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The Effects of Corn Price, Shrink, and Harvest Moisture on Corn Silage Economics

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Summary

Economic assumptions were applied to corn production to set corn silage prices for breakeven corn production, whether harvested for corn grain or corn silage. Price levels were used for the calculation of returns per finished steer as corn silage inclusion increased in finishing diets containing distillers grains. As corn price increased, the economics of feeding elevated concentrations of corn silage became more favorable. The economic importance of shrink and harvest moisture content were assessed. As corn price increases and the inclusion of corn silage increases, corn silage management decisions have greater economic importance.

Introduction

Corn silage has been shown to be an economical partial replacement of corn in finishing diets, especially when corn price is high. Although ADG and F:G get poorer with elevated concentrations of corn silage in finishing diets containing distillers grains, economic benefits were demonstrated with elevated concentrations of corn silage in our lab. However, economic outcomes are the result of price scenarios assumed for corn silage, and corn silage pricing is complex. Therefore, the objective of this dataset was to determine corn silage pricing scenarios that would allow for crop producers to price corn silage at a price level that would be breakeven compared to harvesting corn grain. Then, using these corn silage prices and cattle performance reported previously in *2013 Nebraska Beef Cattle Report*, pp. 74-75, assess the economics of cattle finishing with corn priced at $3.50, $4.50, and $5.50/bu. Another objective was to calculate economic outcomes when varying corn silage shrink and harvested moisture content.

Procedure

Corn grain and corn silage harvesting costs were based on data from *2014 Nebraska Farm Custom Rates–Part II* (EC826) published by UNL Extension. Combining corn charges (including tractor and auger cart) were assumed at $36.28/ac and a yield of 200 bu/ac corn for a calculated per bushel harvesting costs of $0.181. Transportation charges from field to feedyard storage location were assumed at $0.11/bu (assuming fields were in close proximity to the feedyard since they could potentially be harvested as corn silage). Drying grain for storage was assumed to be needed to remove two percentage points of moisture. Drying charges were $0.05/bu per point of moisture removed for a total drying cost of $0.10/bu. It was assumed that harvest, drying, and storage losses were 2.5%. When all harvest, transportation, drying, and storage costs were removed from the per bushel price of corn at the feedyard, a value of corn grain standing in the field was calculated. Harvesting and transportation costs remained constant as corn price changed. We also assumed purchase of the grain by the feedyard at harvest time and, consequently, no storage costs of the grain. Corn silage chopping, hauling, filling, and packing bunker charges were assumed at the rate of $9.85/as-is ton of corn silage (up from $8.13/as-is ton in 2012). The dry matter content of the corn silage would affect the dry matter harvesting costs of corn silage. When harvesting corn silage at 32% DM, $9.85/as-is ton would equate to $30.78/ton of corn silage on a DM basis; however, if corn silage was harvested at higher DM content, the harvest cost per DM ton of corn silage would decrease. Harvesting at 42% DM corn silage, the harvest cost would calculate to $23.45/ton of corn silage on a DM basis.

Fertilizer value of stover removed with corn silage was calculated from values determined from the NRC (2001). Corn grain CP, P, and K concentration data (approximately 3,500 samples) were used to calculate the amount of N, P, and K contained in a ton (DM) of corn grain. This was also done for corn silage nutrient concentration data (approximately 32,000 samples). The amount of fertilizer nutrients removed from harvesting corn silage instead of corn grain was then assessed using a partial budget approach taking into account only nutrients removed with corn stover. These values were 11.4 lb of N, 1.1 lb of P, and 22.0 lb of K per ton of corn silage (DM) removed. To re-emphasize, these are calculated nutrients coming from the stover fraction (partial budget approach) of the corn silage and would not be representative of the total amount of nutrients removed from corn silage harvest. These potential fertilizer sources were then valued at $0.37/lb of N (assuming $600/ton for anhydrous ammonia), $1.04/lb of P (assuming $550/ton for DAP and valuing the 18% N contained in DAP at $0.37/lb of N), and $0/lb of K_2O (assuming adequate potassium soil levels; UNL Extension publication EC117, *Fertilizer Suggestions for Corn*). When calculated on a per acre basis, the stover removed from corn silage harvesting would remove $40.21 per acre in fertilizer value using calculations based on 200 bu/ac assumed corn grain yields. Although in these calculations this fertilizer value was charged against the cost of the corn silage, in an integrated feedlot/crop system that applies cattle manure onto corn silage ground, the value of this nutrient removal would be a lower charge against the corn silage price and even potentially a benefit as more manure nutrients would be allowed to be applied back in the system.

