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	# FORAGE PRICING METHODS	
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FORAGE PRICING METHODS

Gayle S. Willett, William P. Ford, and Neil M. Lanning*

INTRODUCTION

Forage has economic value because it can generate income from milk, meat, and wool production. Higher quality forages are more efficient than lower quality forages, since less tonnage is needed to produce a given quantity of animal product. If the market is working effectively, buyers will bid up the price of higher quality forage until the added profits from its use are offset by a higher forage price. Thus, growers of higher quality forage should expect to receive a price premium.

This publication outlines certain principles and procedures forage sellers and buyers can use to identify the relationship between forage value and forage quality and/or moisture content. Procedures will be presented for: (1) adjusting the price of forage to reflect different quality and moisture levels; and (2) calculating the price of green silage that is equal to a base hay price by adjusting for differences in storage shrinkage and moisture.

While there are several methods for adjusting forage prices, the price ultimately will have to fall within the bounds of the local forage market--a matter of both supply and demand. While we want to specifically point out ways in which forage prices can be adjusted for quality and moisture differences (both demand factors), it should be noted that cost of production (a supply consideration) will weigh heavily in the forage grower's pricing decision.

The forage grower is concerned about getting a price that will cover the production costs. If these costs can't be covered and a profit realized, less forage will be produced. This, in turn, will drive forage prices up. Thus, while supply and demand factors may dictate that the forage grower will have to temporarily accept a price below cost of production, cost can be expected to serve as the seller's point of departure in price negotiations.

The basis for equitable pricing is testing for forage quality. For a test to be useful to growers and buyers in marketing and ration formulation, it must be accurate, repeatable, understandable, and relatively inexpensive.

* The authors are Extension Economist, Area Extension Agent, and Area Dairy Extension Agent, respectively.

PRICING ALFALFA HAY WITH THE TRI-STATE METHOD

In an attempt to standardize methods of testing and reporting, representatives of the Oregon, Idaho, and Washington Hay Grower's Associations are jointly supporting a tri-state reference alfalfa hay test (Exhibit I). This test determines percent moisture and dry matter, crude protein (CP), and acid detergent fiber (ADF),[1] from which comparative hay values are calculated.

These values are:

1. Quality factor (QF): The estimated feeding value of the hay as compared to the reference.

   QF = 0.9199 + 0.0136(CP) - 0.0054(ADF)

2. Reference factor (RF): The estimated feeding value compared to the reference and adjusted for percent moisture.

   RF = (QF)(% dry matter) 0.0114

3. Total digestible nutrients (TON):

   TON = 54.3208 + 0.7387(CP) - 0.2915(AOF)

Several commercial and university forage testing laboratories participate in a standardized method of testing, coordinated by the Tri-State Alfalfa Coalition. Your county extension agent can help you locate a cooperating laboratory.

Selection of the reference (a quality hay to which all alfalfa hay would be compared) was based on two criteria:

1. The hay would represent an achievable quality goal.

2. The hay would support a high level of production when fed as the major roughage in a dairy ration.

The reference selected is (on a 100% dry matter basis):

- 18.5% crude protein

- 32.0% acid detergent fiber

- 58.7% total digestible nutrients

[1] Acid detergent fiber is mainly cellulose, lignin, and silica. These components are low in digestibility. Thus, as a rule, as ADF values increase, energy values decrease.

