Agriculture By the Numbers

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NDSU Extension Agribusiness and Applied Economics

Production Expense Categories for Crop Production Stay Surprisingly Consistent

Bryon Parman, Agricultural Finance Specialist

From 1995 to 2022, national crop production expense totals more than doubled. In 1995, U.S. production expenses in agriculture totaled $167.8 billion; however, in 2022, production expenses were $452.7 billion. That implies that production costs on average have increased by 3.6% per year. According to the Bureau of Labor Statistics, the average annual inflation rate during that time was 2.3%. Had production expenses increased at only the rate of inflation from 1995 to 2022, they would be $317.2 billion or over $135 billion less.

However, with the increases in production expenses also have come increases in per-acre production. Average yields for most major field crops are much higher today than they were in the mid-90s. For instance, the national average yield for corn was 113 bu/acre (when?) while in 2022 the national average yield for corn was 173.4 bu/acre. National average soybean yields 1995-2022 increased from approximately 35 bu/acre to nearly 50 bu/acre, and spring wheat yields increased from averaging around 33 bu/acre to about 48 bu/acre.

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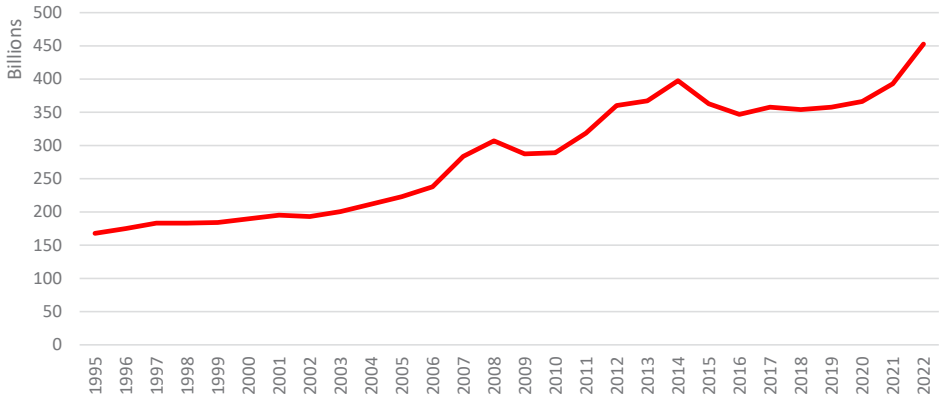
Figure 1: National Total Production Expenses 1995-2022 in Billions of Dollars per Year



Editor: Bryon Parman
Assistant Professor/Agricultural Finance Specialist

701-231-8248
bryon.parman@ndsu.edu

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North Dakota State University
Fargo, North Dakota

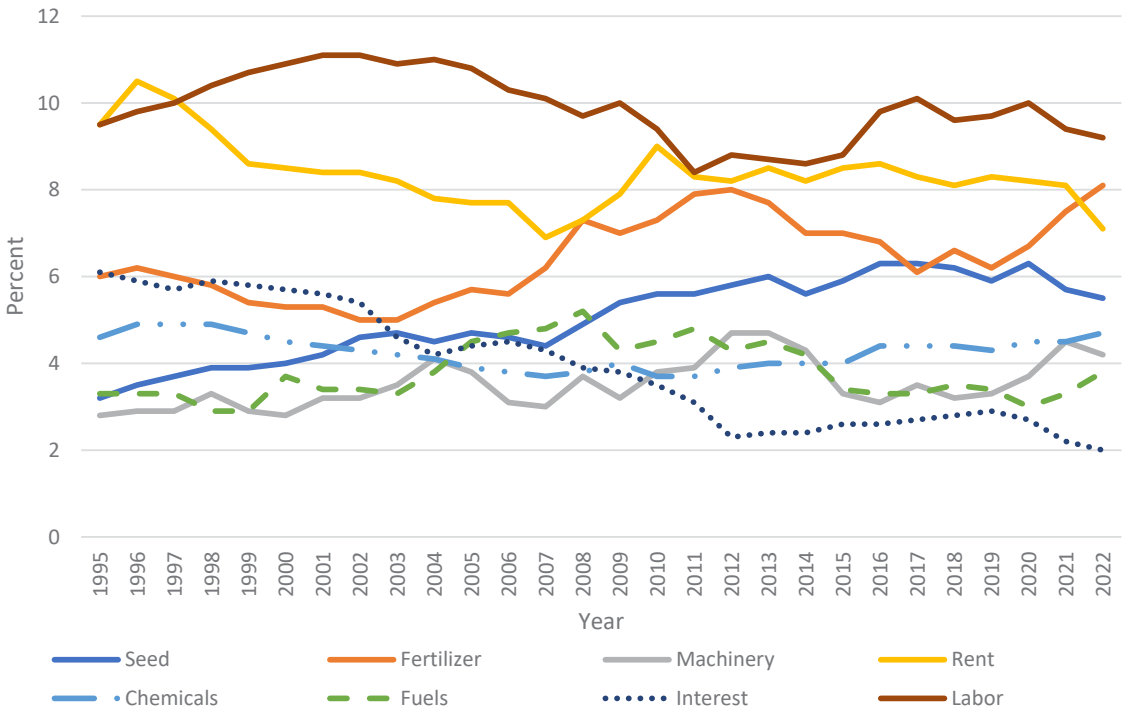
Production Expense Categories for Crop Production Stay Surprisingly Consistent — continued from page 1

