

# Valuing Alfalfa for Dairy Cattle from A Nutrient Perspective

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## Abstract

Dairy producers purchase feed to meet protein, energy, and fiber requirements for their cows and alfalfa is a viable feed to contribute to all three nutrient needs. Currently nutrient values for metabolizable protein, net energy for lactation (NEL) and for effective fiber by geographic region are published by Nutritionists William Wiess, Ph.D., Normand St-Pierre, and graduate student Alex Tebbe, From The Ohio State University. Dr. Wiess has also determined a method of correcting the value of forages based on how fiber influences feed intake on the value of milk produced. Dairy alfalfa is currently sold on a Relative Feed Value (RFV) basis which only uses neutral detergent fiber (NDF) and acid detergent fiber (ADF) to determine quality which does not reflect protein content or adequately describe energy in the hay. Nutrient values were calculated using values for nutrients for Northwest United States published on January 1, 2018 to determine the value of alfalfa produced in an alfalfa variety trial for 32 varieties in the Pacific Northwest. This research suggests protein, energy and fiber in fairly equal in value to dairy animals and that leaving value of any one of these three nutrients out would not give an accurate estimation of hay value. Our research from the variety trial conducted at Othello, WA determined that RFV overestimated or underestimated the protein value as much as \$5.30 / Ton or \$42.40 / acre for first cutting. Alfalfa varieties metabolizable protein value ranged from 74.46 to 86.51 \$/ton, NEL value from 63.62 to 71.28 \$/ton, effective fiber value from 84.08 to 72.71 \$/ton and discount for excessive fiber from 40.38 to 6.65 \$/ton for a difference of 12.05, 7.66, 11.37, 33.73 \$/ton in protein value, energy value, fiber value, and milk production value adjustment for fiber, respectively. The estimated total dollar value of alfalfa varieties for hay ranged from 181.79 to 223.85 \$/ton based on variety selected. Using this method instead of RFV would provide better estimates of alfalfa value to the dairy cow in ways that will assist nutritionist, dairy farmers, and researchers and the forage and dairy industry in general.



Figure 2. Washington State University Alfalfa Variety trial yield and quality data for first cutting was used in conjunction with the alfalfa from a nutrient perspective based on the model, method and prices from Dr. Bill Weiss, Nutritionist, Professor, Dr. Normand St-Pierre, Professor, Alex Tebbe, graduate student Department of Animal Sciences, The Ohio State University (2017 Western Alfalfa and Forage Symposium, Proceedings).

## Energy

Nutritionists and Dairymen think in terms of Net Energy of Lactation (abbreviated as NE<sub>L</sub> or NEL) Units of NEL are Mega Calories per Pound (Mcal/lb) refers to a million calories in one pound To calculate NEL the following inputs get into the calculation -Crude Protein along with ADICP, NDICP, NDF, Lignin, Ash, Fat (Ether Extract)

## Fiber

- Fiber to be of value must be effective fiber
- For alfalfa hay approx. 92% of NDF fiber is effective fiber
- Neutral Detergent Fiber Is (NDF)
- Many of newer analysis put aNDF which means ash corrected NDF
- Nutrient value calculations for fiber is reported appear to be more valuable in the West (Tebbe, et al., 2018)

