



# An Economic Overview of Ethanol Co-product Utilization in Nebraska

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The rapid growth of the ethanol industry in recent years has led to the formation of an active commodity market for ethanol co-products. The variability in co-product prices over time and across markets suggests fundamental supply and demand factors are changing and influencing prices. In order to more fully understand the extent of these changes and quantify the effects of co-product utilization on the Nebraska cattle feeding industry, cattle producers were surveyed regarding their co-product feeding and pricing practices. Although many Nebraska cow/calf operations and feedlots use ethanol co-products, this survey primarily focused on feedlot use.

While the USDA Agricultural Marketing Service (AMS) reports daily average cash prices and a range of prices across multiple plants, the prices that individual cattle producers pay for co-products can vary substantially from these averages, depending on quantity purchased, contracting, and other factors. One objective of this project was to collect price data from producers and compare the data to AMS prices which are based on prices reported

| Abbreviation Key                      |   |
|---------------------------------------|---|
| Common terms used in this publication |   |
| <b>AMS</b>                            | — USDA Agricultural Marketing Service           |
| <b>CIF</b>                            | — Price including cost, insurance and freight   |
| <b>DCGF</b>                           | — dry corn gluten feed                          |
| <b>DDGS</b>                           | — dried distillers grains plus solubles         |
| <b>DM</b>                             | — dry matter                                    |
| <b>FOB</b>                            | — cost at the source, without delivery          |
| <b>MWDGS</b>                          | — modified wet distillers grains plus solubles  |
| <b>NASS</b>                           | — USDA National Agricultural Statistics Service |
| <b>WCGF</b>                           | — wet corn gluten feed                          |
| <b>WDGS</b>                           | — wet distillers grains plus solubles           |

by ethanol plants. In addition, AMS price data for previous years indicate a seasonal price pattern exists for co-products. This survey was conducted to further document this concept. A second objective was to collect data on ethanol co-product pricing and storage strategies, co-product inclusion levels in feedlot rations, the percentage of operations using co-products, and several other ethanol co-product issues relevant to Nebraska cattle feeders.



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## Producer Survey on Co-product Use

In February 2008, 1,370 Nebraska cattle feeders and ranchers were surveyed about their co-product use in 2007 and their views on feeding and contracting co-products. Questions addressed the operation's composition as well as its use of ethanol co-products in feedlot rations, cattle performance response to feeding co-products, and co-product storage and pricing strategies.

Individuals also were asked to complete a co-product information sheet for each type of co-product purchased in 2007. If the same co-product was purchased from more than one plant, a separate information sheet was completed for each plant. The co-product information sheet included the type, amount, and price of the co-product purchased for each month as well as the location of co-product source and producer satisfaction regarding several co-product characteristics (e.g., co-product consistency, guaranteed nutrient analysis).

### Survey Results

From the 1,370 surveys distributed to Nebraska cattle feeders and ranchers, 251 surveys were returned, yielding an 18.3 percent survey response rate. In order to understand the type of operations surveyed, general information was collected regarding feedlot size and composition. The average one-time capacity and average number of cattle on feed were 5,760 head and 4,764 head, respectively, which included feedlots with capacities of less than 100 head to more than 100,000 head. Of the total number of cattle on feed, 49.8 percent were owned by the feedlots and 50.2 percent were custom fed. Of the total number of cattle custom fed, 48.3 percent were owned by Nebraska investors and 51.7 percent were owned by out-of-state investors.

### General Co-product Use

While 59.4 percent of all cattle operations surveyed included ethanol co-products in feedlot rations, 87.0 percent of operations with a one-time capacity of more than 1,000 head reported using co-products in rations. As a result, 91.2 percent of Nebraska cattle on feed represented in this survey were fed co-products as a component of their ration in 2007. The percentage of operations responding to this survey that were feeding co-products was considerably higher than the 36.0 percent national average reported by USDA National Agricultural Statistics Service (NASS) in 2007.

### Co-product Use Related to Ethanol Plant Location

Survey respondents reported the average co-product dietary inclusion level was 37.0 percent (as-is basis) for all operations and was 39.5 percent (as-is basis) in feedyards

### Who Was Surveyed and How

Co-product use surveys were distributed to the following Nebraska cattle feeders and ranchers:

- Attendees at the 2008 UNL Beef Feedlot Roundtable meetings (87)
- Mail list for the UNL Beef Feedlot Roundtable meetings (399)
- Nebraska Cattlemen Farmer/Stockman and Feedlot Councils (886)
- Cattle feeder list of the Ag Promotion and Development Division of the Nebraska Department of Agriculture not included in Feedlot Roundtable list (36)
- 2008 Beef Spotter list not included in Feedlot Roundtable list (15)