With respect to crop production, obviously total cost per acre has increased remarkably, but it is interesting to note how the composition or contribution to cost has remained fairly consistent. Figure 2 shows the percentage contribution to production expenses for seed, fertilizer, machinery, rent, chemicals, fuels, interest and labor. There are often comments and concerns that one or another category of production cost is becoming more burdensome than another. However, though there are ebbs and flows for items like fertilizer, fuels, machinery and labor, over the long run, the percentage those input items contribute to production costs stay fairly consistent. This includes fertilizer, which was nearly 33% higher in 2022 than in 1995 as a percentage of production expenses, but this had happened before from 2010 to 2013 when it declined more in line with where it was in the 1990s. Labor costs were higher relative to other costs in the early 2000s, declined a decade later and are back on the rise again.

There are three exceptions, however. The first is interest costs, which steadily declined from 1995 to 2022. However, since 2021, interest rates have nearly doubled so interest as a percent of total expenses will be increasing in the coming years. Next are seed costs which have nearly doubled as a percentage of total expenses since 1995. Finally, land rents as a percentage of total costs have steadily declined during the same period. However, rents, along with interest rates as a percentage of total costs, can change and revert back to where they were in the mid-1990s. Seed costs, on the other hand, likely will not decline relative to other production costs.

One thing this graph certainly shows is that while some costs may be more volatile than others, they all tend to rise together at a similar rate over the long run. Essentially one cost item may grow at a rapid pace for a while, but others will catch up. Additionally, a cost category may be volatile and will eventually fall back into place, such as fuels and fertilizer have done. This can also be the case for interest expenses and rents, albeit on a much longer timeline.

Figure 2: Crop Production Expenses as A Percentage of Total Costs 1995 – 2022



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Does It Pay to Use Field Peas Instead of DDGS in Beef Cattle Backgrounding/Finishing Rations in North Dakota?

Jon T. Biermacher, Extension Livestock Development Specialist, and
Michael Undi, Assistant Research Extension Center Specialist

Field peas are a palatable source of protein and energy, which makes them a valuable livestock feed. In fact, the energy content of field peas is similar to cereal grains such as corn and barley when included in high concentrate finishing diets. Field peas are primarily grown for human consumption and for the pet food industry; however, the livestock industry is a potential market for field peas in situations where there is excessive field pea production thus saturating the pet food market or production of field peas that do not meet quality specifications for human consumption.

It's noteworthy to point out that field pea production in North Dakota has increased significantly over the past 20 years with acres planted and harvested increasing by more than 68% and yield (lbs/acre) increasing by about 30% over that period (Table 1). Moreover, the total value of the North Dakota edible pea crop has increased by more than 400% in the same period. With the increase in supply of field peas in the state, beef cattle farmers have expressed interest in understanding whether using field peas as a source of energy in their finishing rations is economical compared to ingredients that are more commonly used such as dried distiller grain solubles (DDGS). In response to this interest, we conducted an economic analysis to help producers understand the economic trade-offs between field pea-based rations and DDGS-based rations.

To evaluate the economics of field peas, we utilized data from a beef cattle feeding trial conducted at the NDSU Central Grasslands Research Extension Center located in Kidder and Stutsman counties in North Dakota.

Table 1. Production and value of edible field peas in North Dakota (2003 - 2023)

Variable of interest:	2013	2023	Change (%)
Acres planted	160,000	270,000	68.8%
Acres harvested	155,000	261,000	68.4%
Yield (cwt)	2,744,000	6,003,000	118.8%
Yield (lbs/acre)	1,770	2,300	29.9%
Price ($/cwt)	5.54	15.40	178.0%
Price ($/lb)	0.06	0.15	178.0%
Value of total crop ($)	17,946,000	92,446,000	415.1%

*Source: https://quickstats.nass.usda.gov/results/36378AE1-1332-3183-96B8-9EBE6C09A45F

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Does It Pay to Use Field Peas Instead of DDGS in Beef Cattle Backgrounding/ Finishing Rations in North Dakota?

