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PRICING CORN SILAGE FOR SALE

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Arriving at a fair and equitable price for corn silage is difficult due to the number of factors involved that are dynamic and biologically variable. Some factors include production costs, grain price, harvesting costs, costs of handling, hauling and storage, grain drying costs, fertility value of stover, and forage quality (especially starch content and neutral detergent fiber digestibility-NDFD). The amount of moisture has a major influence on its feed value and needs to be considered to accurately determine fair silage prices. Some growers will want to calculate the price based on corn grain yield (as the alternative harvestable crop) and some dairymen will want to calculate the price based on alternative forages (primarily alfalfa as the alternative forage source). In either case the final price is affected by supply and demand within a region.

In one old, quick, common method corn price is used to establish the per ton price of corn silage. Depending upon the percent dry matter and the amount of harvesting (standing versus ensiled) conversion factors ranging from 6 to 10 are multiplied by the current corn price to establish a silage price. For example, assume the corn price is $2.00 per bushel and corn is standing in the field at 40% dry matter, then the silage could be negotiated to be worth 8 times the price of Number 2 shelled corn ($2.00 per bushel X 8 = $16.00 per wet ton), while the same corn if harvested and ensiled might be worth $20.00 per wet ton ($2.00 X 10). Another field may be at 30% dry matter standing in the field and its price might be negotiated at $12.00 per wet ton ($2.00 X 6). In all of these examples little attention is paid to the relationship between grain yield and forage yield under differing production levels.

Recently there have been attempts to account for not only changes in yield, but also changes in forage quality when calculating corn silage price. In most dairy rations, corn silage is considered a forage containing grain and thus, the two most important nutrient components associated with feeding are starch content and NDFD.

It is often difficult to obtain data for both corn grain and forage yield. Usually one or the other is harvested in a field or plot research situation. In this research, paired plots were used where corn was harvested for forage and left in the field for later grain harvest. The objective of this paper is to describe the relationship between grain yield and forage yield, total digestible nutrients (TDN) and forage yield, and relative feed quality (RFQ) and forage yield.

Materials and Methods

For the growing seasons between 1997 and 2002, experiments were conducted to measure the impact of plant density, planting date and row spacing on corn performance. At harvest forage yield and quality was measured in four of eight rows in the plot. The remaining four rows were left for later grain harvest yield and quality measurements. Most of the research was conducted at Arlington, WI (Table 1). In each year two to four adapted, high performing hybrids were selected and managed using practices similar to neighboring commercial production conditions. Management treatments depended upon year and in general ranged from 15000 to 65000 plants per acre for plant density, April 15 to July 1 for planting date, and 15 versus 30 inches for row spacing.

Table 1. Number of plots in data set used to analyze the relationship between grain yield and forage yield.

Location	Trial	N	2002	2001	2000	1999	1998	1997
Arlington, WI	02PD	292	36	54	44	38	79	41
Arlington, WI	03DOP	239	36	30	30	48	47	48
Arlington, WI	04PDxDOP	269	53	36	36	36	72	36
Arlington, WI	06PDxRS	172	24	24	32	30	32	30
Ashland, WI	03DOP	46					46	
Fond du Lac, WI	06PDxRS	64				32	32	
Hancock, WI	03DOP	91				44	47	
Marshfield, WI	03DOP	92				47	45	
Sparta, WI	06PDxRS	12					12	
Sparta, WI	WOFT	24						24
Spooner, WI	03DOP	95				47	48	
Valders, WI	06PDxRS	62				30	32	

Forage quality was analyzed using NIR and the global Milk2000 (v. April 2002) equation was used to predict forage quality parameters. SAS PROC MIXED was used develop the relationships. The factors year, trial, hybrid and rep were considered random. Plant density, planting date and row spacing were used as covariates. Predicted values derived from the MIXED model for grain yield and TDN were used in the graphs.

Results and Discussion

I. Pricing corn silage based on grain value

Grain yields ranged from 8 to 246 bushels per acre while dry matter forage yields ranged from 3.0 to 12.3 tons dry matter per acre. The relationship between grain yield and forage yield is shown in Figure 1. Little grain yield was measured when forage yields were below 2 to 3 tons dry matter per acre. The relationship between grain yield and forage yield was mostly linear through forage yields of 8 tons dry matter per acre. Grain yield per ton of silage for two moisture levels is shown in Table 2. Depending upon grain yield level, grain yield equivalents per ton of corn silage ranged from 3.4 to 7.4 bushels per ton of silage. These values are slightly higher than the values calculated by Jorgenson and Crowley in 1972.

