

Agriculture By the Numbers

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NDSU Extension Agribusiness and Applied Economics

Using Individual Animal Measurement Technology to Improve Feed Efficiency

Early Look at Farmland Values for 2023 Shows A Slower Increase Than 2022

U.S. and North Dakota Beef Cow Liquidation Will Support Prices

Understanding the Black Sea Grain Initiative Renewal

Using Individual Animal Measurement Technology to Improve Feed Efficiency

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The development of individual animal measurement technologies such as Vytelle's Sense (formally GrowSafe), Tru-Test Walk-over-Weighing (WOW) systems, and C-Lock's SmartFeed and SmartScale system are allowing researchers the ability to improve the efficiency for how large and small ruminant species convert feed into desired weight gain at the farm. As an example, an initial study of dry matter intake (DMI) of beef cows conducted in Louisiana revealed there were as many smaller, lighter weight cattle that had below average DMI as there were larger, heavy cattle. These results were the first to challenge the popular notion that only large, heavy cattle do not efficiently convert feed into pounds of beef. Based on this result, we wanted to know what would be the value to cow-calf producers who could easily identify and cull out inefficient animals (large and small) from their herds? To address this question, my colleagues and I conducted a study to determine the economically optimal stocking rates (head/acre) and economic net returns (\$/acre) for six alternative cow-calf production systems.

Data were collected from a feeding trial (replicated twice) initiated in September 2019 at the Noble Research Institute's Individual Animal Measurement drylot facility in south-central Oklahoma. Forty-eight spring-calving commercial Angus cows (1,561 pounds, plus or minus 115 pounds, and 7.0 years, plus or minus 8 months) were chosen from a pool of 90 contemporaries to participate in the study. Prior to trial initiation, spring calves were weaned and cows were managed as a group for 14 days while transitioning from lactating to non-lactating. Following the post-weaning adjustment period, cows were stratified by relative feed intake (RFI) genomic score, initial body weight, age and days pregnant at trial initiation and randomly assigned, 12 cows per pen, to one of four pens each equipped with four GrowSafe intake units. Three cows were eliminated from the study due to incomplete data, providing data for 45 cows.

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Continued on page 2.

Using Individual Animal Measurement Technology to Improve Feed Efficiency — continued from page 1

A hay diet treatment (HAY) consisting of 100% chopped grass hay (10% crude protein, 53% total digestible nutrients) was fed three times per day. The HAY diet also had 10% water added to reduce dust and improve ease of delivery. The HAY diet was designed to represent a proxy for a pasture-only diet representing the typical quality associated with pastures commonly used by cow-calf producers in the Southern Great Plains (SGP). A 14-day warm up period was conducted to allow cows to adapt to the diet, feeders and cohorts. Following the warm-up period, DMI data was collected for 50 days. Initial, midpoint and ending measures of cow body weight and average individual daily measures of DMI of HAY diets were collected in the trial. The spring-calving calves born to the dams used in the trial were weaned in the fall of 2020 and their weights were adjusted to a 205-day weaning weight (WW) in order to minimize variation surrounding calf birthdate. Mixed regression models were estimated using the data from the feed efficiency trial and were used to test a number of hypotheses necessary to justify using the individual animal measurement data for the economic analysis.

Two additional sets of cows, comprised from two subsets of the original 45 cows used in the feed efficiency trial, were used in the economic analysis, including the 22 cows that represent the upper 50% of cows in terms of DMI, and the 12 cows that represent the upper 25% of cows in terms of DMI. Two pasture types common to the Southern Great Plains (i.e., introduced bermudagrass (BG) and native prairie grass (NG)) were superimposed on the three herds, providing for six alternative cow-calf production systems. The six alternative production systems are designated henceforth as AvgBG, AvgNG, 50%BG, 50%NG, 25%BG and 25%NG.

Enterprise budgeting techniques were used to calculate expected revenues, production costs and net returns for the six cow-calf production systems. Revenues were calculated as the product of 10-year (2010-2020) average calf price (average steer prices for steers and average heifer prices for heifers) times 205-day adjusted WW (pounds/head) times stocking rate (SR, head/acre). Only production costs that differed between the two forage systems (BG and NG) were included in the analysis.

Continued on page 3.