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The two-year (2020/21 – 2021/22) was conducted beginning in fall of each year using a total of 162 growing Angus heifers weighing on average 656 lbs/hd plus or minus 78 lbs/hd. Heifers were divided into two groups of similar average body weight, and the groups were randomly assigned to six dry lot pens. Three groups of heifers (27 heifers/pen) were assigned randomly to either a field pea-based or corn DDGS-based total mixed ration.

Economic evaluation of the feed costs for each of the two rations (DDGS and peas) was based on the two-year average measures of dry matter intake (lbs/hd/day), total gain (lbs/hd) and days on feed generated from the feeding trial. The two total mixed rations fed to heifers in this study were formulated to be isocaloric and isonitrogenous. Statistical testing revealed that the animal performance (total gain) was the same between the heifers on both feed rations, thus there was no need to account for revenues of cattle for each of the two rations. Therefore, enterprise budgeting techniques were used to calculate the two-year average costs of individual ingredients for each of the two rations. For the study, prices of corn grain ($250/ton), hay ($80/ton) and DDGS ($295/ton) were obtained from a local farm input supplier (Farmers Coop Elevator Company, Streeter, N.D.). In addition, a price of $30.84/ton was used for corn silage and, based on conversations with field pea producers, $332/ton was used as the base-case price for field peas in the analysis.

Two-year average cost of feed for each ingredient on a ($/head/day and $/head basis) are reported in Table 2. The cost of hay, silage, corn grain and supplements equaled $82.09/head (or $1.84/head/day) over the total feeding period, accounted for 87% and 81% of the total cost of the corn DDGS-based ration and field peas-based ration, respectively. The total cost of feed for a representative heifer for the total (fall plus winter) feeding period for the corn DDGS-based ration is $93.89/head (or $2.10/head/day) and is $6.88/head (7.3%) less than the dry peas-based ration cost of $100.77/head (or $2.26/head/ day) for base-case prices of $295/ton and $322/ton for corn DDGS and field peas, respectively. For perspective, at the base-case prices, a producer interested in feeding a group of 100 heifers similar to those fed in the study, the cost of feeding field peas instead of DDGS in the ration would cost an extra $688 over the total feeding period.

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Table 2. Two-year average cost of feed for individual feed ingredients for two total mixed rations for fall, winter, and total grazing periods

	Feeding Period					
	Fall		Winter		Total	
Feed ingredient	$/hd/d	$/hd	$/hd/d	$/hd	$/hd/d	$/hd
Hay	0.29	13.25	0.33	15.24	0.60	27.13
Silage	0.12	5.15	0.13	6.13	0.24	10.95
Corn grain	0.26	11.59	0.32	14.89	0.62	27.14
Supplement	0.09	4.27	0.11	5.15	0.21	9.25
Dry distiller grains (DDGS)	0.11	4.95	0.13	6.06	0.24	10.70
Total cost with DDGS included	0.87	39.22	1.01	47.46	1.90	85.17
Field peas	0.18	8.48	0.20	9.51	0.38	16.95
Total cost with field peas included	0.94	42.75	1.09	50.91	2.05	91.41
Difference in cost between rations	0.07	3.53	0.07	3.45	0.15	6.24

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Table 3 reports differences in the total cost of field peas relative to the total cost of DDGS for alternative combinations of prices of field peas and DDGS that range from ± 50% of the base-case prices. For reference, price combinations that have a negative total cost indicate market situations where field pea-based rations have an economic advantage over corn DDGS-based rations. For instance, in cases where field peas can be purchased at a price 30% below the base-case price (i.e., $232/ton instead of $332/ton), then the price of DDGS must be priced at least 30% higher than the base-case price (i.e., $383/ton instead of $295/ton) for peas to have a $2.28/head economic advantage over DDGS. For a market scenario where peas can be purchased at a price 50% less than the base-case price, the price of DDGS is 50% higher than the base-case price, then a producer would benefit by using peas by $8.37/head, holding all other feed ingredient prices constant. Overall, for a base-case average price of $295/ton for DDGS, the breakeven price for field peas is $209.70/ton, which is 36.8% less than the base-case price of $332/ton for peas and 71% of the base-case price of DDGS. Conversely, for the base-case price of field peas of $332/ton, the breakeven price of DDGS was $467/ton, which was 58.3% more than the base-case price of $295/ton for DDGS and 141% more than the base-case price for field peas. At the respective breakeven prices, producers would be indifferent between using field peas or corn-based DDGS in their total mixed ration.

In conclusion, the results suggest producers could benefit economically from feeding field peas in their cattle rations in situations where excess production of field peas exist and accompanied with a sizeable discounted price. However, producers typically rely on feed supply companies that they have built a trusting relationship with for their feed ingredients that is complemented with a reliable supply of competitively priced feeds. Therefore, the pea industry will have to develop a reliable market for cattle-quality peas or producers will likely not be inclined to switch away from their reliable and trustworthy suppliers.