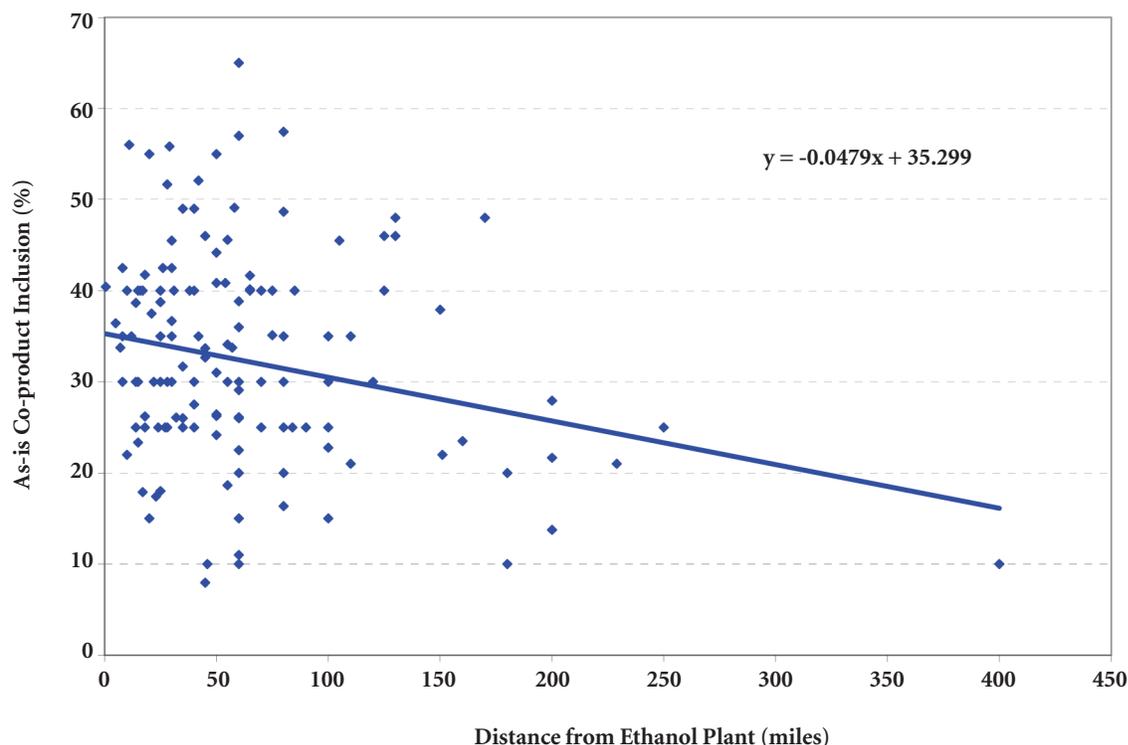
Because some feedyards were included in multiple samples, the mailings for each list were staggered in order to act as a follow-up mailing, so some feedlots may have received more than one survey; however, the lists were cross-referenced so the response rate could be calculated using the number of unique individuals surveyed.

with greater than 1,000 head capacity. As the distance from the operation to the ethanol plant increased, co-product inclusion level appeared to decline (*Figure 1* and *Table 1*). Even when excluding the operation that hauled co-product nearly 400 miles, it is evident from *Figure 1* and *Table 1* that inclusion levels tended to decrease when feedlots were 100 miles or more from an ethanol plant.

**Table 1. Co-product as-is inclusion relative to distance of feedyard from ethanol plant.**

|                           | Average Co-Product Inclusion<br>(percent as-is) |
|---------------------------|---|
| Less than 25 miles        | 32.85   |
| 25 to less than 50 miles  | 34.70   |
| 50 to less than 75 miles  | 31.89   |
| 75 to less than 100 miles | 31.30   |
| 100 miles or greater      | 29.88   |

These results somewhat coincide with University of Nebraska–Lincoln research reported by C.D. Buckner and others in 2008 on the economics of using co-products. They found that the optimum dry matter (DM) inclusion for wet distillers grains plus solubles (WDGS) was 35.0 percent to 40.0 percent if the feedlot was located at the ethanol plant, but 20.0 to 25.0 percent when the feedlot was 100 miles away from the ethanol



**Figure 1. Relationship between co-product as-is inclusion level and distance of feedyard from ethanol plant.**

plant. Although research regarding WDGS optimum inclusion was similar to producer results reported in *Table 1*, the UNL research determined that the optimum DM inclusion level for Sweet Bran remained constant at 50.0 percent, regardless of the distance of the feedlot from the ethanol plant (up to 100 miles).

### Preferred Co-Products

Operations reported buying WDGS most often followed by modified wet distillers grains plus solubles (MWDGS), Sweet Bran, and wet corn gluten feed (WCGF) (*Table 2*). Additionally, survey participants

reported including WDGS and MWDGS at approximately 35.0 percent of the ration as-is while Sweet Bran and WCGF were included at slightly lower levels (roughly 27.0 percent as-is) (*Table 2*). The lower inclusion levels associated with Sweet Bran and WCGF may be attributable to supply issues and the subsequent reduced availability as compared to WDGS and MWDGS. Although producers were also asked to provide buying and inclusion information about dried distillers grains plus solubles (DDGS), Dakota Bran™ Cake, and dry corn gluten feed (DCGF), there were insufficient responses to report these in *Table 2*.