Oregon State University

EXHIBIT I

FORAGE ANALYTICAL SERVICE

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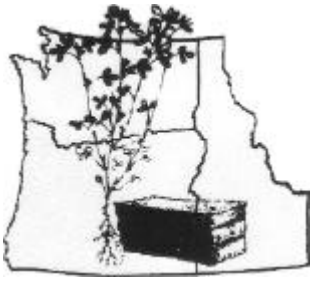

TRI-STATE ALFALFA COALITION

TRI-STATE REFERENCE ALFALFA HAY TEST:

- Sample No. _____
- Sampling Date _____
- Sampled by _____
- Cutting No. _____
- County _____

RESULTS SENT TO:

Name _____
Address _____
_____
Telephone No. _____

LABORATORY APPRAISAL

Date Received _____ Laboratory No._____
Percent Dry Matter _____ Percent Moisture _____

	SAMPLE	TRI-STATE REFERENCE
CHEMICAL ANALYSES:	100% Dry Matter Basis	100% Dry Matter Basis
Crude Protein (CP)	_____	18.5%
Acid Detergent Fiber (ADF)	_____	32.0%
ESTIMATED VALUES:		
Quality Factor[1]	_____	1.00
Reference Factor[2]	_____	1.00
TDN[3]	_____	58.7%

VISUAL APPRAISAL

(Provided by sampler)

- **COLOR** (Bright-green, light green, Yellow-green, brown)
- _____ % **GRASS**
- _____ % **WEEDS**
- **DAMAGE** (Rain, mold, frozen, dirt)
- **AMOUNT** (Tons, bales, loaves)
- **LEAF HOLD** (Attached to stems, whole leaves, Not attached, crumbled leaves.)
- **PROCESSING** (wire, twine, round, loaves chopped, cubed, pelleted, green chop, haylage)
- **IRRIGATION METHOD** (Flood, sprinkled, dry land)
- **STORAGE** (Covered, open)
- **SAMPLING METHOD** (Probe, broken bales, chopped pile, window, field clip.)

[1]**Quality Factor**: The estimated feeding value of the Hay as compared to the reference.
QF=0.9199+0.0136 (CP)-0.0054 (ADF)

[2]**Reference Factor**: The estimated feeding value compared To the reference and adjusted for percent moisture.
RF=(QF)(DM)0.0114

[3]**TDN:** Total digestible nutrients estimated from CP and ADF and adjusted for 3X maintenance.
TDN=54.3208+0.7387 (CP) – 0.2915 (ADF)

Samples sent to cooperating laboratories can be compared to the tri-state reference, using the quality factor (QF). Thus, hay higher in CP and lower in ADF than the reference will be rated as greater than 1.0, while hay lower in CP and higher in ADF will be given a quality factor less than 1.0. Dry matter percentage is used to calculate a reference factor (RF), to assure that hay buyers are not paying extra for water and to compensate growers for hay that is less than 12% moisture.

Worksheet I is designed to help alfalfa hay growers and buyers use the Tri-State Method to adjust the price of the hay to reflect differences in quality and moisture. The following example illustrates how to use laboratory test results and the worksheet.

Example 1

A hay grower and a dairy farmer want to determine a fair price for alfalfa hay that tested 23.05% CP, 29.4% ADF, and 10.55% moisture. The current market price for hay equal in quality to the tri-state reference hay is $90 per ton. How much is the hay worth?

Since the hay in question is considerably higher in CP, lower in ADF, and lower in moisture than the reference hay, a higher price is justified. Completion of Worksheet I indicates that an adjustment for protein and fiber differences raises the price to $96.70 per ton (line 9). An additional adjustment for less moisture increases the price to $98.60 per ton (line 12).

ADJUSTING FORAGE PRICE FOR PROTEIN AND MOISTURE DIFFERENCES

The Tri-State Method is appropriate for alfalfa hay and when hay testing has been done by a cooperating laboratory. However, for other forages, and for alfalfa hay that has not been tested by the standardized Tri-State Method or when the current market price for the tri-state reference hay is not known, a different pricing procedure is necessary. The following formula may be used where the Tri-State method is not appropriate:

$$\text{Adjusted Price per ton} = \text{Price per ton of reference forage} \times \frac{\text{\% dry matter of forage you want to price}}{\text{\% dry matter of forage reference}} \times \frac{\text{\% crude protein of forage you want to price}}{\text{\% crude protein of reference forage}}$$

The formula assures a price premium for forages higher in CP and in dry matter. Worksheet II is based on this formula and its use is