Using Individual Animal Measurement Technology to Improve Feed Efficiency — continued from page 1

Table 1. Measures of Forage and Animal Production and Costs, Revenues, and Net Returns for Alternative Cow-calf Production Systems

Production/Economic Variable:	Forage-based production system*					
	AvgBG	50%BG	25%BG	AvgNG	50%NG	25%NG
Number of cows	45	22	12	45	22	12
Annual forage production (lb/ac)	5000	5000	5000	4618	4618	4618
Pasture utilization rate (%)	0.70	0.70	0.70	0.35	0.35	0.35
Annual forage available (lb/ac)	3500	3500	3500	1616	1616	1616
Average cow weight (lb/hd)	1459	1459	1420	1459	1459	1420
Average weaning weight (lb/hd)	609	577	581	609	577	581
Average dry matter intake (lb/hd/day)	30.07	25.71	23.49	30.07	25.71	23.49
Stocking rate (hd/ac)	2.63	3.07	3.35	1.04	1.22	1.33
Total cost (\$/ac)	220	230	236	64	70	73
Gross weaning weight (lb/ac)	259.85	287.70	316.19	103.06	114.18	125.79
Average price of steers and heifers (\$/lb)	1.67	1.67	1.67	1.67	1.67	1.67
Gross revenue (\$/ac)	431	477	524	171	189	209
Net return (\$/ac)	210	247	289	107	120	136

*AvgBG and AvgNG represent the conventional herd with an average combination of DMI for large and small efficient and inefficient cows on bermudagrass (BG) and native prairie grass (NG) pastures, respectively; 50%BG, 25%BG and 50%NG and 25%NG represent the upper 50% and upper 25% of large and small efficient cows on bermudagrass (BG) and native prairie grass (NG) pastures, respectively.

Production and economic results by production system are reported in Table 1. For BG pastures, SR increased by 16.83% and 27.57% for the 50%BG and 75%BG herds, respectively, compared to the AvgBG herd. Similar percent increases were found for the two more efficient (50%NG and 25%NG) systems. Increases in SR resulted in an increase in total gross WW per hectare by 10.72% and 19.58% for the 50%BG and 25%BG cow-calf systems compared to the AvgBG system. Due to increases in stocking rates, costs (\$/acre) tied to stocking rates for all four of the more efficient systems increased by a range of 4.46% for the 50%BG system to a 13.34% increase for the 25%NG system. Overall, net return for the four more-efficient systems increased by a range of 12.06% for the 50%NG system to 31.71% for the 25%BG system.

Overall, the results suggest the expected economic value from improving overall herd efficiency is not trivial, ranging between \$13 per acre for the 50%NG system and \$80 per acre for the 25%BG system. Having knowledge about the value of improving the efficiency for how beef cattle convert feed into weaning weight will help beef cattle researchers

develop strategies and other technologies that will aid producers in finding easy ways to cull inefficient (large and small) cows from their herds over time, leading to improvements in their bottom lines. Investments in individual animal measurement technologies are rapidly being made at North Dakota State University's Research Extension Centers located throughout the state. As a result, a whole host of research studies focused on improving feed efficiency for beef cattle on pasture, calves on feed, dairy cattle, pigs and hogs, sheep, and poultry are now being conducted in an effort to raise profitability in animal agriculture in the great state of North Dakota.

Early Look at Farmland Values for 2023 Shows A Slower Increase Than 2022

By Bryon Parman, Assistant Professor/Agricultural Finance Specialist

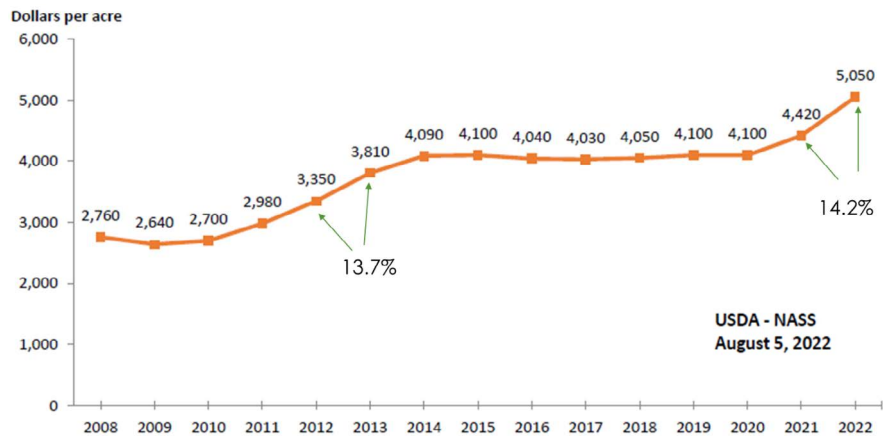
From 2021 to 2022, farmland values increased sharply. According to the U.S. Department of Agriculture's National Agricultural Statistics Services (NASS), cropland prices across the U.S. increased 14.2%. This was the highest increase since 2012-2013 when cropland prices nationally increased 13.7%. States such as Nebraska and Kansas saw increases of over 20% in cropland values, while states such as Arizona and New Mexico were below 10%. North Dakota's and Minnesota's average cropland value increases from 2021 to 2022 were closer to the national average at 14.1% and 17.6% respectively.