**Table 2. Operations buying co-product for use in feedlot rations and average percent inclusion level, as-is basis.**

| <i>Co-product</i>                            | <i>Percent purchasing<sup>a</sup></i> | <i>Percent inclusion, as-is</i> |
|--|---------------------------------------|---------------------------------|
| Wet Distillers Grains Plus Solubles          | 53.25                                 | 35.50                           |
| Modified Wet Distillers Grains Plus Solubles | 29.22                                 | 34.97                           |
| Sweet Bran                                   | 20.78                                 | 26.78                           |
| Wet Corn Gluten Feed                         | 19.48                                 | 27.45                           |
| Dried Distillers Grains Plus Solubles        | NA                                    | NA                              |
| Dakota Bran™ Cake                            | NA                                    | NA                              |
| Dry Corn Gluten Feed                         | NA                                    | NA                              |
| Other  | NA                                    | NA                              |

<sup>a</sup>Percentages will not add to 100 due to respondents being able to select multiple answers.  
NA = Not enough data collected to provide an estimate.

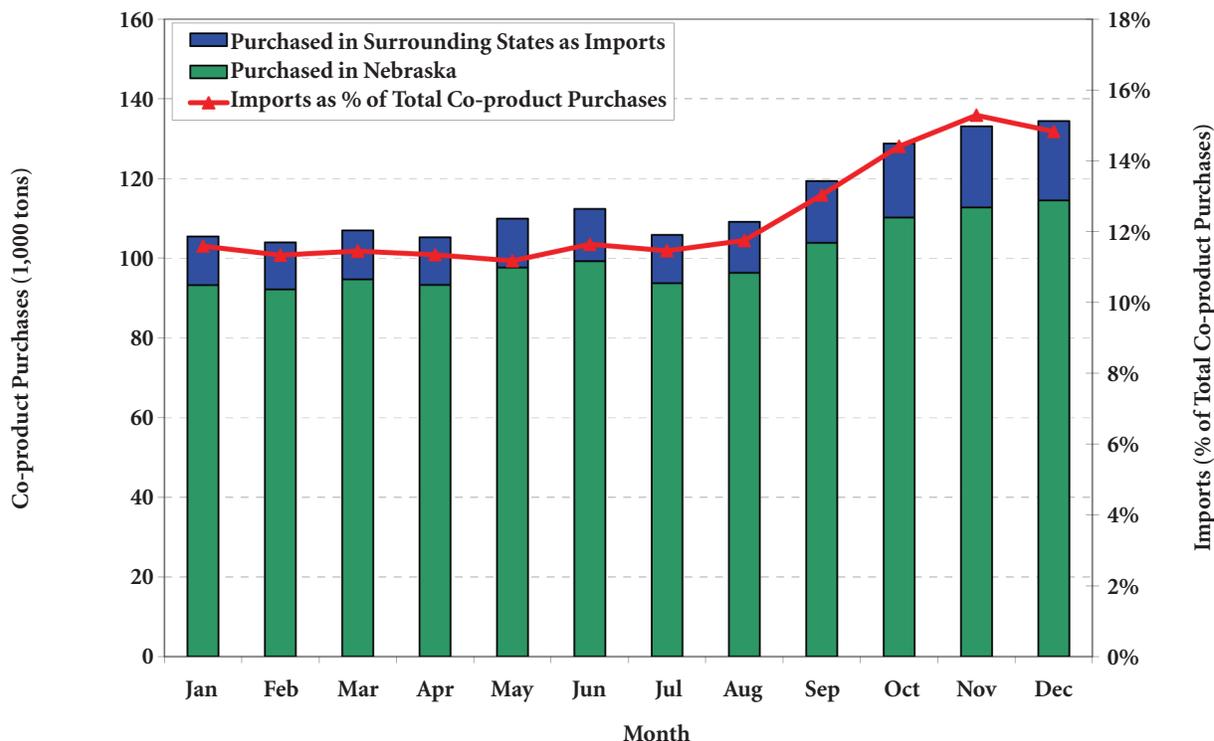


Figure 2. Co-product purchases within Nebraska and as imports (1,000 tons) and imports as a percentage of total co-product purchases, Nebraska, 2007.

### Imported Co-products

According to survey results, approximately 12.6 percent of total ethanol co-products used in 2007 for Nebraska cattle on feed was imported from surrounding states. Similar to all co-product purchased in 2007, most co-product imports were purchased in late fall and early winter with the largest percentage imported in November (Figure 2). This increase in purchasing/importing of co-product in late 2007 coincides with the seasonal increase in cattle on feed. Most imported co-product was from Iowa, followed by Missouri, South Dakota, Kansas, Colorado, and Wyoming (Table 3). Based on survey results, MWDGS was the most common co-product imported to Nebraska, followed by WDGS (Table 4).