Please feel free to contact me with any questions at jon.biermacher@ndsu.edu.

Table 3. Difference in total cost of field peas relative to total cost of dry distiller grains (DDGS) ($/hd) for alternative price ($/ton) combinations

		PEAS							
	%	-	-50%	-30%	-10%	Base*	10%	30%	50%
DDGS	-	$/ton	166	232	298	332	366	432	498
	-50%	148	3.42	7.15	10.88	12.76	14.65	18.38	22.1
	-30%	207	1.07	4.79	8.52	10.41	12.29	16.02	19.75
	-10%	266	-1.29	2.43	6.16	8.05	9.94	13.66	17.39
	Base*	295	-2.45	1.27	5.00	**6.88**	8.77	11.76	16.23
	10%	325	-3.64	0.07	3.80	5.69	7.58	11.30	15.03
	30%	384	-6.01	-2.28	1.44	3.33	5.22	8.94	12.67
	50%	443	-8.37	-4.64	0.53	2.42	2.86	6.59	10.31

*Base-case net return assuming a price of $295/ton and $332/ton for DDGS and field peas, respectively.

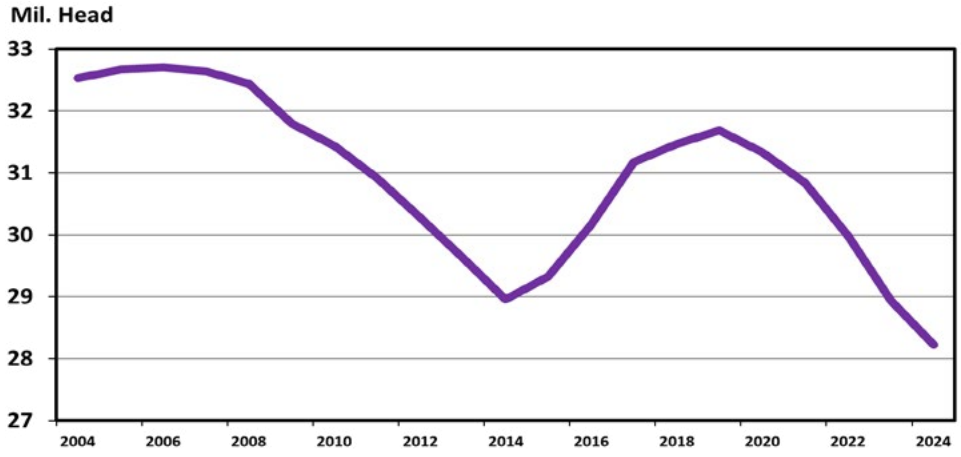
Cyclically Low U.S. Beef Cow Numbers Will Support Prices

Tim Petry, Extension Livestock Marketing Specialist

The USDA National Agricultural Statistics Service (NASS) released the much-anticipated annual "Cattle" inventory report on January 31, 2024. It is available at https://usda.library.cornell.edu/concern/publications/h702q636h.

Given the continuing drought in important cattle-producing regions, with forced liquidation and elevated beef cow slaughter, the big question wasn't if but how much the beef cow herd declined.

January 1 Beef Cow Inventory — U.S., Annual



U.S. beef cows on Jan. 1, 2024, at 28.22 million head were down 716,300 head from the 28.94 million head on Jan. 1, 2023. The 2023 and 2024 numbers were even below the 28.96 million beef cows at the last cyclical low in 2014, which saw the previous record high cattle prices.

2023 marked the fifth straight year of U.S. beef cow cyclical liquidation. Numbers peaked on Jan. 1, 2019, at 31.7 million head, so the five-year decline was about 3.5 million head or 11%.

The rapid cyclical beef cow expansion from 2014 through 2018 meant many cow-calf operations were near fully stocked. Beef production reached record high levels in 2019, which pressured prices. Even with generally favorable grazing conditions, beef cow numbers began the cyclical decline.

The COVID-19 pandemic in 2020 disrupted cattle slaughter capacity and caused volatile and a cyclical low in cattle prices.

Drought also started the year in the Four Corners and Pacific Northwest regions, and expanded throughout the year into much of the western U.S.

Expanding and intensifying drought conditions in 2021 with over 50% of the beef cow herd in areas with at least some drought contributed to continued beef cow liquidation.

Although cattle prices started increasing cyclically in 2021 and continued in 2022 due to the lower cattle numbers and good domestic and export beef demand, drought even worsened in 2022 with 76% of the cow herd in drought by late summer.

Drought conditions in 2023 improved in some important cattle-producing regions, with only 35% of beef cows in drought by year end. And cattle prices reached record high levels.