However, a recent report from the Kansas City Federal Reserve's economists Francisco Scott and Ty Krietman, Feb. 17, 2023, shows that land values may be cooling in 2023. The 10th District, comprised of Kansas, western Missouri, Nebraska, Oklahoma, Colorado, northern New Mexico and Wyoming, shows farmland values increasing at 10% heading into 2023. This is much lower than the same report the year before, showing an increase in the same region closer to 24%. In fact, a quarter of lenders from the Kansas City Federal Reserve's survey reported that land in some areas was actually slightly less than the year before. However, the same report shows that cash rental rate increases in the 10th District remains strong, increasing approximately 12.5% in 2023, off slightly from 15% in 2022.

One of the reasons for the slowing pace in land prices in the 10th district is increasing interest rates. The Federal Reserve Bank of Chicago shows interest rates on farm operating loans and farm real estate loans rising sharply beginning in 2022.

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Average Cropland Value — United States: 2008-2022



Interest Rates Charged on New Farm Loans in the 7th District

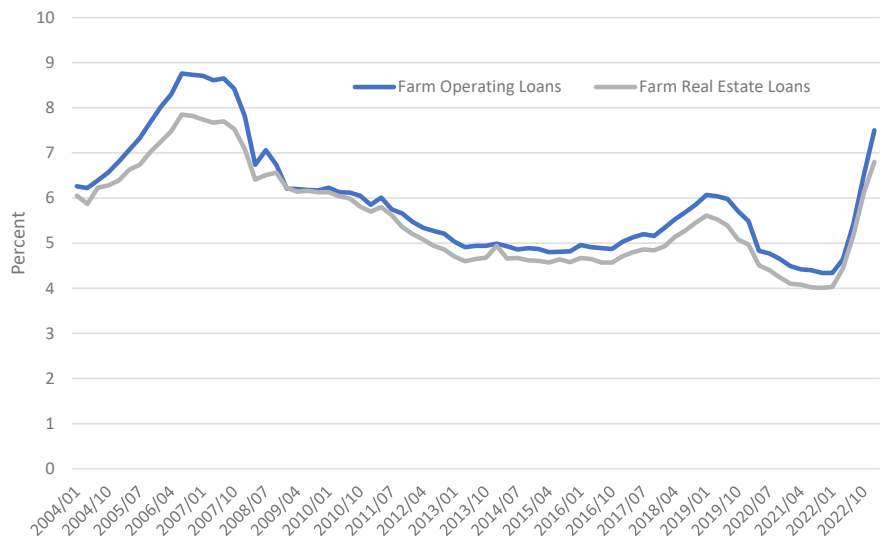
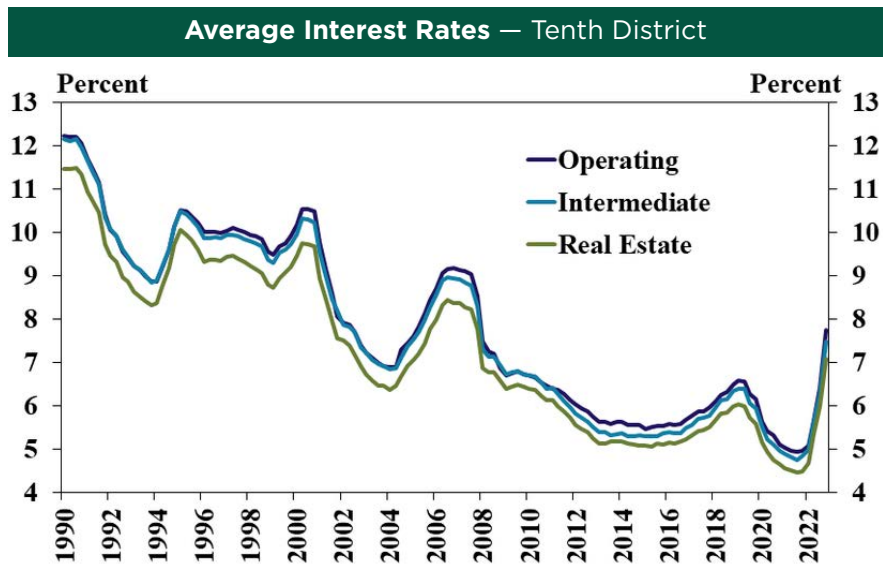