### Performance of Cattle Fed Co-products

The survey also collected information on the performance of cattle fed co-products. Nearly 75 percent of survey respondents reported that cattle performance (e.g., average daily gain, feed conversion) improved when cattle were fed rations containing ethanol co-products compared to rations without co-products. Only 1.9 percent of respondents stated that performance worsened, while 23.6 percent of respondents stated cattle had no change in average daily gain or feed conversion when fed ethanol co-products.

Table 3. 2007 Nebraska co-product imports by state.

|                  | Percent imported by state |
|------------------|---------------------------|
| Iowa             | 82.57                     |
| Missouri         | 6.86                      |
| South Dakota     | 4.77                      |
| Kansas           | 3.99                      |
| Colorado/Wyoming | 1.81                      |

Table 4. Percentages of types of co-products imported to Nebraska, 2007.

|                   | Percent of total imports |
|-------------------|--------------------------|
| MWDGS             | 77.81                    |
| WDGS              | 20.21                    |
| Dakota Bran™ Cake | 1.10                     |
| Other             | 0.87                     |
| DCGF              | 0.01                     |
| DDGS              | 0.01                     |
| WCGF              | 0.00                     |
| Sweet Bran        | 0.00                     |

**Table 5. Percent of respondents agreeing that “the consistency of the product from load to load is satisfactory.”**

|                         | <i>Strongly Disagree</i><br>% | <i>Disagree</i><br>% | <i>Neutral</i><br>% | <i>Agree</i><br>% | <i>Strongly Agree</i><br>% |
|-------------------------|-------------------------------|----------------------|---------------------|-------------------|----------------------------|
| All Ethanol Co-Products | 2.42                          | 6.76                 | 15.46               | 50.24             | 25.12                      |
| WDGS                    | 2.25                          | 7.87                 | 23.60               | 52.81             | 13.48                      |
| WCGF                    | 3.70                          | 3.70                 | 18.52               | 55.56             | 18.52                      |
| MWDGS                   | 2.04                          | 10.20                | 8.16                | 63.27             | 16.33                      |
| Sweet Bran              | 0.00                          | 0.00                 | 0.00                | 26.67             | 73.33                      |

### Satisfaction with Co-product and Importance of Analysis

In addition to cattle performance, respondents were asked to rank their level of agreement (strongly disagree, disagree, neutral, agree, or strongly agree) with the following four statements for each co-product purchased:

- The consistency of the product from load to load is satisfactory.
- This product has a guaranteed nutrient analysis.
- This product has a consistent DM.
- I am willing to buy and use this product again.

The average survey responses are shown in *Tables 5-8* for all co-products combined and individually for WDGS, WCGF, MWDGS, and Sweet Bran. Overall, more than 75.0 percent of survey respondents agreed or strongly agreed that the consistency of all ethanol co-products from load to load was satisfactory. Respondents reported that MWDGS was the most inconsistent of the co-products listed in *Table 5*. The large percentage of individuals agreeing or strongly agreeing somewhat contradicts anecdotal evidence and UNL research by Buckner and others regarding WDGS consistency. Based

on discussions with Nebraska producers, sulfur and DM vary significantly among co-products. This further reinforces the importance of nutrient analyses to obtain accurate co-product nutrient compositions when formulating rations and making buying decisions.

Respondents reported that Sweet Bran was more likely than WDGS, MWDGS, and WCGF to be sold with a guaranteed nutrient analysis (*Table 6*). Furthermore, 18.0 percent and 14.3 percent of respondents did not agree that WDGS and MWDGS, respectively, had a consistent DM (*Table 7*). Respondents buying Sweet Bran, on the other hand, concluded that this product’s DM was particularly consistent. Based on survey responses, it is evident that producer satisfaction with ethanol co-product differs, although most survey respondents agreed or strongly agreed that they would be willing to buy and use the product again (*Table 8*).

Because of the variation in producer satisfaction regarding overall and dry matter consistency and the inclusion of a guaranteed nutrient analysis, it is crucial that producers obtain a nutrient analysis from the co-product source so rations can be correctly balanced. For example, suppose a cattle feeding operation was using a finishing ration that included 8.4 lb of WDGS per day DM (based on 24.0 lb DM intake per day and 35.0 percent ration DM inclusion of WDGS: 24.0 lb × 35.0

**Table 6. Percent of respondents agreeing that “This product has a guaranteed nutrient analysis.”**

|                         | <i>Strongly Disagree</i><br>% | <i>Disagree</i><br>% | <i>Neutral</i><br>% | <i>Agree</i><br>% | <i>Strongly Agree</i><br>% |
|-------------------------|-------------------------------|----------------------|---------------------|-------------------|----------------------------|
| All Ethanol Co-products | 3.98                          | 5.97                 | 28.86               | 42.79             | 18.41                      |
| WDGS                    | 5.88                          | 10.59                | 35.29               | 38.82             | 9.41                       |
| WCGF                    | 0.00                          | 0.00                 | 38.46               | 46.15             | 15.38                      |
| MWDGS                   | 4.08                          | 6.12                 | 22.45               | 55.10             | 12.24                      |
| Sweet Bran              | 0.00                          | 0.00                 | 10.00               | 33.33             | 56.67                      |