The top 10 beef cow states in order of importance are Texas, Oklahoma, Missouri, Nebraska, South Dakota, Kansas, Montana, Kentucky, Florida and North Dakota, which account for 57% of the U.S. beef cow herd. All of those states except Kentucky experienced declining beef cow numbers during 2023.

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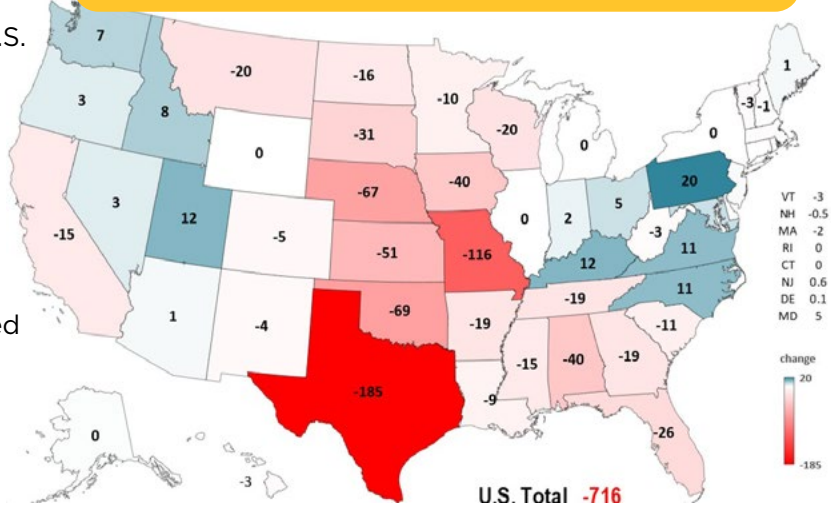
Change in U.S. Beef Cows, 2023 to 2024 (1,000 Head)



Cyclically Low U.S. Beef Cow Numbers Will Support Prices — continued from page 6

Beef cow liquidation was most severe in the Southern Plains with Texas losing 185,000 cows. Missouri had a 116,000 head drop, Oklahoma was down 69,000 and Kansas dropped 51,000 head. Declines continued to move up into the Northern Plains with Nebraska losing 67,000 beef cows, South Dakota dropping 31,000, Montana down 20,000 and North Dakota declining 16,000.

Modest beef cow increases were recorded in a few western, eastern and Appalachian states. Notable increases were Pennsylvania up 20,000 head, Utah and Kentucky increasing 12,000 head each, and 11,000 head expansions in both North Carolina and Virginia.

The 2024 U.S. beef replacement heifer inventory at 4.86 million head declined 71,300 head (1.5%). That was the lowest inventory number since 1950. The number of bred beef heifers expected to calve in 2024 was 3.05 million, down 2% from last year.

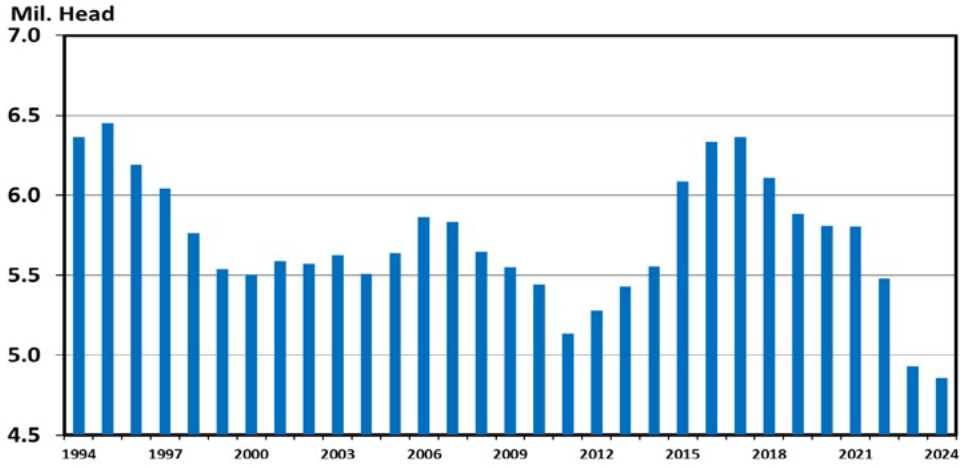
The historical low number of replacement heifers will limit beef cow herd rebuilding this year. Of course, weather remains the wild card to when restocking in earnest can occur. Significant improvement in U.S. moisture conditions have occurred recently, with USDA now reporting only 15% of beef cow areas in drought areas.