WORKSHEET I

Alfalfa Hay Price Adjusted for Quality and Moisture Differences
Using the Tri-State Method

(Example 1)

1.	Enter current market price per ton for reference hay	$ **90.00**
2.	Enter percent crude protein for hay you want to price	**23.05**
3.	Enter percent acid detergent fiber for hay you want to price	**29.40**
4.	Enter percent dry matter for hay you want to price	**89.45**
5.	Crude protein adjustment: multiply line 2 times .0136	**.3133**
6.	Acid detergent fiber adjustment: multiply line 3 times .0054	**.1588**
7.	Subtract line 6 from line 5	**.1545**
8.	QUALITY FACTOR: Line 7 plus .9199	**1.0744**
9.	HAY PRICE ADJUSTED FOR PROTEIN AND FIBER: Line 8 times line 1	$ **96.70**
10.	Multiply line 8 times line 4	**96.1051**
11.	REFERENCE FACTOR: Line 10 times .0114	**1.0956**
12.	HAY PRICE ADJUSTED FOR PROTEIN, FIBER, AND MOISTURE: Line 11 times line 1	$ **98.60**

illustrated by the examples below. Crude protein for the forage to be priced and for the reference forage should be expressed on the same moisture basis.

Example 2

A hay grower and buyer want to determine a price for grass/legume hay that tests 87% dry matter and 17% CP. They have agreed that a reference hay (hay typically grown in the area) will test 88% dry matter and 16% CP. The reference hay is currently selling for $80 per ton.

Completion of Worksheet II using the above information results in a hay price of $84.03 (line 9). Even though the hay had a lower dry matter content than the reference hay, the higher protein test resulted in a $4.03 premium.

Example 3

A dairy farmer would like to buy green chop from a neighboring grower. The dairy farmer will harvest the green chop. Moisture content of the green chop at the time of harvest and feeding is estimated to be 80% and crude protein is 16% (dry matter basis). Alfalfa hay with 18% crude protein is currently selling for $115 per ton (88% dry matter), delivered to the farm. The current custom cost for swathing, baling, and stacking hay is $25 per ton. How much is the green chop worth per ton?

To answer this question, it is first necessary to subtract hay harvesting costs from the current hay price. This must be done to account for the fact that the dairyman will be harvesting the green chop. The standing green chop equivalent of the baled hay price is $90 per ton ($115 - $25 harvesting cost) unadjusted for moisture and protein differences. An adjustment for protein and moisture can be made by completing the worksheet using a hay price of $90. The worksheet analysis indicates that the green chop is worth about $18 per ton.

VALUE OF GREEN SILAGE BASED ON HAY PRICE

Often the forage buyer and/or seller will want to base silage prices on a hay price. This requires only a moisture adjustment, assuming that forage quality is similar. Two adjustments are needed for silage that has just been harvested and placed in storage. The first adjustment should account for shrinkage during the storage period and the second should adjust for moisture differences between hay and green silage. The formula for making these two adjustments is:

Value per ton of green silage	=	Hay cost per lb. dry matter	×	1-% shrinkage of silage during storage	×	% dry matter of green silage	×2,000

Worksheet III is based on the above formula. To illustrate its use, consider the following example:

WORKSHEET II

FORAGE PRICE ADJUSTED FOR MOISTURE AND CRUDE PROTEIN

(Example 2)

1.	Enter current market price per ton for reference forage	$ **80.00**
2.	Enter typical percent dry matter of reference forage	**88**
3.	Enter typical percent crude protein of reference forage	**16**
4.	Enter percent dry matter of forage you want to price	**87**
5.	Enter percent crude protein of forage you want to price	**17**
6.	Divide line 4 by line 2	**.9886**
7.	Divide line 5 by line 3	**1.0625**
8.	Multiply line 7 times line 6	**1.0504**
9.	ADJUSTED FORAGE PRICE: Line 8 times line 1	$ **84.03**