**Table 7. Percent of respondents agreeing that “This product has a consistent DM.”**

|                         | <i>Strongly Disagree</i><br>% | <i>Disagree</i><br>% | <i>Neutral</i><br>% | <i>Agree</i><br>% | <i>Strongly Agree</i><br>% |
|-------------------------|-------------------------------|----------------------|---------------------|-------------------|----------------------------|
| All Ethanol Co-Products | 1.95                          | 11.71                | 22.44               | 42.44             | 21.46                      |
| WDGS                    | 2.25                          | 15.73                | 34.83               | 35.96             | 11.24                      |
| WCGF                    | 3.85                          | 7.69                 | 23.08               | 50.00             | 15.38                      |
| MWDGS                   | 2.04                          | 12.24                | 12.24               | 59.18             | 14.29                      |
| Sweet Bran              | 0.00                          | 0.00                 | 0.00                | 36.67             | 63.33                      |

**Table 8. Percent of respondents agreeing that “I am willing to purchase and use this product again.”**

|                         | <i>Strongly Disagree</i><br>% | <i>Disagree</i><br>% | <i>Neutral</i><br>% | <i>Agree</i><br>% | <i>Strongly Agree</i><br>% |
|-------------------------|-------------------------------|----------------------|---------------------|-------------------|----------------------------|
| All Ethanol Co-products | 0.97                          | 0.97                 | 7.73                | 51.21             | 39.13                      |
| WDGS                    | 0.00                          | 2.25                 | 10.11               | 48.31             | 39.33                      |
| WCGF                    | 0.00                          | 0.00                 | 7.41                | 70.37             | 22.22                      |
| MWDGS                   | 2.04                          | 0.00                 | 6.12                | 63.27             | 28.57                      |
| Sweet Bran              | 0.00                          | 0.00                 | 0.00                | 30.00             | 70.00                      |

percent = 8.4 lb). In Nebraska, it is reasonable to assume that DM values for WDGS can vary by at least three percentage points among different ethanol plants (32.0 percent to 35.0 percent DM). If an operation assumed that the percent DM of WDGS contracted for \$65.00 per ton as-is for the entire feeding period (115 days) was 32.0 percent DM rather than the actual 35.0 percent DM, the feedlot would incur an additional cost of \$8.41 per head  $[(2.25 \text{ lb} / 2000 \text{ lb}) \times 115 \text{ days} \times \$65.00/\text{ton} = \$8.41 \text{ per head}]$  due to the inaccurate DM percentage used to balance rations. This inaccuracy would lead to subsequent excessive feeding of 2.25 lb of WDGS  $[(8.4 \text{ lb} / 32.0 \text{ percent}) - (8.4 \text{ lb} / 35.0 \text{ percent}) = 2.25 \text{ lb}]$ . It is important to note that the \$8.41 per head is not net of any changes in cattle performance as a result of feeding an extra 2.25 lb of WDGS. Just as it is important for producers to balance rations and make buying decisions using an accurate DM, it also is essential for ethanol plants to provide feedlot managers with accurate and consistent information.

### Co-product Storage and Use by Smaller Operations

While ethanol co-products can be incorporated into rations of both feedlot and cow/calf operations, it is often more difficult for smaller feedlots and cow/calf operations to use an entire load of co-product before

spoilage occurs (if not bunkered or bagged). Because of this challenge, it is reasonable to assume that some smaller feedlots and cow/calf operations would buy smaller amounts of co-product from larger operations, although only 17.1 percent of respondents reported selling purchased co-product to another operation.

Ethanol co-product storage can be a mechanism for improving co-product utilization for smaller operations. Only 6.5 percent of operations responded they had actually placed WDGS in long-term storage. (In this survey, storage lasting longer than two weeks was considered long term.) Compared to anecdotal information and discussions with producers, the 6.5 percent reporting long-term storage of WDGS seems low. This percentage might be higher if cow/calf operations were included in the survey since many cow/calf producers likely stored co-product in 2007.

The survey only addressed the storage of WDGS, and many feedlots may have stored other co-products such as MWDGS or DDGS. Of the operations reporting WDGS storage, the largest proportion placed the co-product in storage in July and August, which corresponded to seasonally low prices. Although the type of WDGS storage method varied among respondents, most used the bunker method with some type of forage or stored WDGS by itself using some type of protective covering (i.e., plastic).

