PREDICTORS OF ALFALFA FORAGE QUALITY

C. Găvan[1*], C. Bora[1], V. Motorga[1]

[1]Agricultural Research Development Station Şimnic Craiova, Romania

Abstract

The aim of this study was to use acid detergent fibre (ADF) and neutral detergent fibre (NDF) content, height and maturity stage of pre cut alfalfa as predictors of forage quality. Stands of pure first pre cut alfalfa, were sampled from various field experiments during May and June 2011 and 2012 at Agricultural Research and Development Station Simnic Craiova Romania. The samplings and measurements were repeatedly realized from the late vegetative to full flower stage in a 30x30 cm square. The alfalfa maturity stages were used to assign a numerical value to the most mature stem in the sample area. All samples were oven-dried at 60ºC, homogenised to a particle size of 1 mm and analysed for dry matter (DM), ADF and NDF content. Digestible DM calculated from percent ADF, is on estimate of the digestibility of the feed. Dry matter intake, calculated from percent NDF is on estimate of the amount of feed on animal will consume in percent of body weight. Relative feed value (RFV) reflects both digestibility (from % ADF) and intake potential (from % NDF) of alfalfa forage. The plant height and maturity provides a close estimate of RFV in the field. By determining the RFV of standing alfalfa, producers can more accurately when to make first spring cut of alfalfa. Adapting of predictors method by growers can be facilitated by the development of simple tables.

Key words: alfalfa, acid detergent fibre, neutral detergent fibre, relative feed value

INTRODUCTION

Alfalfa forage is an important component of dairy rations. The key management strategy in producing high quality alfalfa forage is knowing the optimum harvest date.

When to begin cutting is always a difficult desicion.

A common approach to determining the optimum harvest date for quality is by observing the growth stage of the alfalfa plants. There is a direct correlation between the morphological development of the plant and the quality and quantity of alfalfa harvested.

Alfalfa nutrient quality decreases as the plant matures from the vegetative stage to full flower stage. At the same time, the kilograms af plant material harvested per hectar increases as the plant matures. The optimum harvest date is by combining the quality and the tonnage produced.

There is an optimum quality for alfalfa that should be fed to dairy cows.

For forage that serves as the primary fibre source in the diet, NDF is the principal forage quality variable of concern [1].

Neutral Detergent Fibre is the step of the Van Soest Method of determining forage quality and indicates the amount of fibre in a feedstuff. NDF is defined as the remnants of a feedstuff that is retained ofer dissolving in a neutral detergent; consisting of cellulose, hemicellulose and lignin. Celluloze and hemicellulose are wall carbohydrates and are avilable for degradation by rymen microbes, which in turn produce volatile fatty acids. Lignin is antinutritive phenolic compound that is indigestible by rumen microbes.

The ideal NDF level in alfalfa hay for dairy cows is 40 % (of dry matter). NDF levels below 40% are to low and the hay ahve high rates of passage through the rumen; resulting in ineficient dry matter conversion. NDF levels greater than 40 % begin to slow rate of passage down, creating a gut-fill effect. Higher gut-fill results in lower dry matter intake; and dry matter intake drives milk production.

It is imperative that producers must be able to accurately estimate in field NDF

*Corresponding author: scdasimnic@yahoo.com
The manuscript was received: 14.02.2013
Accepted for publication: 11.05.2013

levels of alfalfa in order to properly time first cutting and to produce top quality dairy hay. For this reason researchers have developed equations designed to estimate in field alfalfa NDF level [3].

Relative feed value is an index that ranks cool season legumes (alfalfa) and grasses by potential digestible dry matter intake. It is caculated from digestible dry matter and dry matter intake (DMI).

Digestible dry matter is an estimate of the total digestibility of the feed and is calulated from precent acid detergent fiber (ADF).

Dry matter inatke is an estimate of the amount of eed an animal will consume in percent of body weight and is calculated from percent neutral detergent fiber (NDF).

The index ranks forages relative to the digestible DMI of full bloom alfalfa, assuming 41 % ADF and 53 % NDF. The RFV index is 100 at this growth stage.

The goal this study was to use ADF and NDF content, hight and maturity stage of pre cut alfalfa as predictors of forage quality and to test some equations methods for their accuracy and suitability for alfalfa in the first cut period in Şimnic area.

MATERIAL AND METHOD

In spring 2010 the alfalfa experiment was estalished at Agricultural Research and Development Station (ARDS) Şimnic-craiova, Oltenia (182 m above sea level, 4º19` N, 23º48 E). The long-term annual temperature is 10,5ºC-11,5ºC and precipitation 400-600 mm. In 2011 and 2012 the measurements and sampling were repeatedly realized from the late vegetative to the early bloom stage in a 30 x 30 cm square of alfalfa pre cut stand.