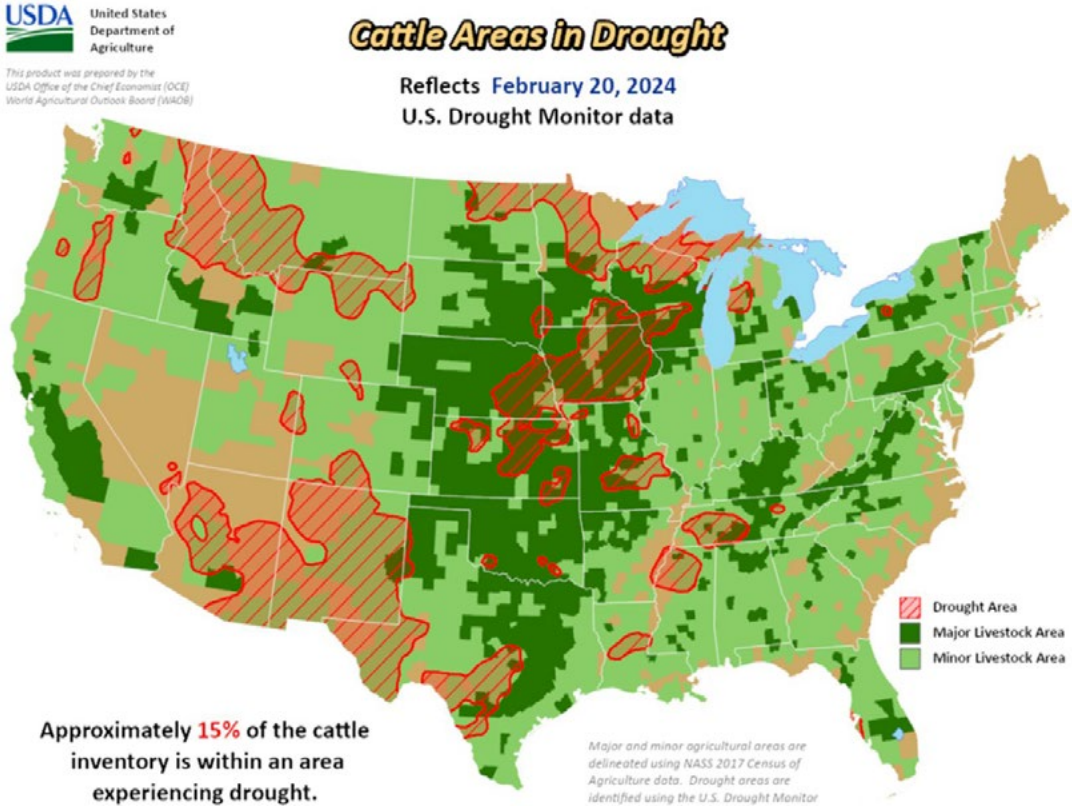
The 2023 U.S. calf crop, which includes beef and dairy calves, declined 2.5% to 33.59 million head and will decline again this year.

The declining beef cow herd and calf crops will mean fewer cattle marketed and declining beef production in 2024 and likely in future years. That will be supportive to cattle prices.

Current cattle prices, except for bred cows and heifers, are at record high levels and are expected to continue to increase cyclically. However, price volatility and risk will likely continue. Drought conditions linger in a few areas, the potential size of the 2024 corn crop is unknown, domestic and export beef demand face challenges, and geo-political tensions continue around the world.

Heifers Held as Beef Cow Replacements — January 1, U.S.





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Competition Between the U.S. and Brazil for Global Soybean Markets Intensifies

Frayne Olson, Extension Crop Economist/Marketing Specialist

Most farm managers in the region recognize the important role that export volumes play in prices for U.S. crops. This is especially true for U.S soybeans. International exports typically account for about 40% of all U.S. soybean usage, according to the most recent USDA World Agricultural Supply and Demand Estimates (WASDE) and Oil Crops Yearbook. Figure 1 shows the historical use of U.S. soybeans by major category.

In addition, U.S. soybean export deliveries are often very seasonal. One of the main reasons is because Brazilian planting, harvest and export seasons are almost exactly opposite of the U.S. periods. In other words, when the U.S. is planting soybeans, Brazil is normally harvesting and exporting soybeans, and vice versa.

