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Corn Use in South Dakota

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CORN USE IN SOUTH DAKOTA

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This article seeks to highlight the amount of corn used by major agricultural sectors in South Dakota. Since 2010, corn production has increased rapidly in South Dakota, resulting from both higher yields and more acres planted (Figure 1). Historically, much of the corn was used on the same farm where it was grown, but due to increased specialization in agricultural production the majority of the corn produced on South Dakota farms is utilized elsewhere. Since 2010, livestock inventories have remained stable, while ethanol production has grown. During the same period, corn production has exceeded use in the state. This project is part of a larger effort to assess the role of agriculture at the state level.[1]

Ethanol

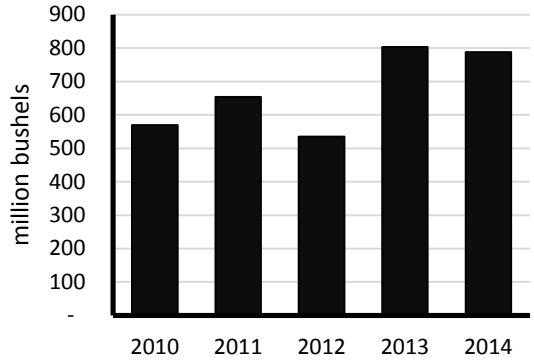
The ethanol industry is the largest user of corn within South Dakota. Publically available data were gathered for each plant operating during 2012, allowing for making a comparison of livestock data used in this study, and the 2012 Census of Agriculture.

Nameplate capacities for each plant show production levels near 1.025 billion gallons of ethanol in 2012, suggesting that total corn used could have equaled 366 million bushels. This represents an upper bound of production, because production is not always maximized in response to market conditions or due to plant maintenance. Assuming a nameplate production capacity of 90% indicates a total production of 900 million gallons of ethanol, using 320 million bushels of corn (Table 1).

Distillers' dried grains with solubles (DDGS) are a coproduct of corn-based ethanol production. DDGS are a substitute feed source for corn and soybean meal in livestock diets. Hoffman and Baker (2009) provide an extensive study on DDGS substitution rates in livestock diets. The following is an example of DDGS substitution rates they provide.[2]

- Beef Cattle- One pound of DDGS can replace 1 pound of corn (for 10-40% dry matter intake).
- Dairy Cattle-1 pound DDGS substitute for 0.45 pounds of corn (up to 20% dry matter intake).
- Swine-1 pound of DDGS substitute for 0.89 pounds of corn (up to 20% of swine diet).
- Poultry-1 pound of DDGS substitute for 0.61 pounds of corn (12-15% of diet).

Industry standards report 17 pounds of DDGS are produced from each bushel of corn used. In total, 5.4 billion pounds (2.70 million tons) of DDGS are potentially produced in South Dakota, enough to substitute for a major portion of corn in livestock rations (given economic and dietary feasibility).



Source: USDA-NASS

Figure 1. South Dakota corn production

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[2]See Hoffman and Baker (2009), table 10, pg. 22

Livestock

A variety of sources can be used to estimate livestock uses of corn. The 2012 Census of Agriculture provides a formal survey of agricultural sales, and allows analyzing the number of livestock sold in the state. The National Agricultural Statistics Service (NASS) annually estimates production, livestock marketed and stocks.[3] The Agricultural Marketing Service (AMS) provides livestock sales reports for South Dakota.[4] Using these data sources in combination with other secondary sources allows for measuring livestock sales within the state.

The four major livestock industries focused on include: cattle farming and ranching, dairy operations, hog and pig farming, and poultry farming. It is important to note that the numbers provided are estimates, or in some cases ranges of estimates. A caveat in our analysis is that interstate livestock transfers and statistical survey errors limit the accuracy of the point estimates.

Cattle and Dairy

Estimating corn consumed by cattle in South Dakota can be done a couple of different ways using the Census of Agriculture and NASS surveys. The Census reported 2,567,027 cattle sold by South Dakota farmers in 2012. Cattle on feed sold were 633,537 head, and calves under 500 pounds sold were 377,999 head. Such calves likely did not consume any corn during this phase. Subtracting cattle on feed and calves sold from total cattle sold gives 1.55 million head of other cattle sold. These represent cattle over 500 pounds, not marketed as calves, or classified as cattle on feed.

