Agriculture By the Numbers

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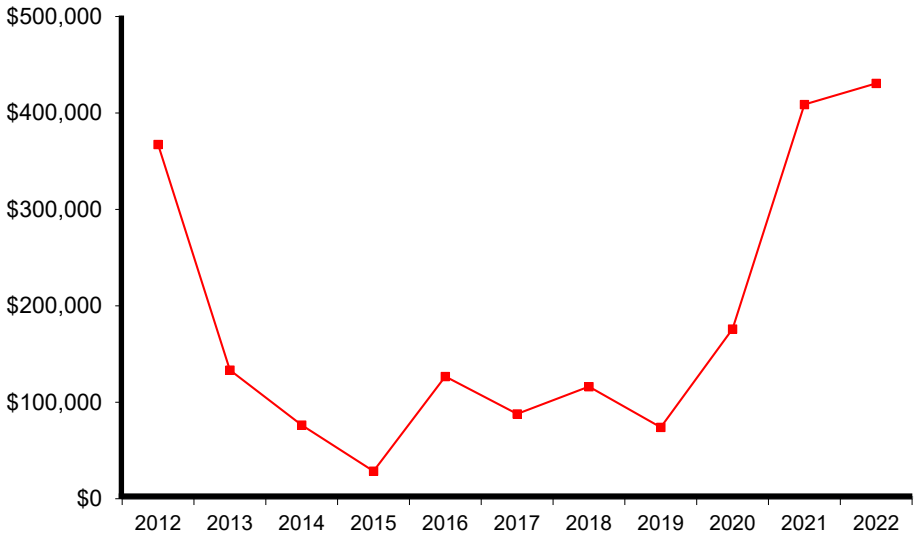
High Land and Equipment Prices Limit Rates of Return for North Dakota Farming

By Bryon Parman, Assistant Professor/Agricultural Finance Specialist

2021 and 2022 have been excellent years on average for North Dakota farmers as net farm incomes significantly exceeded those experienced in what was previously a record in 2012. According to the state farm business management data collected by the North Dakota Department of Career and Technical Education, Farm Management Education Program, net farm income in 2021 and 2022 averaged over $400,000 per farm statewide. Before 2021, record net farm income was achieved in 2012 at just over $367,000 per farm which occurred due to major drought though much of the U.S. excluding North Dakota.

Figure 1: North Dakota Net Farm Income in Dollars: 2012 - 2022



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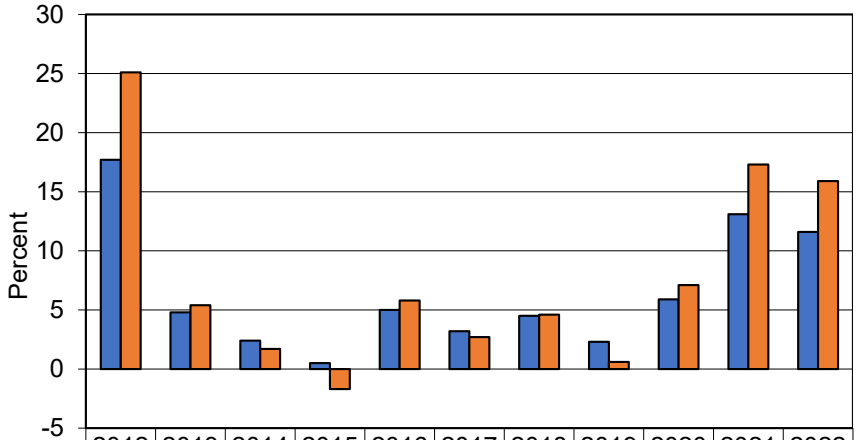
However, the rates of return on assets and equity in 2021 and 2022 were considerably lower than 2012. In 2012, which was the previous high-water mark for net farm incomes, the rate of return on assets was 17.7% and the rate of return on equity was 25.1%. In 2022, the rates of return on assets and equity were 11.6% and 15.9% respectively despite net farm incomes being nearly $67,000 higher compared to 2012. In fact, despite net farm income being nearly $22,000 higher in 2021 vs. 2022, rate of returns on assets and equity fell 1.5% and 1.4% respectively.