The corn kernel has not reached physiological maturity or maximum DM accumulation at the time of most corn silage harvest. Due to this, the

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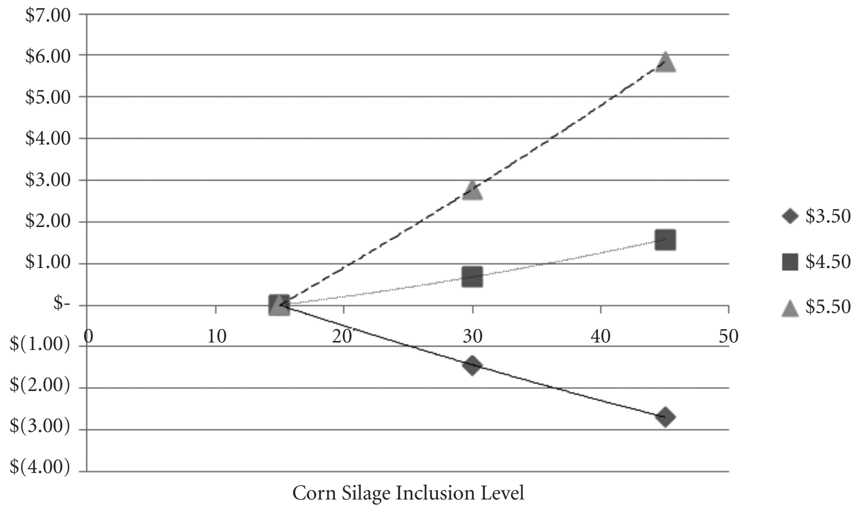

Figure 1. Effect of corn price ($/bu) on per steer returns from feeding elevated concentrations of corn silage in finishing diets containing 40% modified distillers grains with solubles.

yield of corn grain has not been maximized at the time of corn silage harvest. To account for this "yield drag" with corn silage harvest, corn silage was separated into grain and stover fractions. The stover fraction yield was assumed to stay constant across harvest DM concentrations. The stover fraction yield was equal to the amount of corn stover in corn silage from corn silage harvested at 35% DM and containing 51.86% corn grain ((200 bu/ac – (200 bu/ac * 16.9% grain yield drag) * 84.5% grain DM * 56 lb/bu) / 51.86% grain to stover ratio)) – (200 bu/ac – (200 bu/ac * 16.9% grain yield drag) * 84.5% grain DM * 56 lb/bu). The corn grain fraction within corn silage was determined from corn grain yield in bu/ac * "yield drag constant" (i.e., 200 bu/ac * 16.9% "yield drag constant for harvesting at 35% corn silage DM content" * 56 lb/bu * 84.5% grain DM; this scenario would yield 7,864 DM lb of corn grain at corn silage harvest time from 200 bu/ac corn at corn grain harvest time). Data from hand-harvested commercial corn grain yield trials (conducted in 2011 and 2012) were compiled for determination of a regression line and yield drag constants between corn silage dry matter content and corn grain yield drag from harvesting immature corn kernels.

