NDF (r=-0.325), to ADF (r=-0.439) and there are positive correlations NDF and ADF (r=0.823).

According to Bruno-Soares *et al.*<sup>[25]</sup>, the strongest relationship was found between the extent of DM and NDF degradations (r=0.942) and the degradation curves of DM and NDF fractions showed a parallelism, which is similar to that observed by Varga and Hoover<sup>[26]</sup>, Flachowsky *et al.*<sup>[27]</sup> for different feeds.

Altinok *et al.*<sup>[28]</sup> reported, there were significant differences between on dry matter and protein content of annual Medic and *M. scutellata* and *M. polymorpha* dry matter yields tended to increase while crude protein concentrations tended to decrease at later cutting stages.

Forage plant species that are commonly preferred by grazing animals. Successful grazing management must consider the type of livestock and their nutritive needs. Sufficient and high quality livestock production can be provided by the increased range productivity in the countries where animal largely depends on grazing ranges. Thus, the range improvement programs may be successful if vegetation structure of rangelands are known. *Vicia sativa*, *Pisum arvense*, *Lathyrus sativus*, *Vicia narbonensis*, *Dactylis glomerata*, *Chrysopogon gryllus* and *Festuca ovina* are natural species on rangeland in Trakya. For example, farmers of the region believe that livestock can not show a fine development during the grazing season if it doesn't eat sufficiently *Chrysopogon gryllus*. The frequency of the range production will increase if the fodder crops such as *Vicia sativa*, *Pisum arvense*, *Lathyrus sativus*,

*Vicia narbonensis*, *Dactylis glomerata*, *Chrysopogon gryllus* and *Festuca ovina*. Consequently, grazing livestock will be more healthy and productive.

The results of present examination showed large differences in nutritive value between grass and legumes. The nutritional value and digestibility of forages is related to stages of maturity at harvest, such as vegetative, heading and flowering. It was determined that grasses had lower concentration of CP but higher CF, DM, NDF and ADF concentration than legumes.

The highest protein content was determined as 16.35% for *Lathyrus sativus*. *Chrysopogon gryllus* had the lowest content of protein (3.85%), but higher CF(39.17%), NDF(77.04%) and ADF(45.27%) values than other species.

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