## Alfalfa NDF and Milk

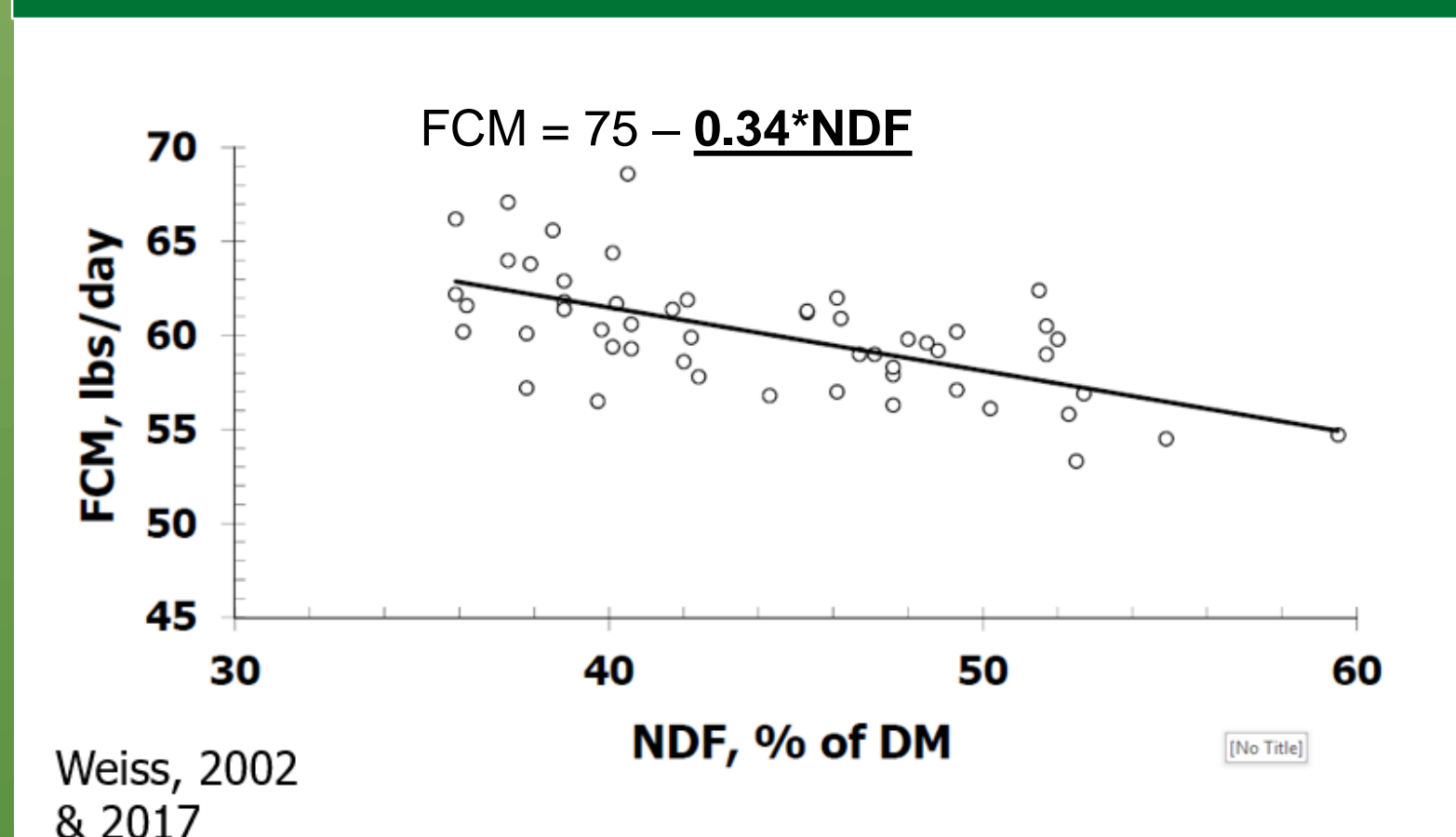


Figure 3. Relationship between neutral detergent fiber (NDF) as a percent of dry matter influence on milk production. Although NDF is necessary for dairy production, NDF has a negative effect on milk production.

## Alfalfa Quality Adjustment - from Weiss

- Captures value of lost or increased in milk yield
- Base 44% NDF = 0 Adjustment

Milk Value	\$ decrease or increase per NDF/ Ton	
	<44% NDF	>44%NDF
\$17/cwt	+\$4.75	-\$4.75
\$22/cwt	+\$7.00	-\$7.00

Table 1. The adjustment for fiber on alfalfa value per ton is influenced by milk price and NDF. As milk price goes up the greater influence positive or negative NDF has on value of alfalfa hay.

## Comparison of Nutrient Prices between Geographic Areas

Source: January 1, 2018 Progressive Dairyman Alex Tebbe, graduate student of Dr. Bill Weiss, Nutritionist, Professor, Department of Animal Sciences, Ohio State University

Item <sup>1</sup>	Southwest	West	Northwest
NE <sub>L</sub> (c/Mcal)	4.2	15.0	7.5
MP (c/lb)	51.5	26.1	43.8
e-NDF (c/lb)	10.3	11.6	9.1
ne-NDF (c/lb)	-3.0	-0.7	-4.7
Nutrient costs (\$/cow per day) <sup>2</sup>	4.91	7.40	5.41
Nutrient costs (¢/lb of feed DM)	10.0	15.1	11.0
Nutrient cost (\$/cwt of milk)	7.01	10.58	7.72

Table 2. The Ohio State University calculates the value of metabolizable protein, energy in mega calories, and fiber per pound based on feedstuffs being sold in the geographical area. The values for the Northwest area was used to calculate the value for alfalfa varieties grown in the following tables.