The other cattle category also includes culled breeding livestock sold for slaughter. To maintain a cow inventory of 1.7 million head at a 15% turnover rate (cull percentage) suggests a total of 255,000 head of cows and bulls sold. While these animals may have consumed some corn for maintenance, it is assumed they did not do so for the purpose of adding weight before slaughter.

That leaves 1.3 million head sold at some other weight. The Agricultural Marketing Service (AMS) provides the South Dakota Weekly Auction Summary, which was used to find that the average weight of feeder steers and heifers sold at auction was 750 pounds in 2012. Assuming these feeder cattle consumed 15 bushels of corn per head during their weight gain from 500 to 750 pounds, corn use totals 19.5 million bushels (table 1).

Cattle on feed is a direct measure from which corn consumption can be estimated. Assuming it takes 65 bushels of corn to raise a feeder steer or heifer to a 1,200 to 1,400 pound animal, cattle on feed consumption totaled 41.2 million bushels of corn (633,537 head * 65 bu./head) (Table 1).

The other category of cattle using corn in the state is cows and bred heifers. The Census of Agriculture reported 1.7 million cows and heifers that calved in 2012, including 1.61 million beef cows and 91,831 dairy cows. These cows and heifers consumed a mixture of corn, silage, hay and other feed sources. A common maintenance ration for beef cows and heifers assumes consumption of 10 bushels of corn per head throughout the year. This suggests that the 1.61 million beef cows and heifers consumed a total of 16.1 million bushels of corn in 2012 (Table 1).

Combined, cattle use in South Dakota totaled 77 million bushels of corn in 2012. Because the assumptions on cattle feed rations are simplified, the estimates of corn consumption provide only a cursory indication of the actual corn consumption of livestock within the state.

Corn silage within the state was fed to a variety of cattle. Recently, silage production has ranged from 3.1 to 6.2 million tons, and averaged 4.5 million tons between 2010 and 2014. Dairy cattle may consume upwards of 8.0 tons of silage/head per year, totaling 7 million tons. This suggests that dairy cattle could account for consumption of the entire silage crop produced in the state.

A justification for the feeder numbers is that calves sold in a given year may be sold the following year as feeders, breeding stock or fed cattle. In any year, the calf crop minus calves sold provides an estimate of cattle sold as feeder steers and heifers. Assuming a constant calf crop of 1,700,000 calves (NASS) minus 380,000 calves sold (Census) implies that 1.3 million cattle were sold as feeders.

Inter-state movement of cattle complicates the situation. In addition to the 2012 calf crop of 1.71 million head, NASS reports inshipments of 607,000 head, giving total supply of 2.32 million head for the year. From that total, NASS also reports marketings of calves that leave the state totaling, coincidentally, 374,000 head. NASS also reports marketings of cattle of 1,590,000 head in 2012. As discussed above, assuming 900,000 head are needed to replace feedlot cattle and breeding stock would imply 690,000 head leave the state as feeder cattle.

[3] NASS reports and statistics are available at www.nass.usda.gov.
[4] AMS reports are available at www.ams.usda.gov

Hogs and Pigs
The Census of Agriculture reported 3,914,312 hogs sold in South Dakota during 2012. Hogs sold by type of operation are also reported in the Census. Total hogs sold by farrow-to-finish and finish-only operations in South Dakota were 2.1 million head in 2012. This total is an estimate of barrow and gilts sold as market hogs. The remaining sales of 1.81 million head are hogs sold by farrow-to-wean, farrow-to-feeder, nursery, or other operations. A caveat in this calculation is that sales may be reported more than once for the same animal as they move through specialized operations (sow to nursery, nursery to finishing, or other combinations).

NASS provides sample estimates of inventories, marketings, the pig crop, and hog inshipments. In 2012, NASS estimated a pig crop of 3.76 million head and inshipments of 636,000 head in South Dakota. Subtracting estimated hog deaths from these numbers gives 4.28 million hogs born in or shipped into South Dakota in 2012.

Comparing those numbers with quarterly market hog inventories, as reported by weight class, allows a calculation of the number of hogs that are raised to slaughter weight. An estimated 60% of the available market hogs, or 2.6 million head, are raised to market weight in South Dakota. The remaining hogs are shipped out of state to be finished. Analysis of the USDA (AMS) "National Direct Delivered Feeder Pig Report" shows the majority of outshipments occur for weaned pigs weighing 10-12 pounds.