Chart data from the Federal Reserve Bank of Chicago, AgConditions 2/9/23.

Early Look at Farmland Values for 2023 Shows A Slower Increase Than 2022 – continued from page 4

Interest rates in the 10th District are up sharply as well with rates rising on real estate from around 4.5% at the start of 2022 to closer to 7% heading into 2023. However, lenders surveyed by the 10th District Federal Reserve believe that the impact of interest rates is somewhat modest. While rates are up to levels not seen since 2007 to 2008, these rates are not prohibitively high for borrowers on solid financial footing. Possibly the larger reason for the pace of farmland prices slowing is the reduction in farm income and farmer borrower liquidity. The 10th District index for farm borrower liquidity fell from a 10-year high of 175 in 2021 to closer to 90 heading into 2023. Farm income is expected to do the same. Essentially, this shows that farmers from 2021 to 2022 possessed large amounts of cash while having very strong net farm incomes over that same period. It appears that heading into 2023, much of that cash has either been used for asset purchases or used for general operations. This means less cash available for new land purchases moving forward and a reduction in incomes slowing the rate of liquidity recharge.

Data and information for 2023 in the 9th Federal Reserve District, which is comprised of North Dakota, South Dakota, Minnesota, Wisconsin and Montana, regarding land values and rents will be coming out later on this year; however, data from 2022 shows the district finished off the year strong, albeit with higher interest rates. Fixed rates across the 9th District for real estate increased from 4.3 % in January 2022 to 7.0% for the beginning of 2023. If initial reports out of the 10th District and 7th District show a similar scenario in the 9th District, it would be expected that land values across the northern Plains will increase at a slower pace in 2023 than in 2022. Additionally, it would be expected then that cash rental rate increase will continue to increase as much or more than 2022.



Note: Average rates are calculated as the average of fixed and variable rates for each loan category.



U.S. and North Dakota Beef Cow Liquidation Will Support Prices

Tim Petry, Extension Livestock Marketing Economist

The U.S. Department of Agriculture National Agricultural Statistics Service (NASS) released the much-anticipated annual Cattle inventory report on Jan. 31, 2023. It is available at: <https://usda.library.cornell.edu/concern/publications/h702q636h>

Given the continuing drought in much of the Plains and western states with forced beef cow liquidation and high beef cow and heifer slaughter, the big question wasn't *if* but *how much* the beef cow herd declined.

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.

Last year marked the fourth straight year of U.S. beef cow cyclical liquidation. Numbers peaked on Jan. 1, 2019, at 31.7 million head, so the four-year decline was 2.77 million head or 8.75%.

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

The COVID-19 pandemic in 2020 disrupted cattle slaughter capacity and caused volatile and lower cattle prices. Drought also started that year in the Four Corners and Pacific Northwest regions and expanded throughout the year into much of the western U.S.