## Comparison in Nutrient Value changes for Varieties at Othello, WA (used PNW values)

Place in O. Trial	NDF	Fiber Value/ Ton	CP %	CP Value/ ton	NEL	Energy Value/ ton	Total Value /ton
Top	45.4	\$72.71	20.4	\$86.51	0.54	\$71.28	\$230.50
Avg	49.4	\$79.12	18.7	\$79.27	0.509	\$67.19	\$225.58
Bottom	52.5	\$84.08	17.6	\$74.46	0.482	\$63.62	\$222.17
Bottom minus Top	7.1	\$11.37	2.8	(12.05)	0.058	(7.66)	(8.33)
Avg. minus Top	4	\$6.41	1.7	(7.24)	0.031	(4.09)	(4.93)

Table 3. Comparison in nutrient value changes for varieties at Othello, WA. Nutrient values totals varied between cultivars ranging from \$222.17 to \$230.50 per ton.

## NDF Quality Adjustment

Place in O. Trial	Total Value Prev. Slide	NDF Value (%)	NDF Change (%)	Change@ \$4.75 (\$/ton)	Final Value @ \$4.75 (\$/ton)
Top	230.50	45.0	1.4	(6.65)	223.85
Avg	225.58	49.4	5.4	(25.65)	199.93
Bottom	222.17	52.5	8.5	(40.38)	181.79
Bottom minus Top	(8.33)	7.5	-7.1	(33.73)	(42.06)
Avg. minus Top	(4.93)	4.4	-4.4	(19.00)	(25.93)

Table 4. Value of hay per ton after discounted for NDF content. The amount discounted depends on milk price (Table 1) discounts of \$4.75 / ton were calculated. The discount range based on NDF was much larger than nutrient values ranges. Discounts up to \$42.06 / ton or larger could occur. Hay prices after discounts were higher than that typically being received by producers for this quality of hay.

## Total Value Per Acre

Place in O. Trial	Final Value @ \$4.75 (\$/ton)	Yield@ 12% Moisture Basis	Final Value @ \$4.75 (\$/acre)
Top	223.85	3.29	736.47
Avg	199.93	3.40	679.76
Bottom	181.79	3.26	592.64
Bottom minus Top	(42.06)	(0.03)	(143.83)
Avg. minus Top	(25.93)	0.11	(56.70)

Table 5. Total value per acre as influence by yield and value per ton impacted the first cutting by up to \$143.83 per acre which is huge. Results were calculated using a discount \$4.75 /ton /NDF over 44% NDF hay which corresponds with a milk price of \$17/cwt.



Figure 4. Valuing alfalfa from a nutrient perspective is an excellent way to evaluate the value differences in quality from a nutritionist's perspective that is beyond yield and should allow breeders and agronomists in their efforts to improve total value of alfalfa produced.

## Conclusion

- Eliminating any of the three major sources of value in alfalfa: protein, energy, and fiber will greatly reduce the value of alfalfa.
- NDF quality adjustment has a large impact on final hay price
- Hay valued in this trial had higher value than is seen in the market when considering protein, energy, and fiber even after discounting for NDF impact on milk production.
- Using estimated values from the Pacific Northwest for metabolizable protein, energy and fiber and adjusting for milk produced based on NDF is a much better method of alfalfa estimation than RFV.



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## Problem

We need to be able to value feed in a way that will give us a better understanding to hay producers nutritionists & dairymen what a fair value of our alfalfa hay is worth and to be able to compare with other feed stuffs.

