SILAGE FOR BEEF CATTLE
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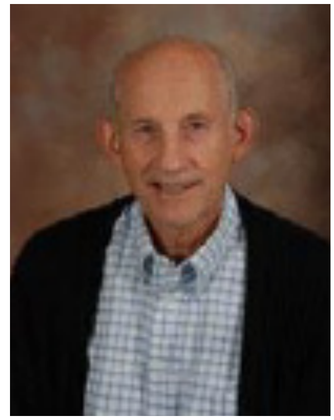
ACCURATELY PRICING CORN SILAGE



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Of course, the economics are important. The biology is essential to be able to do the economics, but the biology alone without economics is not especially important to producers. Here is our attempt to put economics to the biology that has been presented.

There are 2 very important issues that need to be addressed. First is the price of the corn grain to use for pricing the corn silage in the field and second is valuing the manure.

We will discuss pricing assuming the silage is being purchased from a corn producer, realizing many cattle operations will also have a farming operation. The principle is the same. Most corn producers don't want to price the corn in September because on average, it is the lowest price of the year. Corn price increases from harvest through the next Spring and Summer.

However, the grain must be stored until that time of higher price. Storage costs increase from about \$0.30/bu for the first month, plus about \$0.03 for each additional month. Corn price increases about 15% to a peak in April to July. The cost of storage is about equal to the price increase from harvest to Spring. If you cut silage, you pay the storage cost in the silo. Therefore, it is logical to price corn in the field based on the price of grain at harvest. For our calculations, we used September futures price (April 2) minus the basis \$3.73/bu. (\$4.12-0.39).

In the past, corn producers have charged for the plant nutrients (N & P) removed in the forage portion of the corn plant when silage is harvested. That is logical, but the same producers have not wanted to pay for the nutrients in the manure resulting from the feeding of the silage. Table 1 shows the nutrients in the manure from feeding 45% silage in a finisher. That includes the nutrients from the other ingredients in the diet. Further, Rick Koelsch (UNL Beef Watch) has reported the following benefits to manure over commercial fertilizer: increased crop yields, increased soil microbial mass, decreased N losses, increased water stable soil aggregates and increased soil carbon. Therefore, it seems logical that the corn producer should pay for the manure returned to the fields from which the silage was cut. The manure would supply about 4 times the P level needed for plant growth. The three options to accommodate the P are shown in Table 2. Rotating fields each of the 4 years is most economical. However, silage is usually cut from fields close to the feedlot to minimize silage hauling expense. Therefore, hauling manure every fourth year may be the most practical solution and the one we will use for silage pricing.

In a fairly intensive study over 2 years, Row et al. (2016) measured the effect of silage dry matter on grain yield. Grain yield is maximized at black layer and silage was 42.2% dry matter (Table 3). That may be a bit dry for good silage packing, therefore we propose using 38% dry matter for silage harvest. Based on the data of Row et al. (2016), the silage yield of that harvested at 38% dry matter, will be 94% of that at black layer.

Based on the previous assumptions, the pricing of silage in the field is presented in Table 4. Table 5 then shows the further calculations of the price of silage to the feed bunk. Depending upon value placed on manure and amount of silage shrink, the price of silage to the feed bunk is 68 to 78% the price of the corn grain after grain storage.

A 4-trial summary is presented in Table 6. The data are adjusted to equal final carcass weights so 5 more days were required to finish the 45% silage-fed steers. The 45% silage-fed steers gained slower and less efficiently than those fed 15% silage, but net income was more than \$13 greater for the 45% silage-fed steers because of the lower cost of silage compared to grain.

The use of DG in the diet is important to the cattle performance as well as the economics. Burken et al. (2015) fed 4 combinations of DG and silage. The 45% silage diet decreased gain and efficiency and the 40% level of DG tended to increase gain and efficiency (Table 7). There was not a clear interaction indicating 20% DG was probably sufficient. Economics were better for 45% silage-fed steers and best when fed with 40% DG (\$19 advantage to 15:20 diet).

Ovinge et al. (2019) compared systems for feeding higher levels of silage. Feeding 75% silage followed by 15% was similar in performance to 45% silage throughout the finishing period (Table 8). Economics favored feeding the higher level of silage. Somewhat more silage was fed with the continuous 45% level feeding which helped the economics. The 45% level of silage feeding was more than $50 more economical than feeding 15% silage.

Silage has excellent value in grower diets. As shown by Watson (this conference), meeting the protein requirement is very important. The availability of distillers grains (DG) at reasonable prices affords the opportunity to provide economical diets based on corn silage and distillers grains. Two experiments have been conducted where DG was the supplement. While we cannot compare them directly, it may be a useful observation. In one experiment, 15% DG was fed and in the other, 21% DG was fed. The additional level of DG adds both protein (RUP) and energy to the diet (Table 9). Calves gained more rapidly and efficiently when fed 21% DG and cost of gain was more than $6/cwt less. This illustrates the opportunity for using DG and silage for growing cattle.

In the Ovinge et al. (2019) experiment, the calves were fed three levels of silage during the first 70 days (growing period), 15, 45 and 75%. This is a time of efficient gains and feed: gain was less than 5 with only a small decline for the 75% silage-fed calves (Table 10). Cost of gain was $5/cwt less for the calves fed 75% silage. The silage had 96% the feeding value of the grain.

Assuming 72% TDN in the silage and 88% in the corn and 114% for DG, the cost per pound of TDN is presented in Table 11. Clearly, silage and DG are the economical sources of energy and the DG supplies protein (RUP) in addition.

