Agriculture By the Numbers

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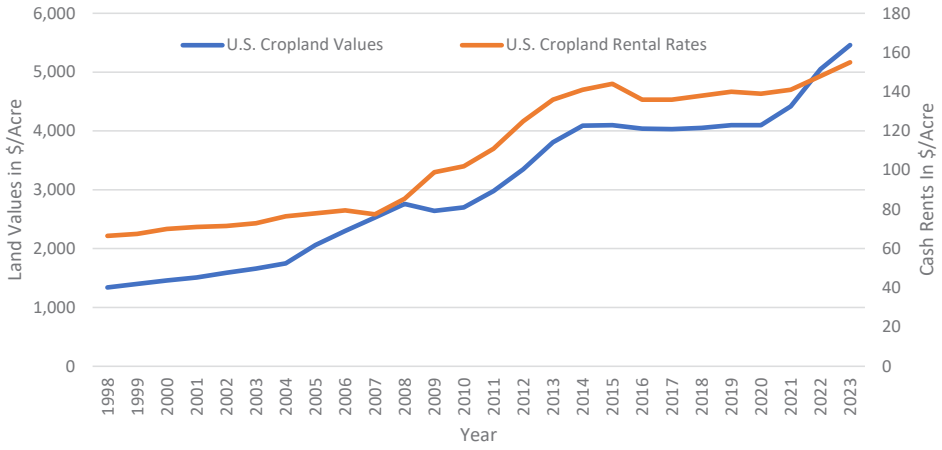
Could Farmland Experience A Crowding Out Effect?

By Bryon Parman, Assistant Professor/Agricultural Finance Specialist

Farmland may finally be reaching a tipping point as far as rental rates, which have lagged considerably behind farmland values. After six years of moving sideways, national average cropland values have increased each year from 2021 through 2023. According to the USDA's yearly farmland value surveys published each August, farmland values were up 7.8% in 2021, 14.3% in 2022 and 8.1% in 2023. Pastureland has followed suit, increasing 5.7% in 2021, 14.8% in 2022 and 6.7% in 2023.

Figure 1: National Average Cropland Values and Cash Rental Rates



Meanwhile, cash rents for cropland have also increased but at a much slower rate. From 2021 to 2023, rents for cropland increased 1.4%, 5% and 4.7% during those years. For cropland, that's a 33.2% increase in market value from 2020 to 2023, while rents increased a total of 11.5% for that same period. Farmland values increasing faster than cropland rent isn't something that just started recently. The rent to value ratio (sometimes called a CAP rate) has been declining for decades. Historically, in the late 1980s and early 1990s, the CAP rate was around 9%, meaning that the cash rental rate on cropland was about 9% of the market value someone would expect to pay when

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buying. By the late 1990s, the CAP rate had fallen to around 5%. Around the time of the Great Recession, the CAP rate had fallen further to approximately 3%. After bumping up to close to 4% by 2010, the CAP rate began to trend down again, falling below 3% in 2022 and 2023.