WORKSHEET II

FORAGE PRICE ADJUSTED FOR MOISTURE AND CRUDE PROTEIN

(Example 3)

1.	Enter current market price per ton for reference forage	$ **90.00**
2.	Enter typical percent dry matter of reference forage	**88**
3.	Enter typical percent crude protein of reference forage	**18**
4.	Enter percent dry matter of forage you want to price	**20**
5.	Enter percent crude protein of forage you want to price	**16**
6.	Divide line 4 by line 2	**.2273**
7.	Divide line 5 by line 3	**.8889**
8.	Multiply line 7 times line 6	**.2020**
9.	ADJUSTED FORAGE PRICE: Line 8 times line 1	$ **18.18**

Example 4

A dairy farmer would like to buy silage from a nearby grower and both have agreed to price the silage on the basis of alfalfa hay. The dairy farmer can buy alfalfa hay delivered at the farm for $115 per ton (88% dry matter). The silage grower will deliver the silage to the dairyman's bunk silo. It is expected that the silage will shrink by 20% during the storage period and will have about 25% dry matter upon delivery. What price should the silage receive?

As indicated on line 10 of Worksheet III, the silage would be worth $26.12 per ton upon delivery to storage.

WORKSHEET III

Calculation of Green Silage Price Based on Hay Price
Adjusted Only for Differences in Moisture and Storage Shrinkage

(Example 4)

1.	Enter current market price per ton for hay	$ **115.00**
2.	Enter typical percent dry matter of hay on line 1 (enter as a decimal)	**.88**
3.	Multiply line 2 times 2,000	**1,760**
4.	Divide line 1 by line 3	**.0653**
5.	Enter percent loss in weight between green silage and fed silage (enter as a decimal)	**.20**
6.	Subtract line 5 from 1.00	**.80**
7.	Enter percent dry matter of green silage (enter as a decimal)	**.25**
8.	Multiply line 6 times line 7	**.20**
9.	Multiply line 8 times 2,000	**400**
10.	PRICE PER TON OF GREEN SILAGE: Line 9 times line 4	$ **26.12**

APPENDIX

WORKSHEET I

Alfalfa Hay Price Adjusted for Quality and Moisture Differences Using the Tri-State Method

1. Enter current market price per ton for reference hay .... $ ____
2. Enter percent crude protein for hay you want to price .... _____
3. Enter percent acid detergent fiber for hay you want to price ..... _____
4. Enter percent dry matter for hay you want to price ..... _____
5. Crude protein adjustment: multiply line 2 times .0136 ... _____
6. Acid detergent fiber adjustment: multiply line 3 times .0054 ..... _____
7. Subtract line 6 from line 5 ..... _____
8. QUALITY FACTOR: Line 7 plus .9199 ..... _____
9. HAY PRICE ADJUSTED FOR PROTEIN AND FIBER: Line 8 times line 1 ..... _____
10. Multiply line 8 times line 4 ..... _____
11. REFERENCE FACTOR: Line 10 times .0114 ..... _____
12. HAY PRICE ADJUSTED FOR PROTEIN, FIBER, AND MOISTURE: Line 11 times line 1 ..... $ _____

WORKSHEET II

Forage Price Adjusted for Moisture and Crude Protein

1.	Enter current market price per ton for reference forage	$ _____
2.	Enter typical percent dry matter of reference forage	_____
3.	Enter typical percent crude protein of reference forage	_____
4.	Enter percent dry matter of forage you want to price	_____
5.	Enter percent crude protein of forage you want to price	_____
6.	Divide line 4 by line 2	_____
7.	Divide line 5 by line 3	_____
8.	Multiply line 7 times line 6	_____
9.	ADJUSTED FORAGE PRICE: Line 8 times line 1	$ _____

Use pesticides with care. Apply them only to plants, animals, or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is violation of law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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Published . Subject codes 274, 340.A.

EB1268