Figure 2: Rate of Return on Assets and Equity in North Dakota: 2012 – 2022



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
RoR on Assets	17.7	4.8	2.4	0.5	5	3.2	4.5	2.3	5.9	13.1	11.6
RoR on Equity	25.1	5.4	1.7	-1.7	5.8	2.7	4.6	0.6	7.1	17.3	15.9

While costs for almost all inputs have increased dramatically in the last two year, so too have gross incomes as illustrated by overall net profits setting records. However, the cost of farm land and machinery has skyrocketed. From January of 2021 to Jan 2023, the producer price index for farm machinery and equipment increased almost 34%. In North Dakota, land prices have increased 13.46% from 2022 – 2023 and 10.9% from 2021 – 2022. This makes for a combined increase in farmland prices over the last two years of approximately 25.8%.

What this implies is that the value of farm equipment and farmland is much higher relative to net farm income potential than it was as recently as just a couple years ago. This represents one of the biggest challenges that current farmers, and especially new or beginning farmer face. The capital investment required to begin farming, or maintain an existing farm is extremely high compared to other businesses. Also, due to economies of scale, there is a high floor for the number of acres and amount of equipment necessary to get started making starting small very difficult without other outside employment or help from an established farm.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Higher Interest Rates Impacting Storage Costs and Marketing Plans

Frayne Olson, NDSU Extension crop economist/marketing specialist

The economics of on-farm grain storage is actually more complicated than many people think and can vary considerably from farm to farm. Many farm managers view the cost of the bin, loading and unloading systems, and drying systems as a cost for producing crops. Their view is that on-farm storage increases harvest efficiency by reducing the wait times for trucks hauling grain away from the combine.

Other farm managers think of on-farm storage as a key tool in their long-term marketing strategy. In their view, the costs of storage are linked to crop marketing, not crop production. On-farm storage allows flexibility to manage cash flow needs, take advantage of unexpected futures price increases, and provides an opportunity to benefit from strengthening basis levels.

Please remember that when storing grain, either on-farm or in commercial storage, anticipating (or hoping for) a price increase is a form of speculating. The farm manager gains, dollar for dollar, when prices increase, but also loses dollar for dollar when prices decrease. This is not necessarily a bad decision, but it is important to recognize that storage without a price risk management strategy is speculating.

There isn't enough space in this article to cover all of the interactions between on-farm grain storage, grain market price dynamics and marketing strategies. However, the increase in interest rates since mid-March 2022, has dramatically changed the costs for storing grain. It is important that farm managers understand these changes and take time to reevaluate their storage and marketing strategies.

Table 1 below shows a comparison between the interest costs for storing spring wheat, corn and soybeans based on spot market prices for grain in on-farm storage. The cash prices are an average of several elevators in east central North Dakota on June 8, 2022, and June 8, 2023. The interest rate used represents the typical rate for a farm operating loan. The assumption is that grain in storage could be sold and used to finance the farming operation. So, stored grain should generate a return at least as high as the interest rate charged on a farm operating note.

Even though the market prices for grains have dropped from 2022 to 2023, the interest rates have increased more rapidly. The total interest expense per bushel per month has increased 32% for hard red spring wheat, 58% for corn and 55% for soybeans. While these increases are only a few cents per bushel per month, they add up over time and as more bushels are stored.

For example, the total interest costs for storing 50,000 bushels of corn for four months went from $4,800 in 2022 to $7,667 in 2023. Interest costs for storing 50,000 bushels of soybeans for four months went from $10,800 in 2022 to $16,800 in 2023.

The core takeaway is that on-farm grain storage can be profitable, but increased interest expenses must be incorporated into your marketing plans. Changes in the intermonth futures market prices, normally called the "carry in the market," as well as strengthening basis levels will need to be larger to cover the higher interest costs. Finally, most elevators have already adjusted their monthly commercial storage costs to cover the increased interest expenses their companies are experiencing.

Table 1 – Estimated interest costs for on-farm storage

Crop	Average Cash Price on June 8, 2022	Estimated Interest Cost at 4.0% APR	Average Cash Price on June 8, 2023	Estimated Interest Cost at 8.0% APR	Percentage Change in Cost/ Bu./Month
	(per bushel)	(Cost/Bu./Month)	(per bushel)	(Cost/Bu./Month)	
Hard Red Spring Wheat	$11.50	$0.038	$7.50	$0.050	+32%
Corn	$7.20	$0.024	$5.75	$0.038	+58%
Soybean	$16.20	$0.054	$12.60	$0.084	+55%

Changes Across Time in the Beef Cattle Inventory in the Central 15-State Region of the United States

By Jon T. Biermacher, Ph.D., Extension Livestock Development Specialist

Dating back more than 100 years, the United States Department of Agriculture's National Agricultural Statistics Service (USDA-NASS) has been collecting and reporting various categories of useful data surrounding the beef cattle industry for each state in the U.S. This data is available to the public free of charge in the form of a searchable database known as Quick Stats and can be accessed online at: https://quickstats.nass.usda.gov/.