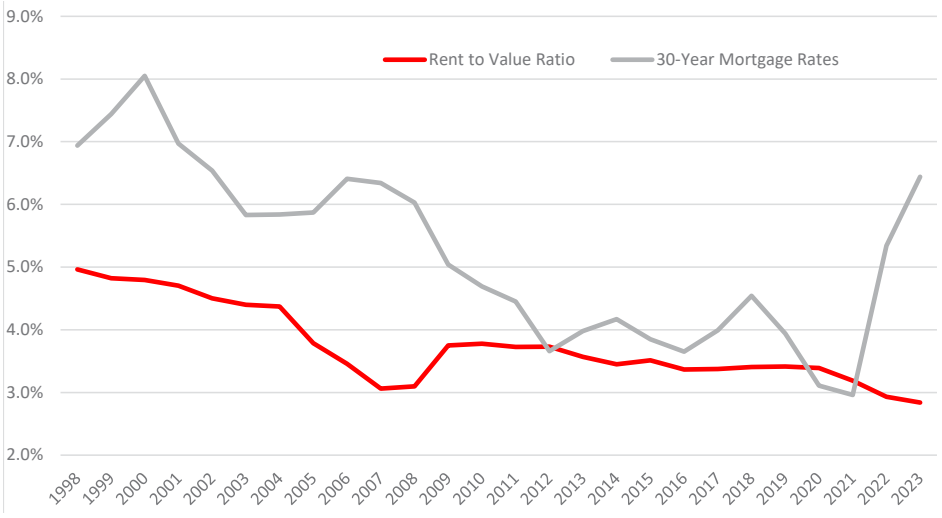
Many believe the low returns from most investment opportunities outside of the stock market, plus low interest rates have allowed land values to increase much faster than rents. Essentially, the cost of borrowing was low, return rates on "safe" assets like bonds or certificates of deposits were very low, and farm incomes have been relatively stronger, so there hasn't been as much financial resistance for farmers wanting to buy land, and investors looking to diversify had few other choices that would bring in 3% or 4% as they tried to limit some of their exposure to stock holding.

However, things have changed dramatically in the last 18 months or so. In an effort to fight inflation, the U.S. Federal Reserve has increased the federal funds rate, which influences interest rates charged to consumers, businesses, bank to bank lending and government borrowing rates. Early in 2021, the federal funds rate was around 0.25% with the average 30-year mortgage rate down below 3%. As of the writing of this article, the federal funds rate was approximately 5.5%, and the 30-year mortgage rate was over 7%.

It is well understood that higher interest rates can lower the market value of real-estate, especially if many of the purchases are expected to be financed, since higher rates increase the payment amount and limit who may be able to afford to buy it. Even with higher rates, the negative impact may be limited if the buyers are paying more in cash up-front, negating somewhat the impact of higher payment amounts for the same asset. However, one thing that can tame demand for farmland if the CAP rate stays below 3%, regardless of how many purchases are cash purchases, are the returns on other safe assets. As of the writing of this article, many certificate of deposit options for different lengths of time can be obtained easily with returns well above 5%. Currently, the yield on 10-year U.S. treasuries is 4.25% where the CAP rate on farmland hasn't been that high since before 2005, and corporate 10-year AAA bond yields are over 5.1%.

Essentially, the opportunity cost of buying and owning farmland has increased rapidly with the expected annual return from income continuing to decline relative to market value. With so much of the U.S. either in retirement or entering retirement age, and money managers having a diversification option they haven't had in decades, a secure annual rate of return of 5% or even higher for the next decade may become too attractive to investors to ignore. As for farmers themselves, many may be reluctant to tie up their money in the stock market due to volatility, and much of the aversion to stock purchases is not there for bonds or CDs. Questions regarding options like TIPS (Treasury Inflation-Protected Securities), CD terms, bond options and other fixed income assets have picked up, especially in farmers who were in business in the 1980s and 1990s when those investment options were far more attractive than they have been over the last 20 years. All of this together may point to other investment options beginning to crowd out investment in farmland should their returns stay attractive while rental rates significantly lag market value increases.

Figure 2: Cropland Rent to Value Ratio and the 30 Average Mortgage Rate 1998 - 2023



How many hogs can two soybean crush plants support in North Dakota?

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

As I write this article, two soybean crush plants are being built in North Dakota along the I-94 corridor. One is near the community of Spiritwood, the other near the community of Casselton. Although the two plants are not yet operational, they are expected to have the capacity to produce soybean meal at rates of 150,000 and 125,000 tons of meal per day at the two sites, respectively. It is expected that both plants will operate 360 days per year, which when converted, equates to roughly 1.2 and 1.0 million tons of meal per year at each plant, respectively, or a total of 4.4 billion pounds of meal per year (Table 1).

To understand how many hogs this amount of meal will support, I broke down the numbers between three large-scale swine production enterprises, including (1) confined hog finishing, (2) confined farrowing, and (3) confined finishing and farrowing enterprises. Further, each enterprise type (finishing and farrowing) was separated into two different-sized modern confinement operations, including 2,500-head and 5,000-head operations. The results of this part of the analysis are reported in Table 1.