## RFV Prediction of Crude Protein (First Cut Othello 2017)

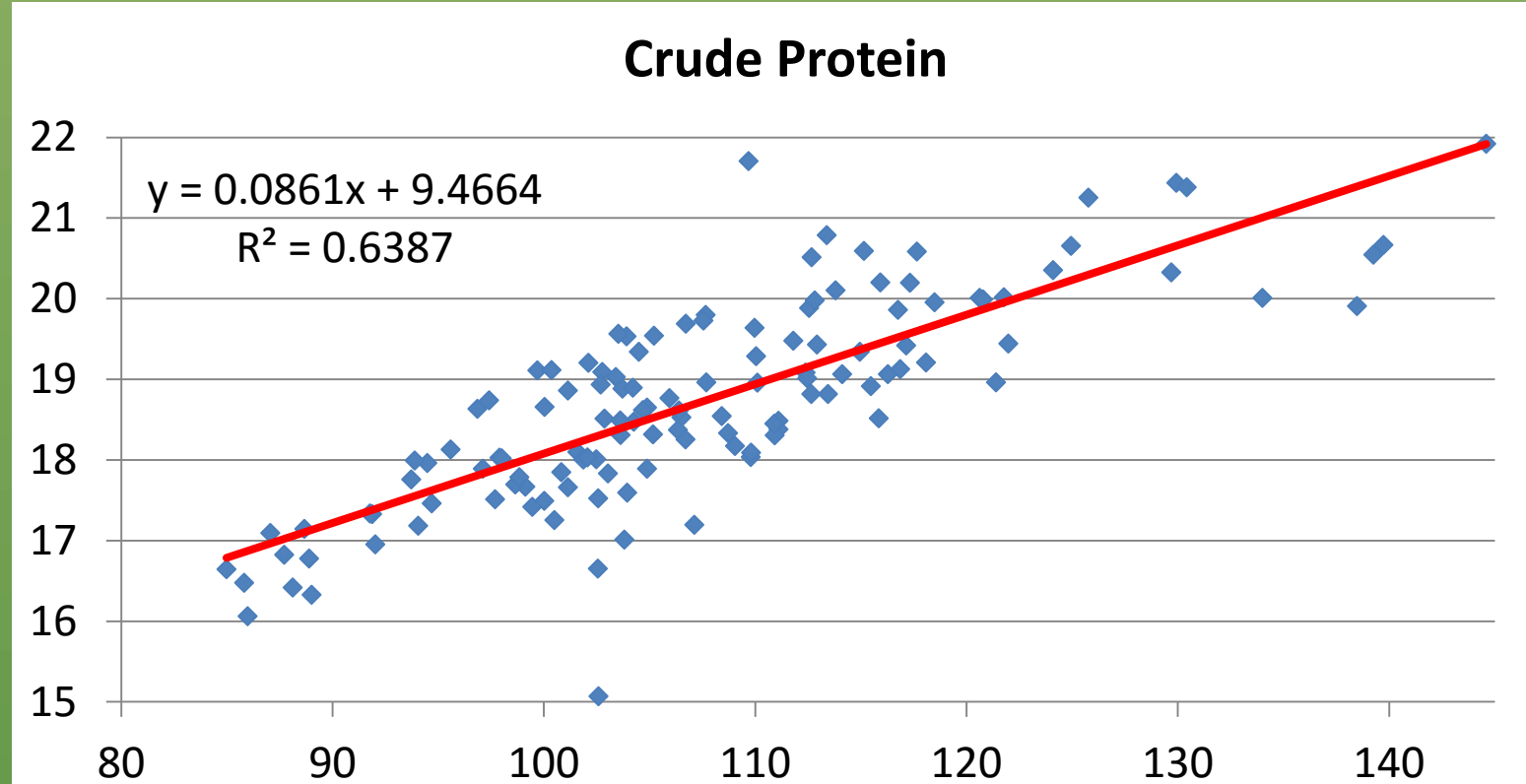


Figure 1. Relative feed value (RFV) does not predict crude protein in hay well. Using RFV for4 protein can miss protein levels by 2.5%, even half of that amount 1.25% would misrepresent the value of the alfalfa by \$5.30 per ton or based on yield \$42.40 per acre.

## The Needs of A Dairyman from Alfalfa are for:

- Protein
- Energy
- Fiber
- Minerals
- Vitamins
- Lets take a closer look at the big 3 protein, energy and fiber

## Protein: All protein is not equally absorbed by the cow

Crude protein on feed analysis must be converted to metabolizable protein for an accurate assessment of value

- Alfalfa: 0.55 (IE 55% of C.P. is metabolizable)
- Distillers: 0.65
- SBM: 0.70

So a sample with 20% crude protein would have a metabolizable protein of: 20\*0.55=11%