For this article, data reflecting beef cattle inventory (cows per state) for the 15 states making up the middle part of the country that represent the primary cattle production region in the U.S. are reported and discussed in Table 1. Data were collected over the 103-year period between 1920 and 2023 for the 15-states, including Arkansas, Colorado, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming. Note that states in Table 1 have been sorted by the percentage change in the beef cattle inventory (last column) from highest percentage change to lowest.

Over the 103-year period, Arkansas realized the greatest percentage increase in total number of beef cows, beginning with 86,000 cows on Jan. 1, 1920, to 866,000 on Jan. 1, 2023, or a 907% increase over the period. North Dakota saw the second largest increase in cow numbers across the period, moving from 152,000 head in 1920 to 876,000 head in 2023 for a 476% increase. Over the 103-year period, Texas maintained the largest beef cattle herd in the nation with more than 2.8 million head in 1920 and growing to 4.3 million head in 2023, realizing a 51% increase in inventory over the period. It is noteworthy to point out that Texas realized the second smallest total percent increase in inventory compared to all other states except Colorado over the 103-year period evaluated. Colorado realized the lowest percent increase at 38%.

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Table 1. Beef Cow Inventory (head) by Year, State and Region

State/Region	1920	1940	1960	1980	2000	2023	Change (%)
Arkansas	86,000	120,000	554,000	1,079,000	928,000	866,000	907%
North Dakota	152,000	120,000	648,000	962,000	970,000	876,000	476%
Oklahoma	383,000	432,000	1,390,000	2,161,000	1,898,000	1,981,000	417%
Missouri	395,000	429,000	1,135,000	2,278,000	2,062,000	1,945,000	392%
South Dakota	463,000	280,000	1,250,000	1,527,000	1,734,000	1,533,000	231%
Montana	397,000	386,000	1,114,000	1,427,000	1,582,000	1,270,000	220%
Minnesota	122,000	93,000	335,000	560,000	400,000	360,000	195%
Kansas	547,000	467,000	1,195,000	1,716,000	1,492,000	1,315,000	140%
Nebraska	732,000	640,000	1,499,000	1,950,000	1,974,000	1,703,000	133%
Wyoming	300,000	347,000	550,000	620,000	824,000	671,000	124%
Texas	2,850,000	2,407,000	4,206,000	5,585,000	5,430,000	4,300,000	51%
Colorado	465,000	450,000	761,000	853,000	835,000	642,000	38%
Louisana	507,000	656,000	1,081,000	790,000	555,000	445,000	-12%
New Mexico	876,000	744,000	671,000	665,000	800,000	725,000	-17%
Iowa	1,747,000	1,895,000	1,936,000	2,118,000	1,240,000	1,100,000	-37%
15-state Region	10,022,000	9,466,000	18,325,000	24,291,000	22,724,000	19,732,000	97%
USA	12,525,000	10,676,000	26,344,000	37,107,400	33,575,000	28,917,900	131%
Regional % of USA	80.02%	88.67%	69.56%	65.46%	67.68%	68.23%	-14.72%

Source: https://quickstats.nass.usda.gov/

Changes Across Time in the Beef Cattle Inventory in the Central 15-State Region of the United States

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Table 1 also reports the beef cattle inventory at the national level and the inventory in the 15-state region as a percentage of the national total. It is interesting to note that the inventory of cows in 1920 in the 15-state region comprised roughly 80% of the total inventory of beef cows in the U.S. By 1940, almost 90% of the nation's inventory was located in this region, but the percentage has been declining since. As of Jan. 1, 2023, the inventory in the 15-state region has declined over the 103-year period by about 15%, now only representing about 68% of total inventory in the country. This is an indication that states outside the 15-state region have been expanding the number of beef cattle over this period.