For this part of the analysis, it was assumed that soybean meal would be used only for the hog finishing enterprise. That is,

Table 1. Expected Soybean Meal Production and Number of 2500-hd and 5000-hd Modern Confined Finishing and Farrowing Operations that Crush Plant Production can Support in North Dakota

	Crush Plant Locations		
Variable of interest:	**Spiritwood**	**Casselton**	**Total**
Soybean use (tons/day)	150,000	125,000	275,000
Soybean to meal conversion rate (lbs of beans/lbs of meal)	45.05	45.05	45.05
Meal production (tons/day)	3,330	2,775	6,104
Days of production	360	360	720
Total meal production (tons/year)	1,198,668	998,890	2,197,558
Total meal production (lbs/year)	2,397,336,293	1,997,780,244	4,395,116,537
Finishing only (head/year)			
Soybean meal demand for finishing hogs (lbs/head/year)	119	119	119
Maximum pigs fed per year (head/year)	20,145,683	16,788,069	36,933,752
Feeder pigs needed for 2,500-head operations (head/year)	5,000	5,000	5,000
Feeder pigs needed for 5,000-head operations (head/year)	10,000	10,000	10,000
Maximum number of 2,500-head finishing operations	4,029	3,358	7,387
Maximum number of 5,000-head finishing operations	2,015	1,679	3,693
Farrowing only (head/year)			
Soybean meal demand for breeding sows (lbs/litter/year)	149	149	149
Average litters per sow per year	2.2	2.2	2.2
Average number of pigs per litter	7.7	7.7	7.7
Maximum number of sows on feed (head/year)	7,313,412	6,094,510	13,407,921
Breeding sows for a 2,500-hd farrowing operation (head/year)	2,500	2,500	2,500
Breeding sows for a 5,000-hd farrowing operation (head/year)	5,000	5,000	5,000
Maximum number of 2,500-hd farrowing operations	2,925	2,438	5,363
Maximum number of 5,000-hd farrowing operations	1,463	1,219	2,682

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How many hogs can two soybean crush plants support in North Dakota?

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we assume that producers will purchase weaned pigs and finish them to slaughter weight. Information obtained from enterprise budgets produced at Iowa State University shows that it requires, on average, 119 pounds of soybean meal to finish a weaned feeder pig to slaughter weight in a modern confined finishing facility (ISU, 2022). Using this figure, the analysis suggests that North Dakota would have enough soybean meal to feed to slaughter weights a maximum of 20.12 and 16.8 million head of hogs at the Spiritwood and Casselton plants, respectively, or a total of 36.9 million head between the two locations. Further evaluation assumes that 2,500- and 5,000-head modern large-scale confinement operations would produce 5,000 and 10,000 head of finished hogs per operation per year (i.e., two finishing cycles per year). Based on these assumptions, and assuming we feed all of the soybean meal produced at both locations, North Dakota could support a maximum of 7,387 2,500-head or 3,693 5,000-head

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Table 2. Projected Number of Modern Confined Finishing and Farrowing Operations and Corresponding Soybean Meal Use Necessary for a 1.85 Million Head Expansion of Finished Hogs in North Dakota