The USDA AMS, "National Daily Direct Prior Day Hog Report" was also used to estimate market hogs raised in South Dakota. During 2012, 1.776 million barrow and gilts originated in South Dakota and were directly delivered to large slaughter plants. This is a lower bound estimation for market hogs raised in South Dakota, because it does not account for hogs sold in open markets or sold to small packers.

Comparing market hog sales and inventories from these data sources gives a range of 1.8-2.6 million market hogs raised in South Dakota, with the remainder of marketings shipped out of state. By averaging the Census and NASS inventories, market hogs raised in-state are assumed to be 2.4 million head. The directly delivered slaughter number was not used in the calculated average, because it does not account for a portion of the market hogs sold.

With market hog weights averaging 270 pounds in 2012, each hog was assumed to have consumed 630 pounds of feed, consisting of 80% corn, thus totaling 22 million bushels of corn used. Sow inventories averaged 175,000 head in 2012, so with each sow consuming 2,000 pounds of feed/year, sows consumed 5.0 million bushels of corn. Hence, total corn used for hogs was 27 million bushels (table 1).

Poultry
Turkeys are the largest portion of the poultry industry in South Dakota by volume sold. The Census reports just fewer than 5.0 million turkeys sold in South Dakota during 2012. A total of 144,000 broiler chickens were sold during 2012 and layer hen inventories were 2.5 million.

NASS Poultry-Production and Value 2013 summary, reported 4.6 million turkeys sold, and 193.20 million pounds of turkey produced during 2012. Lammers and Honeyman (2009) estimate 1.31 bushels of corn consumed per turkey. Thus, the turkeys in South Dakota consumed 6.02 million bushels of corn in 2012. The combined consumption of broilers and laying hen chickens was approximately 2.30 million bushels of corn during 2012, assuming 0.86 bushels of corn per head. Total corn use for poultry is then 8.32 million bushels of corn (table 1).

Summary
The ethanol and livestock sectors used an estimated 432 million bushels of corn in 2012. South Dakota farmers produced 535 million bushels of corn in 2012. Since 2012, production has increased rapidly, reaching 803 and 787 million bushels in 2013 and 2014, respectively (figure 1). Within South Dakota, the production of corn has outpaced use, resulting in surpluses in recent years.

The numbers used in this paper reflect direct corn use in livestock diets. Because there was not an attempt to incorporate DDGS in livestock rations, these estimates provide an "upper bound" on corn use in South Dakota. In actuality, DDGS produced in South Dakota could substitute for a large portion of the corn used in livestock rations, resulting in even larger surpluses.

We welcome any thoughts and considerations on topics presented in this paper.

Table 1. Corn use by sector in South Dakota, 2012.

Sector	Head Produced	Per Head (bu)	Total Corn (bu)
Ethanol	---	---	320,000,000
Cattle on feed	633,537	65	41,200,000
Feeder cattle	1,300,000	15	19,500,000
Beef cows	1,610,000	10	16,100,000
Market hogs[2]	2,400,000	9.1	21,840,000
Sows	175,000	29	5,000,000
Chickens[3]	2,644,000	0.86	2,273,840
Turkeys[4]	4,600,000	1.31	6,026,000
Total			**431,940,000**

[1]Values reflect estimates by the author, based on secondary data sources.
[2]Feed use from PIC.
[3, 4] Corn per head from Lammers and Honeyman (2009) ISU.

References

Hoffman, L. and Baker, A. *Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex*. Outlook Report No. FDS-11-I-01, USDA, Economic Research Service, October 2011, available at: http://www.ers.usda.gov/media/236568/fds11i01_2_.pdf

Lammers, Peter J. and Honeyman, Mark S. "Corn Use as Livestock Feed in Iowa," Animal *Industry Report*: AS 655, ASL R2462, 2009, Available at: http://lib.dr.iastate.edu/ans_air/vol655/iss1/84

Shields, D. and Mathews Jr., K. *Interstate Livestock Movements*. Outlook Report No. LDP-M-108-01, USDA, Economic Research Service, June 2003, available at: http://www.ers.usda.gov/media/312234/ldpm10801_1_.pdf

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