For the most part, beef cattle inventory peaked in most states somewhere between 1980 and 2000. The exception is Oklahoma, which has realized a slight increase in their inventories between 2000 and 2023. It is important to point out that over this same period where beef cow numbers peaked, the average body weight of weaned calves has increased significantly, with multiple studies reporting average increases in weaning weights of more than one pound per head per year over this period (Lalman, 2019). So, even though cattle numbers have declined for most states between 1980 and 2023, the total pounds of weaning weights sold per cow (and per acre) have increased significantly with the increase in weaning weights attributed to the on-farm adoption of improved genetics in cows (and breeding bulls) and better management practices.

Using the data reported in Table 1, the beef cow inventory by year and state calculated as a percent of the total 15-state region beef cow inventory was calculated for each state and reported in Table 2. This data was also sorted by state based on the percentage change between 1920 and 2023 (i.e., the last column in the table). Over the 103-year period, 10 out of 15 states realized a significant increase in the regional concentration of beef cow inventory, including Arkansas, North Dakota, Oklahoma, Missouri, South Dakota, Montana, Minnesota, Kansas, Nebraska and Wyoming. As an example, in 1920 North Dakota's cow inventory was 2.21% of the 15-state region's total inventory; however, by 2023 North Dakota's cow inventory grew to about 4.44% of the regional total, a growth of 193% over the 103-year period. In comparison, Texas, Colorado, Louisiana, New Mexico and Iowa realized a reduction in their respective percentage contribution of the 15-state region's total beef cattle inventory. For example, in 1920 Iowa accounted for less than 18% of

Table 2. Beef Cow Inventory by Year and State as a Percent of the 15-State Region

State/Region	1920	1940	1960	1980	2000	2023	Change (%)
Arkansas	0.86%	1.27%	3.02%	4.44%	4.08%	4.39%	411%
North Dakota	1.52%	1.27%	3.54%	3.96%	4.27%	4.44%	193%
Oklahoma	3.82%	4.56%	7.59%	8.90%	8.35%	10.04%	163%
Missouri	3.94%	4.53%	6.19%	9.38%	9.07%	9.86%	150%
South Dakota	4.62%	2.96%	6.82%	6.29%	7.63%	7.77%	68%
Montana	3.96%	4.08%	6.08%	5.87%	6.96%	6.44%	62%
Minnesota	1.22%	0.98%	1.83%	2.31%	1.76%	1.82%	50%
Kansas	5.46%	4.93%	6.52%	7.06%	6.57%	6.66%	22%
Nebraska	7.30%	6.76%	8.18%	8.03%	8.69%	8.63%	18%
Wyoming	2.99%	3.67%	3.00%	2.55%	3.63%	3.40%	14%
Texas	28.44%	25.43%	22.95%	22.99%	23.90%	21.79%	-23%
Colorado	4.64%	4.75%	4.15%	3.51%	3.67%	3.25%	-30%
Louisana	5.06%	6.93%	5.90%	3.25%	2.44%	2.26%	-55%
New Mexico	8.74%	7.86%	3.66%	2.74%	3.52%	3.67%	-58%
Iowa	17.43%	20.02%	10.56%	8.72%	5.46%	5.57%	-68%
15-state Region	100%	100%	100%	100%	100%	100%	–

Changes Across Time in the Beef Cattle Inventory in the Central 15-State Region of the United States

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the 15-state regional total cow inventory. However, by 2023 Iowa only accounted for about 5.5% of the regional total inventory, representing a 68% reduction in that state's contribution of the total regional inventory over the 103-year period. Much of Iowa's reduction in their beef cattle inventory is likely due to relative increases in net returns ($/acre) associated with alternative crops such as corn and soybeans, resulting in statewide conversion of pastureland acres to cropland acres. This is likely true for other states, too.

In summary, there has been quite a few changes in the inventory of beef cattle in the United States over the past 103 years with much of the expansion taking place in the central part of the country, especially in states like Arkansas, North Dakota, Oklahoma and Missouri. In most of the 15-state region, expansion started to peak in the 1980s and has continued through 2023. Going back to 1940, the overall share of the beef cattle inventory held by the 15 states that comprise the central part of the country was 90% of the national inventory. This share has since declined by about 15% and accounts for only 60% of the national beef cattle inventory as of Jan. 1, 2023.

