Valuing Corn Silage for Beef Cattle Feed
2014 Guide
(AEC 2014-18)

Introduction:

Corn silage has historically been an attractive alternative for livestock producers when grain prices are relatively low (pre-2006). Corn prices have been extremely high in the last half-dozen years and as a consequence, provided fewer opportunities for profitably feeding silage for beef cattle. However, new crop corn prices for 2014 have decreased considerably compared to the last few years and is around $3.50/bu using a typical new-crop basis. Thus there should be more opportunities for profitably feeding silage this year. *The purpose of this publication is to examine the situation for 2014, and determine what opportunities may exist in using corn silage for beef cattle feed*. The steps in the decision process are outlined to help you work through your options.

To evaluate the potential for cutting corn silage for livestock feed, we need to look at this decision from both the perspective of the corn producer and the livestock producer. Each perspective is different and too often the decision becomes confused by including factors that aren't relevant for one party or the other. As a consequence, two economic sections are included to outline the valuation process from each perspective. Additionally, since feeding corn silage is less familiar than feeding hay for most beef producers, an introductory section has been included to cover the basics of feeding and storing corn silage.

Basics of Feeding Corn Silage to Beef Cattle:

Corn silage has proven to be a high quality feedstuff that can be utilized in beef cattle diets as an energy and roughage source. However, it does have some challenges that producers must manage around. The purpose of this section is to address some basic considerations for feeding silage to cattle.

Moisture level is a critical factor for producing quality corn silage. Quality silage is most often produced at moisture levels near 65%, but the optimum moisture level can vary depending on the storage structure used. It is recommended that producers test the moisture content of the silage they produce or purchase. Ensuring proper moisture will also aid in packing and production of quality silage.

When making silage, it is important to take the appropriate actions at the beginning of the process to ensure a quality product. Silage quality is largely determined by the fermentation that takes place. Proper fermentation and oxygen exclusion involve many factors such as chopping length and packing density. A desirable fermentation results in the formation of acetic and lactic acid, which lowers the pH to near 4.0. Poor fermentation can lead to many undesirable outcomes such as off-odors, reduced intake, and growth of undesirable organisms.

Producers should also ensure that adequate amounts of corn silage are fed daily to reduce spoilage of the silage face. Fresh silage should be delivered daily as heating will occur once delivered to the bunk, degrading the quality of the feed and hampering intake and subsequent animal performance. As a general rule, it is best to limit-feed corn silage either by delivering it to a bunk or using a system that controls access to the silage face which is typically moved daily to provide a fresh allotment. As is often the case with hay, supplementation of corn silage, specifically protein and calcium, may be required to meet the nutritional needs of cows.

Finally, it is also important to understand that during periods of drought, corn silage can pose a risk to livestock. High nitrogen fertility, followed by lack of precipitation can be problematic as nitrate can accumulate in the plant. Fortunately the fermentation process can reduce the nitrate levels in the corn silage by up to 50%. For these reasons, it is advised that questionable silage be tested after the fermentation process and a feeding strategy developed. Further, it is not advised to feed drought stressed corn as green chop without testing for nitrate levels first. When feeding green chop, be extremely cautious immediately following a rain after a drought period as nitrate concentrations may increase in the plant as the nitrates are mobilized in the plant following precipitation.

Valuing Silage – Grain Grower's Perspective:

When attempting to value corn silage, the first question to ask is: Whose point of view are we looking from? To a grain producer, silage is worth its grain value + / - any costs incurred or saved when harvesting for silage rather than grain. The value per ton after these adjustments are made is the minimum that the grain producer would normally be willing to accept.

Whenever possible, producers should use their own production costs for calculations. However, custom machinery rate surveys can serve as a useful guide for estimating the cost of operations such as grain harvesting, silage chopping, trucking, etc. The University of Kentucky publishes updated custom machinery rates each spring and these will be used as a rough guide.[1] The following example outlines the basic steps in the valuation process for the grain grower (per acre basis):

1. Grain value = yield (bu) x price.
2. Subtract grain harvesting, drying, and trucking costs (these are avoided costs).
3. Add chopping, hauling, and filling costs when applicable (these are additional costs).
4. Add net nutrient value removal (nutrient value of silage less nutrient value of grain - this will be an additional cost to the grain farmer in future years).
5. Divide by silage yield (tons per acre).

[1] See Custom Machinery Rates Applicable to Kentucky (2014). http://www2.ca.uky.edu/cmspubsclass/files/CustomMachineryRatesKentucky2014.pdf

Example – Grain Growers Perspective:
Assumptions: 150 bushel corn yields approximately 18.8 tons corn silage.

1) 150 bu @ $3.40per bu	$510
2) – Harvesting, drying, and trucking costs	($100)
3) + Chop, haul, and fill costs (18.8 tons @ $11/ton)	$206
4) + Net nutrient value (6# P_2O_4, 98# K_2O)	$41
"Breakeven" net revenue compared to grain	$657

5) $657/18.8 tons = ***$34.95 per ton***

Based on the assumptions made above, $35 per ton is the minimum price that a grain farmer should be willing to sell silage for, given that the grain farmer was responsible for chopping, hauling, and filling the silage. If the buyer was responsible for these operations you would leave these costs out of the above calculation. This would put the minimum price $11 per ton lower, for a minimum required price of $24 per ton. The above analysis assumes the corn would sell at $3.40/bu. Each change in this price by $.50/bu would result in an approximately $4 change in the minimum price at this yield level. Thus $3.80/bu corn would result in a minimum required price of $39 per ton and $2.90/bu corn would result in a minimum required price of $31 per ton assuming the grain farmer was responsible for chopping, hauling, and filling the silage.