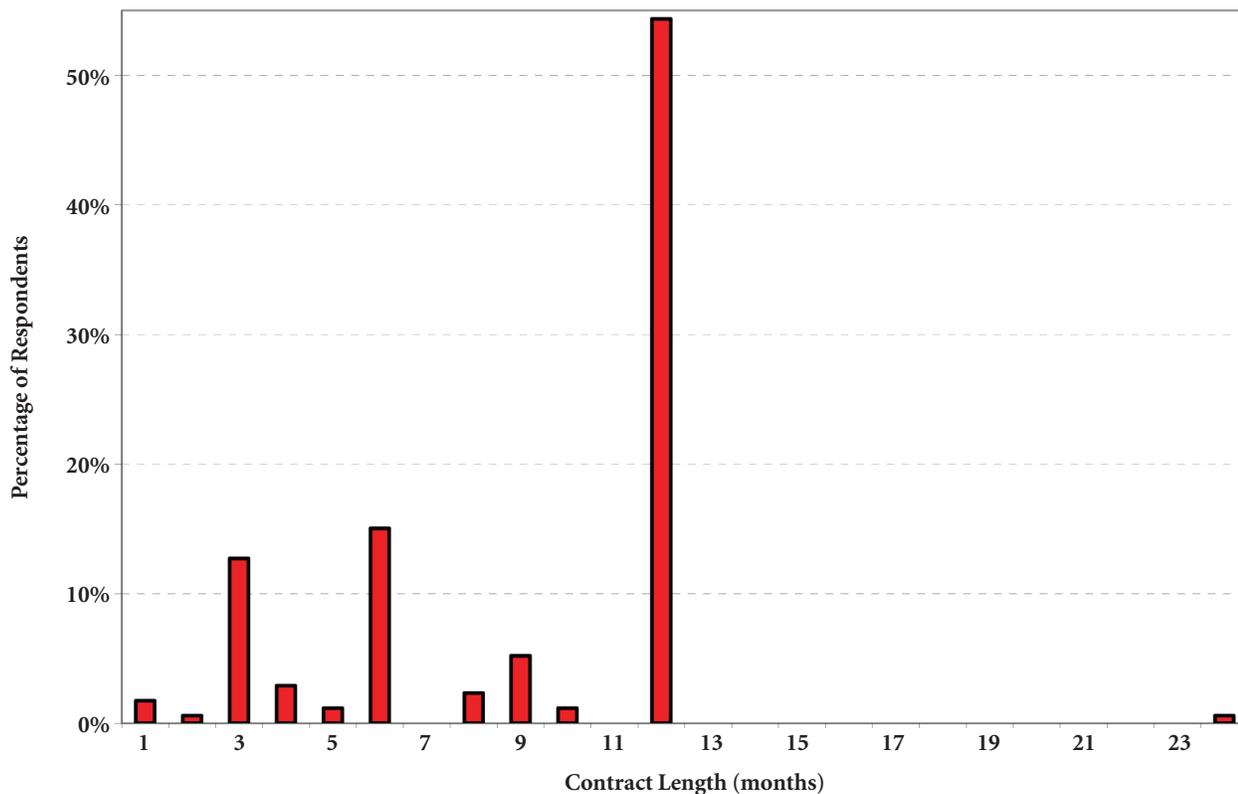


Figure 3. Distribution of co-product contract length.

### Pricing and Contracting

Methods for pricing and contracting ethanol co-products also were addressed in the survey. Most co-product was priced in 2007 using a contract that specified a fixed price for the duration of the contract (Table 9). This differs from the national average co-product purchasing method reported by USDA NASS where 55.0 percent of feedyards bought co-products using a spot contract. Although fixed-price contracting protects a producer’s price risk, a spot market contract leaves producers open to price changes.

The largest proportion of survey respondents stated that their typical contract length was 12 months (Figure 3). Additionally, 43.3 percent of respondents stated they were required to take delivery of a minimum quantity of co-product each week while 56.7 percent stated they did not have to do so. Of those who reported a minimum delivery requirement, the median minimum delivery was reported as 105.0 tons (approximately four to five semi-loads) per week. (The average minimum delivery requirement was 309.2 tons (approximately 12 semi-loads) per week although this high average is due to a non-normal distribution of data.) Furthermore, 38.4 percent of the co-product purchased was priced FOB plant while the remaining 61.6 percent was priced CIF feedlot.

### Co-product Pricing

Survey respondents also were asked to record the price paid for every type of ethanol co-product purchased each month of 2007. Survey responses that did not indicate whether the co-product was priced FOB plant or CIF feedlot were omitted from all price data analysis (Figures 4 and 5). All price data reported CIF feedlot was adjusted to FOB plant using an assumed mileage charge of \$3.50 per loaded mile and an assumed 25 tons of co-product per load. Transportation costs were then calculated by multiplying the number of miles the feedlot was located from the ethanol plant (as reported by survey respondents) by the mileage charge and dividing by the assumed tons of co-product per load. The average calculated transportation cost was \$9.70/ton.

Figure 4 shows the average price paid (FOB plant) for WDGS, MWDGS, WCGF, Sweet Bran, and corn on a DM basis. WDGS, MWDGS, WCGF, and Sweet Bran prices represent survey price data and include both spot market and contracted co-product prices. The corn price in Figure 4 represents multiple ethanol plant spot market bids as aggregated by USDA AMS. On average, WDGS, MWDGS, WCGF, and Sweet Bran were priced (FOB plant) at 78.8 percent, 66.3 percent, 65.6 percent, and 75.9 percent of the price of corn on a DM basis in 2007, respectively.