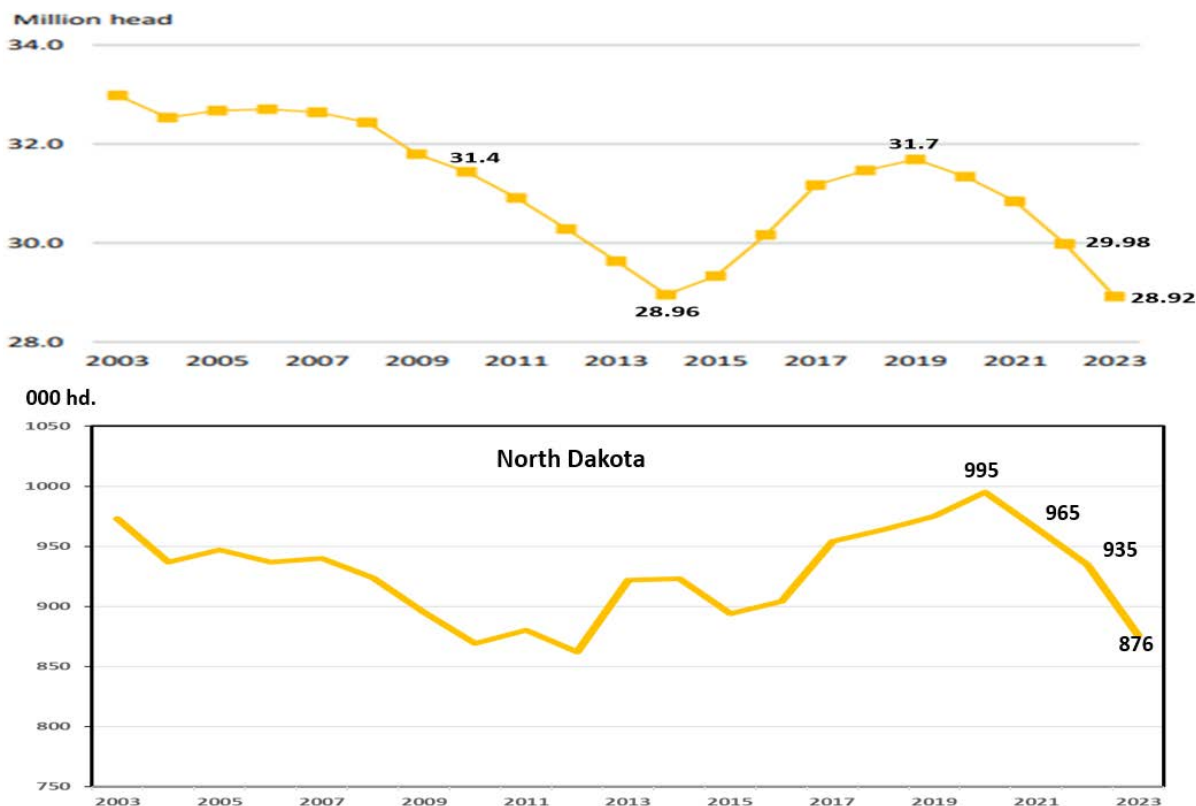
Expanding and intensifying drought conditions in 2021 with over 50% of the beef cow herd in areas with at least some drought certainly contributed to continued beef cow liquidation.

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 worsened in 2022 with 75% of the cow herd in drought by late summer.

Continued on page 7.

U.S. Beef Cows — January 1

United States Department of Agriculture, National Agricultural Statistics Service



Understanding the Black Sea Grain Initiative Renewal

Frayne Olson, NDSU Extension crop economist/marketing specialist

The Black Sea Grain Initiative is an agreement between the Ukraine, Russia, Turkey and the United Nations to allow shipments of grain, food products and fertilizer out of the Ukrainian ports of Odessa, Chornomosk and Yuzhny/Pivdennyi. The initial agreement was signed on July 27, 2022, and was in effect for 120 days. The agreement was then extended for another 120-day period, which will expire on March 18, 2023.

The agreement has allowed Ukraine to remain a key exporter of wheat, corn and oilseeds. According to the United Nations Black Sea Grain Initiative Joint Coordination Center, Ukraine has exported 22.327 million metric tons (mmt) of products as of February 26, 2023. Approximately 48% was corn, 28% wheat, 6% sunflower meal, 5% sunflower oil and 13% other products such as soybeans and barley.