Based on the calculations presented, it seems that corn silage is an economical feedstuff in both finishing and growing diets. The important issues for consideration are: pricing grain at time of silage harvest for silage pricing, pricing grain after storage cost for feeding the grain, accounting for fertilizer value of the manure and minimizing shrink. A final point is that of the use of a cover crop after silage harvest. This is good for the soil and potentially an economic source of forage. The cover crop can be planted early enough to get good Fall growth and with good Spring growth can be grazed or harvested. We will leave the economics of that to others.

TABLE 1.
Manure from 45% Silage Diet[1]

	45% Silage
DMI, lb.	3821
OMI, lb.	3608
Forage (silage)OMI	812
Silage DMI, lb. (ton)	1719 (.86)
Manure, tons	1.88 (.879)[2]
N excreted, lb.	96
N manure, lb. (ton sil)	48 (21.2)[3]
P excreted, lb.	16.8
P manure, lb. (ton sil)	15.1 (6.68)[3]

[1]45% corn silage, 40% DGS, 15% corn
[2]tons/ton 38 dm silage
[3]lb/ton 38% dm silage

TABLE 2.
Options for Manure Credit

- Rotate silage fields every 4 years to distribute P
  Increased hauling distance for silage?
  Full credit for manure
  Silage cost 52-55% corn price

- Spread manure 1 year in 4 to only replace silage removal of P
  One fourth credit for manure
  One fourth hauling expense
  Silage cost 70 to 74% corn price

- Spread manure annually on a P basis
  One fourth credit for manure
  Hauling expense ≈ manure credit
  Silage cost 76 to 80.4% corn price

TABLE 3.
Effect of Silage Dry Matter on Yield[1]

	Weeks from Black layer		
	-1	0	+1
Percent Grain	50.9	52.3	53.5
Grain Yield, bu	237	252	252
Silage Dry Matter	38.1	42.2	43.3

[1]Row et al. 2016

TABLE 4.
Corn Price in Field

- Corn price † fall to summer= $.47/bu (10 year average)
- Corn price increase ≈ storage cost
- Fall basis, Eastern NE ≈ $.39/bu
- Therefore, current cash for September = $3.73/bu
- Harvest, haul, dry, loss ≈ $.47/bu
- Net in field = $3.26
- 263 bu yield = $857/ac, 6.22 tons dm
- 12.1 ton dm silage at 42% dm (black layer)
- 11.35 ton dm at 38% dm (6% yield drag)
- $28.69/ton 38% dm silage in field

TABLE 5.
Silage Price to Feed Bank

	Manure[1]
Silage price in field	$28.69
Residue fertilizer value	$+1.93
Manure fertilizer value	$-3.63
Net Silage Price in field	$26.99
Manure spread cost	$.50
Harvest, haul, pack	$11.00
Storage	$2.00
Net Silage price to feedyard	$40.49
10% Shrink	$44.99 (68.0%)[3]
15% Shrink	$47.63 (72.0%)[3]
10% Shrink, no manure value	$49.02 (74.0%)[3]
15% Shrink, no manure value	$51.91 (78.4%)[3]
10% Shrink, equal fert. value[2]	$46.88 (70.8%)[3]
15% Shrink, equal fert. value[2]	$49.63 (75.0%)[3]

[1] Replacing plant nutrients in silage with manure 1 year in 4
[2] Manure value equal to fertilizer value of nutrients in silage forage.
[3] Percentage of corn prices ($4.12/bu)

TABLE 6.
Four Trial Summary

	Corn Silage	
	15%	**45%**
Initial wt	866	866
Final wt	1403	1403
DOF	136	141
DMI, lb.	26.68	27.10
ADG	4.02	3.81
F:G	6.64	7.11
Net, $	6.49	19.75

TABLE 7.
Silage and DG Levels[1]

	Silage: DG			
	15:20	**45:20**	**15:40**	**45:40**
DMI	26.1	26.9	26.4	26.7
ADG	4.26	4.19	4.42	4.22
Feed:Gain	6.13	6.42	5.98	6.33
Net, $	54.73	65.96	56.32	73.71

[1]Burken et al. (2015)

TABLE 8.
Finishing Systems[1]

	Silage Level		
	15%	**45%**	**75/15%**
DMI	23.7	23.6	23.0
ADG	4.02	3.82	3.73
Feed:Gain	5.88	6.18	6.17
Net, $	27.02	83.64	64.47

[1]Ovinge et al. (2019)

TABLE 9.
Level of DG with Silage Grower

	Hilscher et al.	Ovinge et al.
DG, % dm	15	21
Initial BW	714	698
DMI	21.2	20.3
ADG	3.62	4.17
Feed:Gain	5.86	4.98
Cost of Gain, $/cwt	51.63	45.22

TABLE 10.
Level of Silage in Grower[1]

	Silage Level, %		
	15	45	75
Initial BW	699	701	698
DMI	23.8	23.0	20.3
ADG	4.98	4.75	4.17
Feed:Gain[2]	4.85	4.95	4.98
Cost of Gain, $	50.25	47.62	45.22

[1]Ovinge et al. (2019)
[2]Silage = 96% value of grain

TABLE 11.
Cost/Unit TDN (Grower)

Silage, 10% loss	$.082/lb. TDN
Silage, 15% loss	$.087/lb. TDN
Corn grain ($4.12/bu (.087)	$.099/lb. TDN
DGS (=corn)	$.076/lb. TDN
Hay ($70/ton)	$.0859/lb. TDN
Hay ($80/ton)	$.0960/lb. TDN

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