Corn silage price per ton on a DM basis was calculated, and these values were then utilized to calculate returns per fed steer based off recent performance results, where 15, 30, or 45% corn silage was utilized in diets containing 40% distillers grains (*2013 Nebraska Beef Cattle Report*, pp. 74-75). Feedlot performance was adjusted in the analysis of different corn silage harvest DM. This was done by regressing the original performance data against the amount of corn silage roughage in the diet (assuming the corn silage fed in the performance study contained a stover concentration of 48.14%). As the harvest DM content of the corn silage increased, the proportion of corn grain contained in that silage increased (thereby increasing the amount of corn grain in the diet) and the feedlot performance improved by that difference in corn level in the diet. Due to the effect of variable carcass weight across treatments, DOF were adjusted on a pen basis so that all pens were fed to a constant average carcass weight of 866 lb (DOFc). Initial purchase cost was calculated using average initial weight of a pen multiplied by an initial price/lb determined to achieve a breakeven or net return of $0/head for the 15% corn silage control treatment at the different corn prices evaluated. Cattle interest charges were calculated as 7.5% interest * (purchase price-$200/steer for down payment) * (DOFc/365). Corn (1:1 blend of DRC and HMC) was charged an additional $2.85/ton (DM) for the cost of corn processing. Corn silage was priced at methods outlined above. Modified distillers grains with solubles feed costs were calculated as 90% the price of corn on a DM basis FOB the feedyard. Supplement was assumed to be equal to the price of corn on a DM basis. A pencil shrink was applied to all ingredients—1% was used for corn and supplement, 5% for MDGS, and 10% for corn silage—in the economic models assessing the effects of corn grain price on returns per steer and the effects of harvest moisture on returns per steer. Feed costs were determined by using diet DM costs * DMI * DOFc. A feed interest charge of 7.5% for one half of total feed charges was used. Processing and medicine charges were assumed at $20/steer. Yardage was calculated as $0.45/head/day utilizing DOFc. Cost of gain calculations included yardage, processing and medicine, and total feed costs (feed and feed interest charges). A sale price of $2.25/lb * 866 lb or $1,952.50/steer was used for all cattle. Profit per head was calculated as sales price – initial purchase cost (including cattle interest charges) – total feed costs – processing and medicine – yardage – 1% calculated death loss.

Results

The effect of corn price on per steer returns from feeding elevated concentrations of corn silage in 40% MDGS finishing diets are presented in Figure 1. As corn price increased, it becomes more economically appealing for cattle feeders to feed more corn silage in the diet. Utilizing corn silage pricing assumptions outlined above and corn priced at $3.50, $4.50, or $5.50/bu (leaving all other cost assumptions the same across corn price levels), corn silage would be priced into the bunker (i.e., breakeven for the crop producer producing either corn grain or corn silage and without corn silage shrink) at $39.59/as-is (35%DM) ton, $48.59/as-is ton, and $57.60/as-is ton at corn prices of $3.50, $4.50, and $5.50/bu, respectively. The breakeven amount for the crop producer selling corn silage standing in the field (feedyard pays harvesting costs) to the feedyard would be $29.74/as-is (35% DM) ton, $38.78/as-is ton, and $47.75/as-is ton

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when corn is priced at $3.50, $4.50, and $5.50/bu (respectively). The corn grain price level that would allow for break-even returns across corn silage concentrations is approximately $4.15/bu, or above $4.15/bu corn price, it becomes economical to feed elevated concentrations of corn silage utilizing a scenario in which the corn silage is harvested at 35% DM and with 10% shrink losses. The increased value from corn silage as corn price is increased is mainly due to corn silage harvest costs being a lesser proportion and the actual feed value being a larger proportion of the total costs of corn silage.

The effects of corn silage shrink on per steer returns from feeding elevated concentrations of corn silage in 40% MDGS finishing diets are presented in Figure 2. Controlling shrink of corn silage via proper harvest moisture and packing density, incorporating sealing strategies, and appropriate feedout management is strongly recommended based on economic outcomes. Reducing shrink from 20% to 10% would save $5.60, $11.54, and $17.84 per steer when corn is priced at $4.50/bu and corn silage is fed at 15%, 30%, or 45% of the diet, respectively.

Dry matter content of corn silage at harvest time affects the amount of corn grain harvested and silage energy content. The more immature the corn plant is harvested for corn silage, the less total amount of corn grain is harvested. From data compiled from our lab, scenarios were set up for harvesting corn silage at 32%, 35%, and 42% DM with corresponding corn grain yield drags of 22.2%, 16.9%, and 7.4% (which would be somewhat higher than past literature). Shrink was held constant at 10% across corn silage harvest dry matter content; however, it could be speculated that shrink would be increased at harvested DM contents below 30% DM and above 40% DM, but few data are available to document these shrink changes so shrink was kept at a constant value (Figure 3). Calculated net returns per steer for harvesting corn silage at 35% instead of 32% DM were $2.58, $5.33, and $8.28 per steer at corn silage inclusions of 15%, 30%, or 45% of the diet (respectively). These economic data emphasize the importance of not harvesting corn silage too early resulting in reduced corn silage yield with the potential of harvesting corn silage at higher dry matter content if shrink can be managed. If shrink can be managed when harvesting corn silage at 42% DM by proper packing, sealing, and oxygen exclusion strategies, then the price point of corn grain that it becomes economical to feed increased concentrations of corn silage is approximately $2.50/bu.