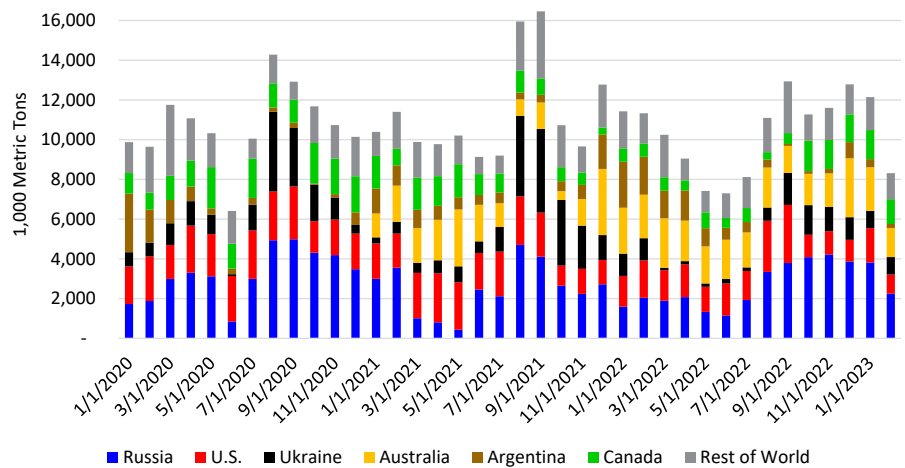
Export amounts for agricultural products from Russia are more difficult to accurately estimate. Figure 1 shows the monthly world wheat exports by country from January 2020 through February 25, 2023, reported by Reuters Refinitiv Ekion. Total Russian wheat exports since the Russian invasion of Ukraine in February 2021 are significantly larger than the same time period before the invasion. Part of this increase is due to the record large 2022 Russian wheat production, estimated to be 92.0 mmt.

Another reason is that key Russian grain export facilities have not been damaged during the conflict.

In contrast, 2022 Ukrainian wheat production is estimated to be 36% lower than last year, due primarily to farmland lost during the invasion and fields that could not be harvested because of bomb damage and fire. Shortages of fuel have also created challenges. In addition, the major Ukrainian grain export facilities in Mariupol and Mykolaiv have been heavily damaged and are currently unusable. Figure 1 shows the dramatic decrease in wheat exports beginning in March 2021 and continuing until August when the grain initiative was implemented.

Continued on page 10.

Figure 1 - Monthly World Wheat Exports by Country



Reuters Refinitiv Ekion

Understanding the Black Sea Grain Initiative Renewal

— continued from page 9

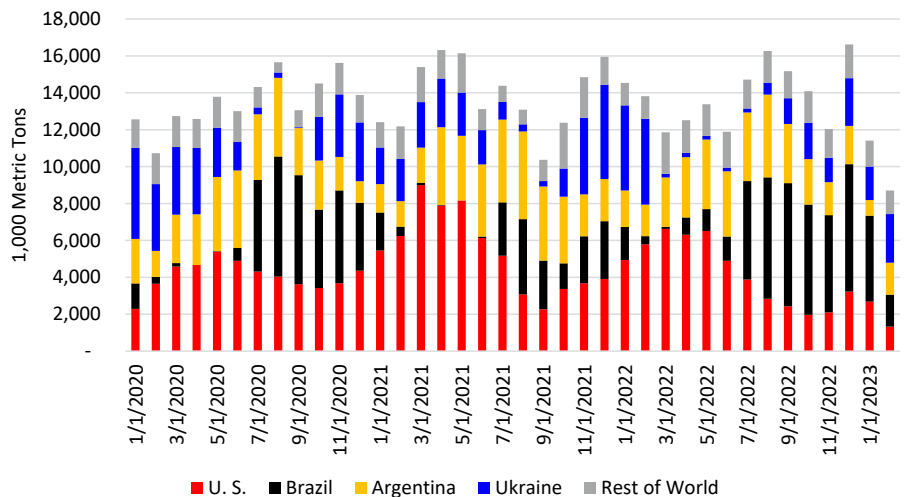
Figure 2 shows the monthly world corn exports by country from January 2020 through February 25, 2023 also reported by Reuters Refinitiv Ekion. Ukrainian corn exports have followed a similar pattern to their wheat exports. There was a large reduction in corn exports beginning in March 2021 and continuing until August.

The structure and length of a revised Black Sea Grain Initiative will have an impact on global and U.S. corn and wheat prices. The Ukrainian government is asking for at least a 12-month agreement, rather than another 120-day extension, and that ports in Mykolaiv be included in the approved shipping corridor. They are also requesting more U.N. and Turkish inspectors to speed the inspection process as vessels enter and exit the Black Sea, which would decrease transit times and increase export volumes.

The Russian government is asking for the U.S. and Western Europe to lower economic sanctions, specifically restrictions on Russian grain exports and limitations on financial institutes. Sanctions on Russian banks are making it difficult for Russian exporters to finance sales and acquire letters of credit needed to secure ocean transportation.

The U.S. corn and wheat markets will be watching the negotiations carefully to determine potential shipping volumes and how competitive U.S. grains will be in the global marketplace.

Figure 2 - Monthly World Corn Exports by Country



Reuters Refinitiv Ekion