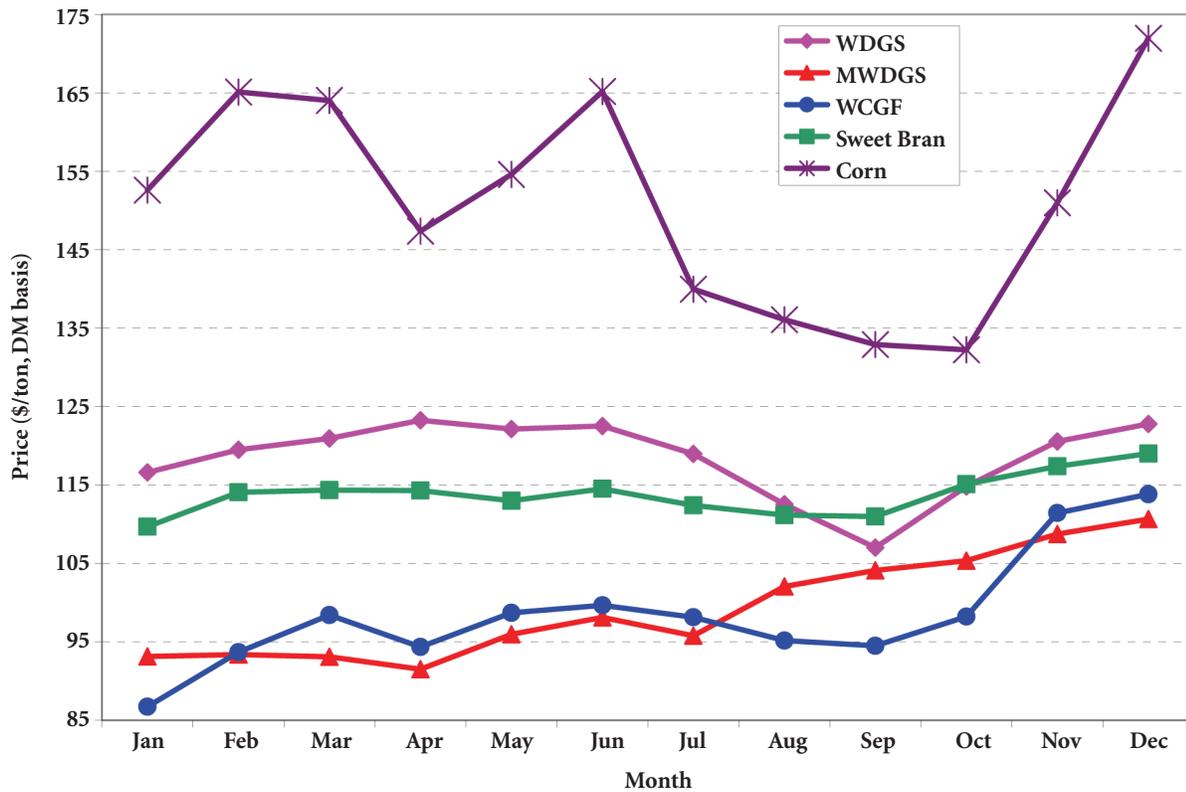


Figure 4. Average WDGs, MWDGS, WCGF, and Sweet Bran prices paid by Nebraska producers, FOB plant, and ethanol plant average corn price<sup>a</sup>, DM basis, 2007.

<sup>a</sup>Corn price from LMIC and USDA AMS (Nebraska Ethanol Plant Report)

The large price differential between WDGs and MWDGS for most of 2007 may partially be due to the difference in demand for the two products during that period as only a few Nebraska ethanol plants were marketing MWDGS in 2007. Furthermore, newly constructed ethanol plants were more than likely marketing most of the MWDGS in 2007. These plants may have been marketing MWDGS cheaper than WDGs in order to achieve market penetration for the new product, thereby essentially forcing producers to pay more for WDGs than MWDGS on a DM basis.

Additionally, producers may not have fully recognized the variation in moisture content between the two co-products, thereby actually paying less (on an as-is basis) for WDGs than MWDGS. Figure 4 illustrates that most survey respondents purchased co-product in 2007 using a 12-month fixed price contract (Table 9 and Figure 3). Although corn price increased dramatically in late 2007, co-product survey prices, which included both spot market and contracted prices, rose only slightly, illustrating the effect of the fixed price contracts.