In the next issue of Ag by the Numbers, I will report and discuss the implications of the USDA-NASS data surrounding the changes in the size of beef cattle operations (head per operation) for the same 15-state region over the same 103-year period of time. Stay tuned.

For questions or comments please contact me at jon.biermacher@ndsu.edu.

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Shorter Supplies Supporting Cattle Prices

Tim Petry, Extension Livestock Marketing Specialist

After a long cold winter, the month of May brought hot and even record high temperatures to North Dakota. The cattle market also heated up with record high prices for some cattle market classes as well.

Tighter supplies of cattle and beef are supporting prices and will continue to do so. Four straight years of U.S. beef cow herd liquidation has resulted in smaller calf crops, cattle on feed and beef supplies.

U.S. beef cows on Jan. 1, 2023, at 28.92 million head were down over one million head from the 29.98 million head on Jan. 1, 2022. That was one of the largest yearly declines in decades. The 2023 numbers were even below the 28.96 million beef cows at the last cyclical low in 2014, which saw record high cattle prices.

Expanding and intensifying drought conditions in 2021, with over 50% of the beef cow herd in areas with at least some drought, contributed to 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 worsened in 2022 with 75% of the cow herd in drought by October.

The 2022 U.S. calf crop (includes beef and dairy calves) declined 2% at 34.46 million head and will decline again this year and next year.

Beef production at 28.3 billion pounds in 2022 was a record high spurred by drought-induced, high beef cow and heifer slaughter. The USDA predicts beef production to decline over 4% to 27 billion pounds in 2023 and to decline again in 2024 to 24.8 billion pounds.

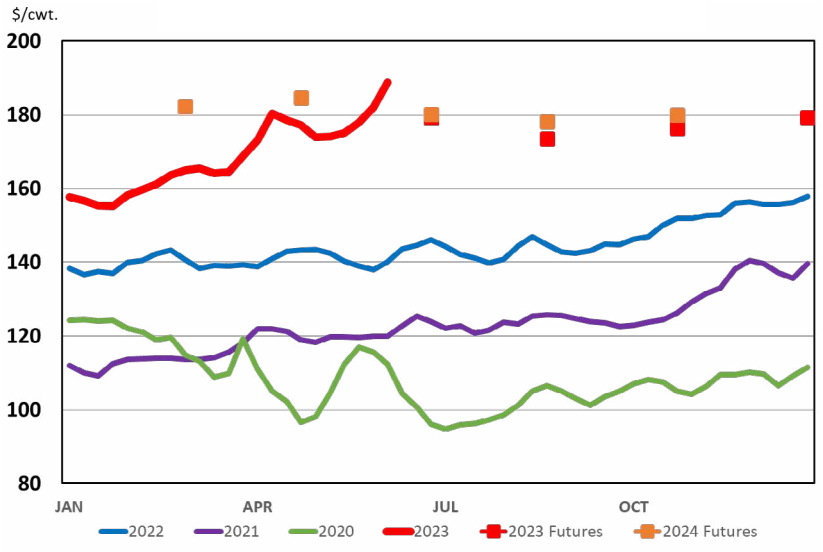
This year, beef supplies have continued to tighten with beef production down every week except one week in January. For the first 20 weeks of the year, beef production has declined 5% as predicted. Fed cattle slaughter is down 2.5%. Beef cow slaughter is down 11% as U.S. drought conditions have improved with 40% of the beef herd now in drought areas compared to 75% last October.

Beef demand has been stronger than some expected, especially with concerns about the economy. High inflation, increasing interest rates and major bank collapses have been headwinds.

The 2023 choice boxed beef cutout value has generally been increasing at higher levels than last year, which suggests strong consumer demand. The cutout is at a historic high level, only outdone by the temporary spike during the peak of the 2020 COVID-19 market disruption. Last week, the choice cutout was 20% higher than last year at $324.49 per hundredweight.

Shorter supplies and strong demand are supporting fed cattle prices. Fed steer prices have generally been increasing and are at higher levels than last year. Last week, fed steers averaged $188.75 per hundredweight, which is a record high and about $48 higher than last year. On a dressed-weight basis, fed steers averaged $299.21, also record high. The USDA is predicting fed steers to average $171.72 per hundredweight in 2023 and $180 per hundredweight in 2024.