Alfalfa developmental stage used to assign the numerical value to the most mature stems in the sampling area, codes of stages and description area presented in table 1.

The stem length was measured in cm, starting from 5,0 cm above the soil surface to the terminal point of the stem.

All samples were oven - dried at 60ºC, homogenised to a particle size of 1 mm and analysed for dry matter (DM), neutral detergent fibre (NDF) and acid detergent fibre (ADF) content.

Table 1 Alfalfa develomental stage [2]

Develomental stage	Codes	Description
Late vegetative	2	Stems length > 30 cm; no buds
Early Bud	3	1-2 nodes with buds; no flowers
Late Bud	4	3 or more nodes wit buds; no flowers
Early Bloom	5	One node with open flower; noseed pods

The NDF and ADF contents were determined acording to [4] using Fibretherm FT 12 (Gerhardt GmbN) System.

Estimation model for alfalfa NDF:

NDF (G/kg)=116+(3,53 x maximum plant hight cm) - 3,76 x stubble height (cm)

Calculation of Relative Feed Value:

Digestible dry matter (DDM) = 88,9-(0,779 x % ADF);

equation 2.

Dry matter intake (DMI)= 120/%NDF

Relative Feed Value (RFV) =DDM x DMI/1,29

Estimation of Digestible Dry Matter (DDM):

DDM=88,9-(0,779 x % NDF-3,41) [Robinson];

Using estimates of DDM, also RFV was estimated.

Values presented are means and standard errors.

RESULTS AND DISCUSSIONS

The means and standard errors of measured parameters are shown in table 2. The stem length, ADF and NDF content increased from late vegetative stage to early bloom stage. The optimum NDF content of alfalfa forage, 40.13 % of DM was in stage 5 in 2011, and in 2012 in stage 4 (40.56 % of DM).

Cool and wet conditions caw delay the flower to open while NDF continues to increase (table 3).

Table 2 Maximum stem length, ADF and NDF contents of alfalfa stand

Year	Maturity stage	Maximum stem lenght (cm)	ADF%		NDF %	
			Mean	SE ±	Mean	SE ±
2011	2	58	25.50	1.03	30.03	0.79
	3	72	28.71	1.03	34.52	1.26
	4	80	33.38	1.14	37.53	1.54
	5	87	34.70	1.85	40.13	0.73
2012	2	60	26.10	0.75	30.13	0.73
	3	76	30.80	1.47	36.24	0.82
	4	87	35.32	1.17	40.56	1.56
	5	90	35.93	0.76	41.13	0.91

Table 3 Diferences between NDF, DDM and RFV calculated and estimated values

Year	Maturity stage	NDF %			DDM %			MI % of body weight	RFV		
		Calc.	Estim.	Dif. %	Calc.	Estim.	Dif.		Calc.	Estim.	Dif.
2011	2	30.03	30.19	0.16	69.04	68.17	-0.87	3.99	213	210	-3
	3	34.52	35.13	0.61	66.54	64.67	-1.87	3.47	179	174	-5
	4	37.53	37.96	0.43	62.90	62.32	-0.58	3.19	155	154	-1
	5	40.13	40.43	0.30	61.87	60.30	-1.57	2.99	143	139	-4
2012	2	30.13	30.90	0.87	68.57	68.09	-0.48	3.98	211	210	-1
	3	36.24	36.55	0.31	64.91	63.33	-1.57	3.31	166	162	-4
	4	40.56	40.43	-0.13	61.39	59.97	-1.42	2.95	140	137	-3
	5	41.13	41.49	0,37	60.91	59.52	-1.39	2.91	137	134	-3

The comparasion between NDF content, DDM and RFV from laboratory analysis versus predictive equations are presented in table 3. The NDF from predictive equation was higher than laboratory analisis, but with small differences, except in stage 4, of vegetative development in 2012 where was lower. The DDM from predictive equation was lower than calculated values, using laboratory analysis of ADF. The differences are small and tend to decrease in stage 4 or 5 of vegetative development in 2012 (table 3).

The RFV from predictive equation also was lower than RFV calculated using laboratory analysis of ADF and NDF.

The idea for RFV estimates was to use the correlation between ADF and NDF content (% ADF = %NDF -3,41) and to make only one laboratory alanyse.

Based on the most mature stem and lenght of the longest stem and using accompanying chart to detremine estimated NDF and RFV of the stabding alfalfa forage predictive equations can be a good tool in making cutting decicions.

CONCLUSIONS

The equation for alfalfa quality seems to be a promising method for the alfalfa foarge quality production under the conditions in Şimnic area.

To developement a functional method, experiments on many sites are needed with validation of this model.

Validation of equation model must be tested by regressing actual laboratory measurements on the estimated values from the predictive equations.

The predictive equation of alfalfa quality is not perfect, but it is likley more occurate yhan using calendar date or bud flower stage alone.

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