Although MWDGS price tended to increase steadily throughout 2007, WDGs showed a seasonal price trend with lower prices in the summer (and the opportunity for co-product storage). WCGF and Sweet Bran also

Table 9. Co-product pricing methods used.

|   | Percent of Respondents <sup>a</sup> |
|---|-------------------------------------|
| Contracted (price is fixed for entire contract) | 76.19                               |
| According to corn price                         | 24.29                               |
| Negotiated each load (no contract)              | 6.67                                |
| Negotiated each month                           | 5.71                                |
| Other   | 0.48                                |

<sup>a</sup>Percentages will not add to 100 due to respondents being able to select multiple answers.

showed seasonal price trends with lower prices in late summer, although the price decrease was smaller than for WDGs. The seasonal low in WDGs price during late summer supports the seasonal price trend illustrated by 2007 Nebraska WDGs prices reported by USDA AMS (Figure 5). As mentioned previously, the prices reported by survey participants included both spot market and contracted co-product prices, while the prices aggregated by AMS represent spot market bids as reported by ethanol plants. Although the average survey price is slightly lower compared to that reported by AMS, the minimum and maximum survey prices are nearly

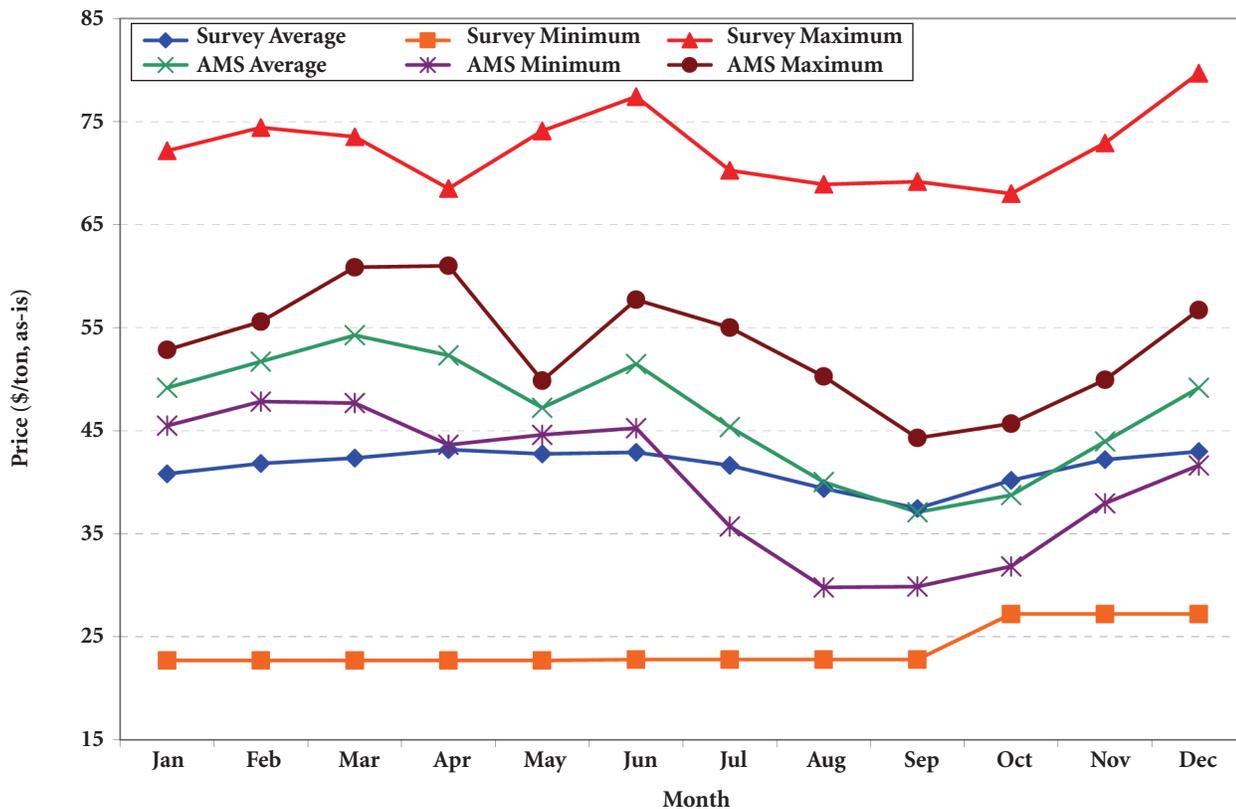


Figure 5. Nebraska WDGs prices paid by surveyed producers and reported by AMS, as-is basis, FOB plant, 2007.

\$20.00 per ton (as-is) different than the AMS minimum and maximum prices. Prices reported by AMS are multiple plant averages, so some variability in co-product price may be masked as producers buy or contract for co-product above and below the price data reported by AMS. Because of this, it is important for producers to contact ethanol plants or co-product merchandisers when forecasting or estimating co-product prices.

### Conclusions

As co-products have increasingly been substituted for more expensive corn, the importance of managing supply and price risk with these products has similarly increased. As a result, it has become more important for producers to contact ethanol plants about contracting opportunities and to recognize the potential for co-product storage during periods of seasonally low prices. The data collected from the ethanol co-product survey helped substantiate these concepts and further quantify ethanol co-product use in the Nebraska cattle feeding industry. In 2007, 91.2 percent of cattle on feed in Nebraska were being fed various types of ethanol co-products from ethanol plants in Nebraska and surrounding states. As illustrated by the price data collected, especially for WDGs, opportunities existed for pricing and storage strategies, although prices reported by survey respondents varied more than those reported by AMS.

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