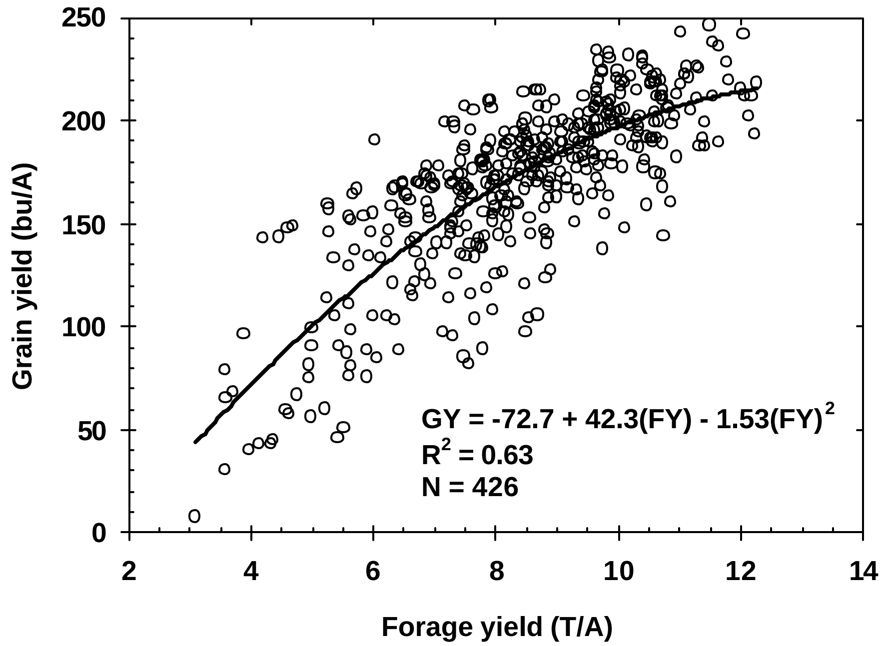

Figure 1. The relationship between corn grain yield and forage yield. Values are collected from experiments conducted in Wisconsin between 1997 and 2002.

To calculate a corn silage price, grain yield must be estimated and a corn price is multiplied for the grain yield equivalent for the yield level. For example, if corn is priced at $2.00 per bushel and grain yields were determined to be 150 bushels per acre then corn silage at 65% moisture would contain 7.4 bushels of grain per ton of corn silage. The corn silage price would be $14.80 per wet ton ($2.00 X 7.4) or $42.40 per dry ton ($2.00 X 21.2). Using an average yield of 20.2 tons dry matter per acre (derived from Figure 1), corn silage price per acre would be $299, which would need to cover all production costs. Further negotiation would need to be conducted over harvest, ensiling and storage costs.

Table 2. Bushels of grain contained in a ton of corn silage. Values are based upon data collected from experiments conducted in Wisconsin between 1997 and 2002 (N = 426).

	Silage at 0% moisture		Silage at 65% moisture	
Grain yield	**Silage yield**	**Grain equivalent per ton of silage**	**Silage yield**	**Grain equivalent per ton of silage**
Bu/A	**T/A**	**Bu/T**	**T/A**	**Bu/T**
25	**2.5**	**9.8**	**7.3**	**3.4**
50	**3.3**	**15.2**	**9.4**	**5.3**
75	**4.1**	**18.3**	**11.7**	**6.4**
100	**5.0**	**20.1**	**14.2**	**7.0**
125	**6.0**	**21.0**	**17.0**	**7.3**
150	**7.1**	**21.2**	**20.2**	**7.4**
175	**8.4**	**20.8**	**24.1**	**7.3**
200	**10.3**	**19.5**	**29.3**	**6.8**

II. Corn silage as forage.

The simplest and crudest estimate is to consider that a ton of corn silage has about the same forage quality as 130 to 150 RFV (or RFQ) on a dry matter basis. Therefore corn silage on an as is basis (assuming 33% dry matter) is worth about ? the value of dairy quality hay. So if dairy quality alfalfa is $120 per ton then corn silage is worth about $40 per ton silage. Note that this assumes no value to the higher protein of alfalfa.

The $40 per ton figure is starting point to figure price. If the buyer harvests the corn silage, the price could be reduced by the harvest cost just as it would if the buyer bales the hay that is purchased. Further, there should be some allowance for storage loss of silage. The loss of hay will be less than 2% if stored under a roof. Corn silage losses with good management generally run 10 to 15%.

One significant refinement to the above calculation is to measure forage quality of the corn silage because it is so variable. We recommend in all cases, when buying corn silage based on forage quality, that the purchaser should have the chopped corn tested as it is harvested to determine forage quality. While the above generalization of forage quality is a reasonable average estimate, Figures 2 and 3 shows that forage quality varies widely at any yield range. Note that TDN generally varies by 8 to 10 units and RFQ varies by 50 or more units at any yield level. Chopped corn analyzed at harvest should not change much during fermentation if good management is used. Further the seller is not responsible for silo management; therefore an analysis of the green chopped corn is a reasonable quality estimate for basing.