Valuing Corn Silage – Livestock Feeder's Perspective:

From the livestock feeder's perspective, the cost to produce the corn or the value of the grain is not relevant. To a livestock producer, the value of any feed is determined by the next cheapest substitute (adjusted for any differences in storage and labor costs). In this example, we will assume the cheapest substitute is hay. The following equation can be used to estimate the feed value of the silage:

Feed Value of Silage (per ton) =

$$\frac{\text{(Price of Hay, per ton) x (TDN \% Silage) x (Dry Matter \% Silage) x (1 – Waste Rate \% Silage)}}{\text{(TDN \% Hay) x (Dry Matter \% Hay) x (1 – Waste Rate \% Hay)}}$$

This equation estimates an appropriate price adjustment factor for corn silage based on the price and quality of grass hay (the same process could be done for another substitute such as distiller's grains). This is done by considering the relative differences in dry matter, energy, and waste rates between the two alternatives. The resulting feed value needs to be adjusted if the livestock producer will chop, haul, or fill the silage and/or if labor and machinery costs are significantly different in feeding silage vs. feeding the alternative. A reasonable estimate for the additional labor and machinery costs of feeding silage versus hay is around $6 per ton of silage fed, based on a 50-cow herd and average management.

If we assume hay is the feeding alternative at 50% TDN, 85% dry matter, 22.5% waste rate, and silage at 70% TDN, 35% dry matter, 15% waste rate, then the above equation simplifies to:

Feed Value Silage (per ton) = (Hay Price per ton) x (.632)

Then we can subtract any relevant processing costs such as chopping, hauling, and filling that might be incurred by the livestock producer as well as the additional or net feeding costs on a per ton basis:

Feed Value Silage = (.632) x (Hay Price/ton) – processing costs – net labor/mach costs.

If the grain farmer is chopping, hauling, and filling and assuming a net labor and machinery cost of $6 per ton the equation can be further simplified to:

Feed Value Silage = (.632) x (Hay Price/ton) – $0 (processing) – $6 (net labor/mach)

If this quality hay is selling for $70/ton:

Feed Value Silage = (.632) x ($70) – $6 = $38.25

The $38.25 per ton represents the maximum price a livestock farmer should be willing to pay for silage given the above assumptions and hay priced at $70 per ton. Since the minimum grain value was estimated in the previous section at $34.95 per ton, this means that there is a small range for both parties to benefit based on the assumptions in this scenario since the feeding value is less then the grain value.

The following two tables give the maximum feed value at different hay prices and different waste rates for silage and hay feeding. These results are based on a TDN of 50% for hay and 70% for corn silage and are also based on weekly labor feeding requirements of 5 hours and 8.5 hours for hay and corn silage respectively. Minimum grain value is estimated in the previous section at $35 per ton (at current corn prices). Thus only in those circumstances where maximum feed value is above $35 per ton will an opportunity exist for both the grain and livestock farmer to benefit (these cases are shaded in the tables).

Table 1: Maximum Feed Value of Corn Silage Per Ton Basis (15% Hay Waste Rate)

	Hay Price per Ton					
Waste Rate Silage	**$50**	**$60**	**$70**	**$80**	**$90**	**$100**
10%	$25	$31	$37	$43	$49	$55
15%	$23	$29	$35	$40	$46	$52
20%	$22	$27	$32	$38	$43	$49

Assumptions: Waste rate of hay 15%; Dry matter silage 35%; TDN silage 70%; TDN hay 50%; Weekly labor requirements are 5 hours for hay and 8.5 hours for silage. Silage delivered to farm.

Table 2: Maximum Feed Value of Corn Silage Per Ton Basis (30% Hay Waste Rate)

	Hay Price per Ton					
Waste Rate Silage	**$50**	**$60**	**$70**	**$80**	**$90**	**$100**
10%	$32	$40	$47	$55	$62	$69
15%	$30	$37	$44	$51	$58	$65
20%	$28	$35	$41	$48	$55	$61

Assumptions: Waste rate of hay 15%; Dry matter silage 35%; TDN silage 70%; TDN hay 50%; Weekly labor requirements are 5 hours for hay and 8.5 hours for silage. Silage delivered to farm.

Based on the above analysis, there are many opportunities in 2014 for both the grain and livestock producers to benefit from the sale of corn silage at current grain ($3.40/bu) and hay prices: Specifically, hay valued at $80/ton or higher with a 15% hay *waste, and hay valued above $60/ton with a 30% hay waste rate*. Keep in mind that there needs to be a fair amount of overlap between the minimum price needed by the grain farmer and the maximum price that can be offered by the cattle farmer so that there is room for both parties to benefit.

The above scenarios assumed a $.33/bu trucking cost ($50/acre) for grain. There are many situations in central and south-central Kentucky where trucking costs will be significantly higher for hauling grain to the elevator. Each $.10/bu increase in trucking cost will reduce the silage value for the grain farmer by approximately $.80 per ton. So if total trucking costs were $.63/bu, then the silage value for the grain farmer would go down by about $2.40 per ton

$$\frac{(\$.63/\text{bu} - \$.33/\text{bu})}{.10/\text{bu}} \times \$.80 \text{ per ton} = \$2.40$$

This analysis focused mostly on energy value and assumed that the protein levels were roughly the same between silage and hay. If significant protein supplementation were needed with corn silage or hay, then additional adjustments would need to be made. However, these adjustments would likely be minor in most situations involving beef cattle. If assumptions for other estimates are significantly different than those used in this analysis, the results may not be applicable. For instance, the labor/machinery estimates used in the analysis (3.5 additional hours per week for silage) decreased the effective feed value of the silage compared to no time difference in feeding. Please contact the authors (see below) if you have situations that are significantly different than those used here.

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Corn Silage (University of Tennessee extension publication):
https://utextension.tennessee.edu/publications/Documents/sp434d.pdf