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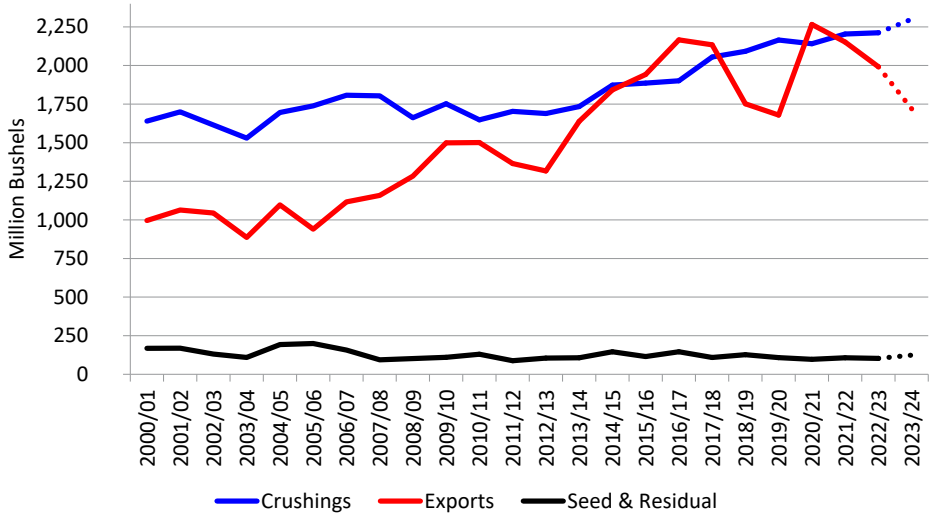
Figure 1: U.S. Soybean Use by Major Category



USDA World Agricultural Supply and Demand Estimates — March 8, 2024, and Oil Crops Yearbook

Competition Between the U.S. and Brazil for Global Soybean Markets Intensifies — continued from page 8

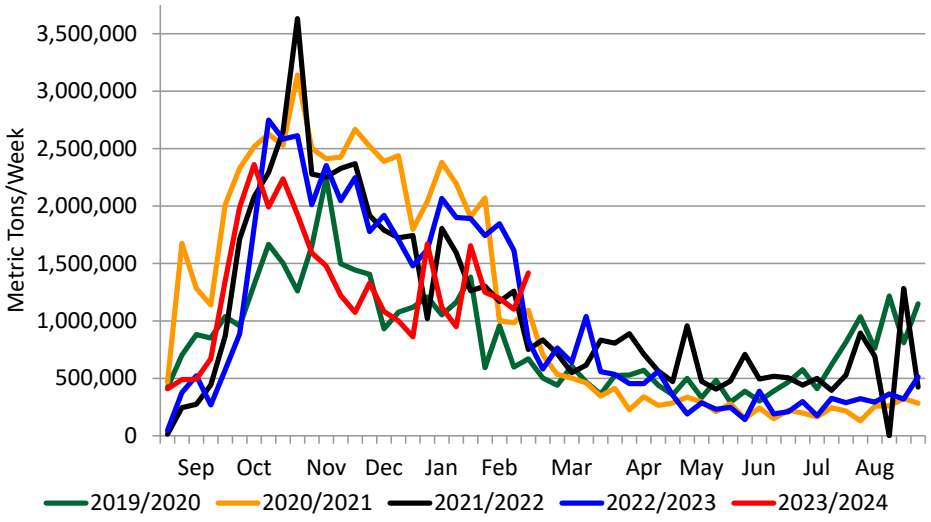
Figure 2 shows the historic U.S. weekly soybeans export sales. Note the strong cyclical pattern in sales levels. This is important because soybeans, corn and wheat must compete for the use of truck, railroad, barge and ocean transportation for grain shipments. This cyclical export pattern can impact transportation availability and rates during the peak shipping season. It can also impact local basis levels. This is because the cash market must ensure the correct amount and quality of grain is delivered to the correct location at the required time. Basis levels in the cash market help signal farm managers, local grain elevators, processors and export terminals about how to efficiently regulate the flow of grain.

Global soybean exports are dominated by two countries: Brazil and the U.S. Brazil is the largest soybean exporter and accounts for about 59% of world exports, the U.S. ranks No.2 with approximately 27% and Paraguay comes in third with about 4%. In contrast, Argentina processes about 70% of its soybeans and exports soybean oil and meal rather than whole soybeans.

Global soybean imports are even more concentrated. Based on the March WASDE, China accounts for approximately 61% of the world's soybean imports, with the European Union ranking second at about 8% of all soybean imports.