Note that in Figures 2 and 3 that forage quality of corn silage generally increases as total forage yield increases. This occurs because grain yield is depressed to a greater extent than total dry matter yield as yield decreases. The response of forage quality to yield is curvilinear reaching a maximum at about 10 tons dry matter per acre. However the response is mainly linear up to about 8 tons silage dry matter per acre. Therefore if one chooses not to measure forage quality one can estimate the average forage quality from the yield by the following equation: RFQ = 11 times yield plus 97.

For example, if corn silage dry matter yield is 6 tons per acre, then the predicted quality would be: RFQ = (11 * 6) + 97 = 163. The value of the corn silage would be considered to be slightly better than standard dairy quality hay (RFQ or RFV 150).

While this estimate is not as good as measuring forage quality, given the range in quality that can occur at any yield, it is better than using a constant forage quality as done in the simplification of the first paragraph above.

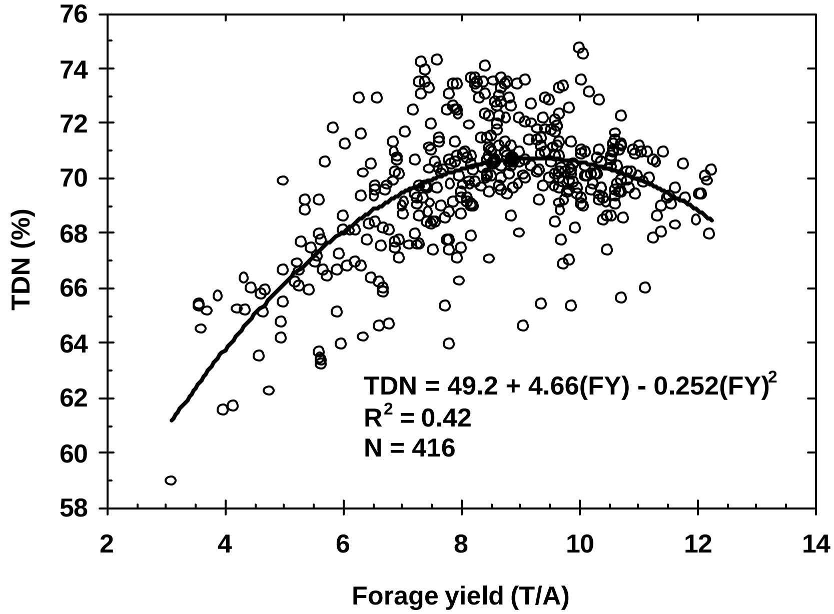

Figure 2. The relationship between corn Total Digestible Nutrients (TDN) and forage yield. Values are collected from experiments conducted in Wisconsin between 1997 and 2002.

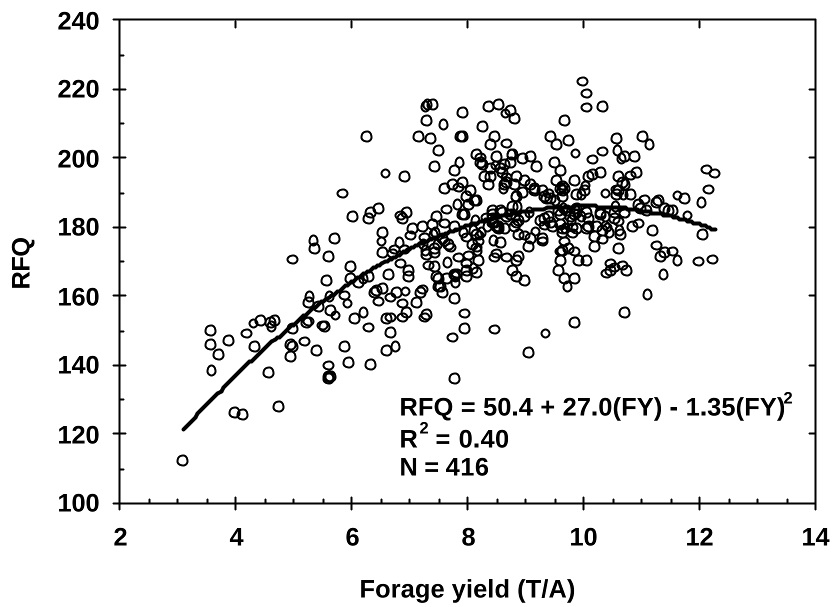

Figure 3. The relationship between corn Relative Feed Quality (RFQ) and forage yield. Values are collected from experiments conducted in Wisconsin between 1997 and 2002.