These data suggest that there is an economic incentive to feeding elevated concentrations of corn silage with distillers grains. The economic incentives are increased when corn price is elevated. These data emphasize the economic importance of proper harvesting and storage of corn silage to minimize shrink, as well as the economic consequence of harvesting corn silage at lower dry matter concentrations. As corn price is increased and the inclusion of corn silage is increased in finishing diets, corn silage management decisions have greater economic importance.

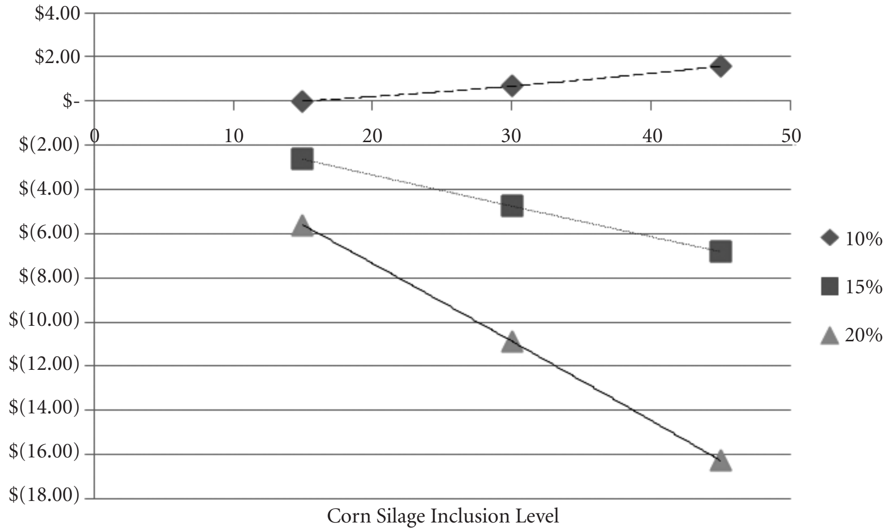

Figure 2. Effect of corn silage shrink on per steer returns from feeding elevated concentrations of corn silage in finishing diets containing 40% modified distillers grains with solubles.

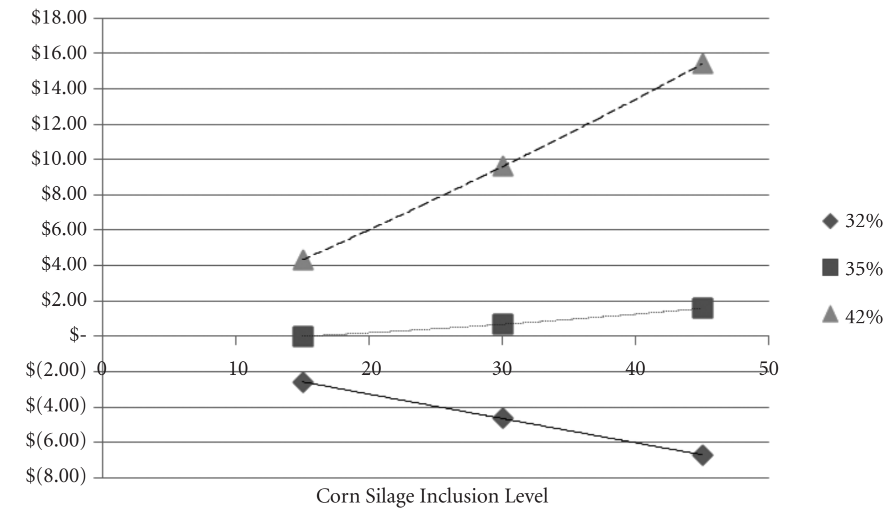

Figure 3. Effect of corn silage DM content at harvest on per steer returns from feeding elevated concentrations of corn silage in finishing diets containing 40% modified distillers grains with solubles.

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