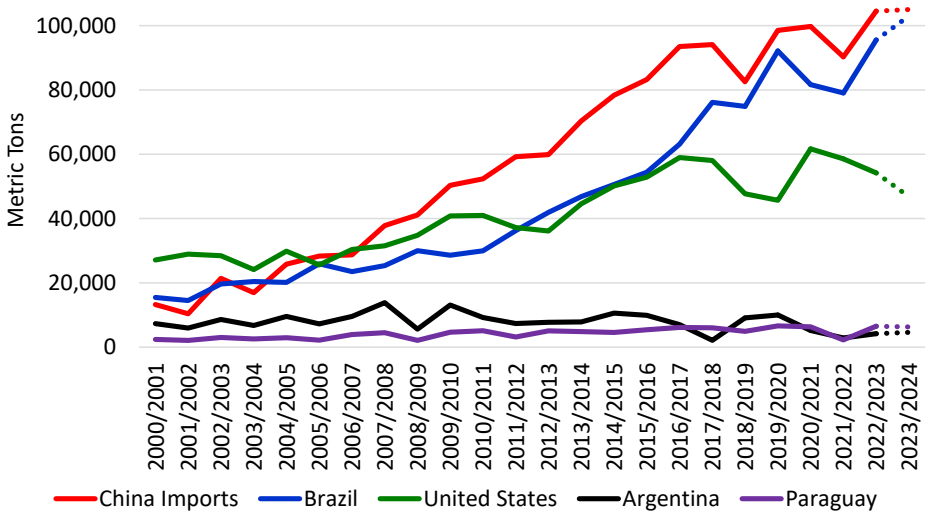
As a result, understanding the dynamics of the world soybean trade is relatively simple: carefully watch the soybean trade flows between China, Brazil and the U.S. Unfortunately, this is not as easy as it seems because these trade flows are always changing. Figure 3 shows the historical Brazil, U.S., Argentina and Paraguay whole soybean exports to all countries versus Chinese soybean imports as a reference.

Figure 2: Historic Weekly U.S. Soybean Export Sales



USDA Export Sales Report — 09/05/19 to 02/29/24

Figure 3: Historic Brazil, U.S., Argentina and Paraguay Soybean Exports and China Soybean Imports



USDA Production, Supply and Distribution Online

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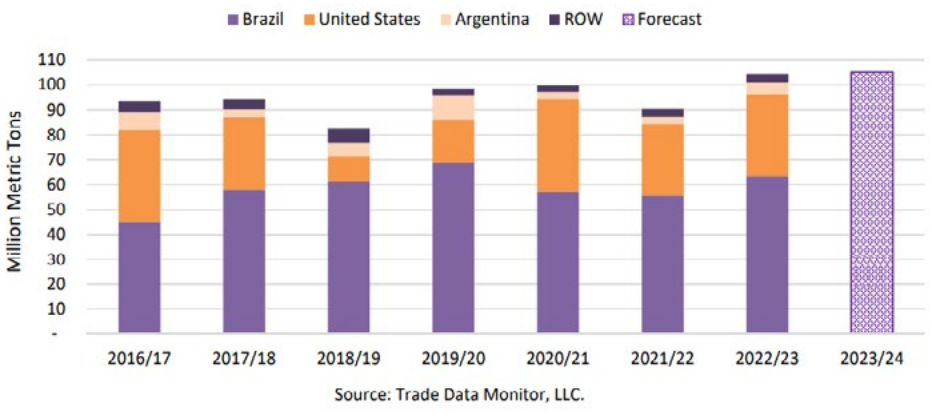
Competition Between the U.S. and Brazil for Global Soybean Markets Intensifies – continued from page 9

Brazil has become the dominant soybean supplier to China. Figure 4 shows the historic Chinese soybean imports by country for the past seven marketing years. The significant drop in Chinese imports from the U.S. during the 2018/19 and 2019/20 marketing years was due to the U.S. – China trade war. The rapid recovery in U.S. exports to China in the 2020/21 marketing year was because of the Phase I trade agreement. Since the 2020/21 marketing year, Chinese purchases of U.S. soybeans have been relatively stable, with imports from Brazil increasing.

Figure 4: Chinese Soybean Imports by Country



USDA Oilseeds: World Markets and Trade, March 2024

In the 2023/24 marketing year, Brazil produced a record large soybean crop of about 162.0 million metric tons, while the U.S. produced about 116.2 million metric tons. The large crop in Brazil reduced its domestic prices and made Brazilian soybeans more competitive in the international market. This has created incentives for China to purchase more of their current soybean needs from Brazil and for a longer time before switching to U.S. supplies.

The size of the 2024 Brazilian soybean crop is still being debated. Private estimates range from 135 to 157 million metric tons, with the USDA forecasting 155 million metric tons (March WASDE).

Even though there have been weather problems in Brazil, lowering the expected size of their 2024 soybean crop, these problems have not resulted in additional U.S. soybean export sales to China. Is this because Brazil has more 2023 soybeans in storage than projected, but the U.S. can regain market share in the future? Is it because the U.S. is simply not price competitive?

Are the lower export sales because China does not consider the U.S. a reliable supplier due to previous trade tensions? Can the U.S. expand other export markets to replace shrinking Chinese purchases?

I have been asked these questions many times during this winter meeting season, and I really don't know. I have studied the trends presented in this article and searched for trade news to give some hints to an answer. Unfortunately, I have not found any clear reasons. I believe we will just need to wait and watch market trends very carefully to try to find an answer. Hopefully, the information in this article will give you the background information to form your own opinions, watch for shifting trends and make better decisions in the future.