Fed Steer Prices
5 Market Weighted Average, Weekly



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Shorter Supplies Supporting Cattle Prices

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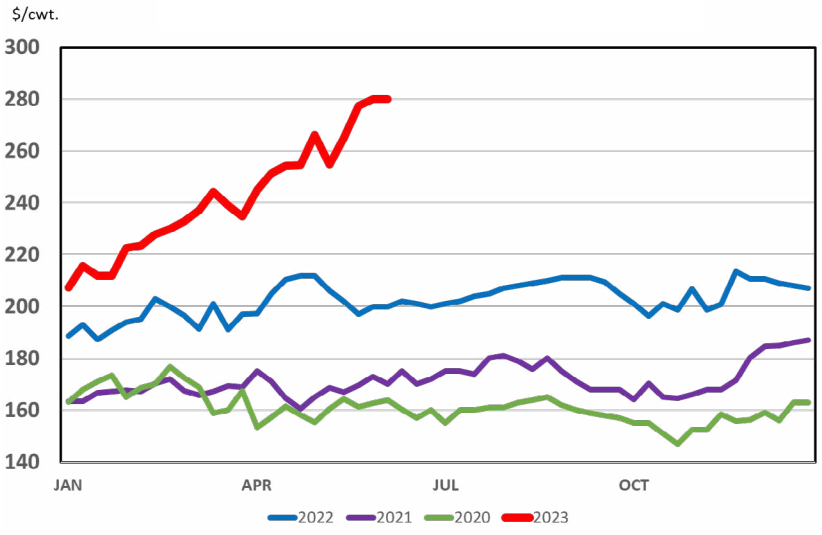
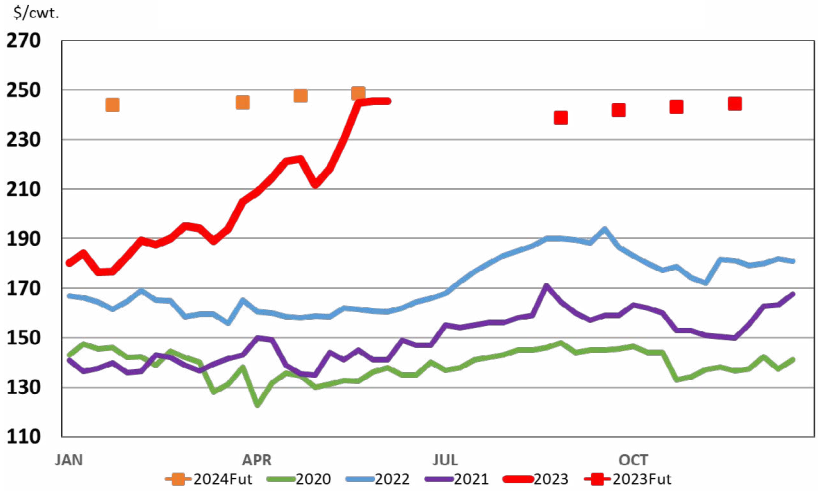
The two factors that affect calf and feeder cattle prices the most are fed cattle prices, especially live cattle futures prices in the month when the feeder cattle will reach slaughter weight, and corn prices.

Strong fed cattle prices and declining corn prices have been supportive to calf and feeder cattle prices. Furthermore, improving U.S. moisture conditions have supported calf prices for summer grazing programs. The U.S. Drought Monitor is reporting only abnormally dry conditions in northeast and southwest North Dakota. The North Dakota average price for 550- to 600-pound feeder steers at $280 per hundredweight is up $80 per hundredweight from last year.

Medium and Large #1 Steer Calf Prices
550-600 Pounds, N.D., Weekly



Medium and Large #1 Feeder Steer Prices
750-800 Pounds, N.D., Weekly



The USDA is predicting a record high 2023 corn crop at 15.265 billion bushels, which is pressuring corn prices. Declining corn prices have supported the heavier-weight feeder cattle prices. North Dakota 750- to 800-pound steer prices are averaging $246 per hundredweight, also up about $80 per hundredweight from last year.

When cattle prices are at historic high levels, price volatility is usually also high. Corn price volatility is expected as information about crop development and expected yield becomes available.

The Corn Belt is starting to experience dry conditions with the USDA reporting 45% of U.S. corn production currently experiencing drought.

So, there is risk for lower cattle prices. During the increasing phase of the cattle price cycle, marketing plans that establish floor prices but leave the top side open are recommended.