Variable of interest:	Assumption/result
Desired number of finished hogs in ND (head/year)	2,000,000
Current number of hogs on farms in North Dakota (head)	150,000
Hogs needed to meet expansion target (head/year)	1,850,000
Average litter size (head/sow)	2.20
Average number of piglets (head/sow)	7.70
Barrows (head/litter)	3.85
Guilts (head/litter)	3.85
Barrows held back for breeding (head/litter)	0.39
Guilts held back for breeding (head/litter)	0.96
Pigs available for finishing (head/litter)	6.35
Pigs available for finishing (head/sow)	13.98
Sows required to meet expansion target (head/year)	132,375
2500-head operations	
Finishing operations needed to support target expansion (confinement barns)	370
Farrowing operations needed to support target expansion (confinement barns)	52.95
Soybean meal needed for finishing operations for target expansion (tons/year)	110,075
Soybean meal needed for farrowing operations for target expansion (tons/year)	167,061
Soybean meal needed for farrowing and finishing operations for targe expansion (tons/year)	277,136
Soybean meal needed to support farrowing and finishing operations (% of total meal)	12.61%
Remainder of meal production available for other livestock uses (tons/year)	1,920,422
Remainder of soybean meal as a percent of total production (%)	87.39%
5,000-head operations	
Finishing operations needed to support target expansion (confinement barns)	185
Farrowing operations needed to support target expansion (confinement barns)	26.47
Soybean meal needed for finishing operations for target expansion (tons/year)	110,075
Soybean meal needed for farrowing operations for target expansion (tons/year)	167,030
Soybean meal needed for farrowing and finishing operations for targe expansion (tons/year)	277,105
Soybean meal needed to support farrowing and finishing operations (%)	12.61%
Remainder of meal production available for other livestock uses (tons/year)	1,920,454
Remainder of soybean meal as a percent of total production (%)	87.39%

How many hogs can two soybean crush plants support in North Dakota? – continued from page 4


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modern confined swine finishing operations. These numbers assume that there would be zero soybean meal available from the two North Dakota plants for use in any other livestock or export enterprise.

Conversely, if we assume that all of the soybean meal production from the two plants is only fed to sows that produce weaned feeder pigs in modern large-scale farrowing facilities (i.e., zero hog finishing facilities), then the calculations show that a total of 13.41 million head of weaned feeder pigs could be produced each year. In this scenario, it is assumed that producers would specialize completely on the production of feeder pigs and none of the soybean meal produced would be used for any other livestock or export enterprise. In the case of sows, it is reported that it requires, on average, 149 pounds of soybean meal each year per sow in order to produce 2.2 litters per year with a litter size of 7.7 piglets (ISU, 2022). Based on these assumptions, the total production of soybean meal from the two crush plants would be enough to operate 5,363 2,500-head confined farrowing barns or 2,682 5,000-head farrowing barns.

To provide some perspective of these results in terms of size of industry, the state of Iowa has the largest swine industry in the nation with approximately 24.4 million head of pigs on farms (USDA-NASS, 2022). This analysis suggest that North Dakota would have enough soybean meal to expand to a size similar to Iowa. Of course, the two scenarios presented above only gives us some perspective on what is possible based on the expected annual production (supply) of North Dakota produced soybean meal for two swine extreme cases of swine enterprises that are decoupled from each other (finishing only versus farrowing only). This perspective is also based on the idea that all the soybean meal would be used for either one or the other (non-complementary) swine production system, which, of course, is not likely from a development/expansion standpoint.

A more likely scenario would be to have some reasonable target level of expansion of the swine industry for North Dakota that includes using the

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How many hogs can two soybean crush plants support in North Dakota? — continued from page 5

state's soybean meal for both finishing and farrowing enterprises that complement each other. Currently, there are only approximately 150,000 head of hogs on farms in North Dakota (USDA-NASS, 2022). For the following analysis, we assume that moving from 150,000 to 2 million hogs would be a more reasonable, yet sizeable, target for expansion. For perspective, this target expansion would represent about 8% of Iowa's swine industry. Table 2 reports the results of the targeted expansion of a hog finishing enterprise that is supported by a hog breeding (farrowing) enterprise.

For simplicity, it was assumed that all 150,000 pigs currently on farms in North Dakota are being fed (finished) to slaughter weight. Therefore, to reach the 2 million head target of expansion requires feeding to slaughter an additional 1.85 million hogs. To reach this level of expansion, it will require building and operating 370 2,500-head modern, large-scale confined finishing barns or 185 5,000-head finishing barns. In addition, the target expansion will also require 53 2,500-head modern confined farrowing barns, or about 27 5,000-head farrowing barns. The assumption here is that the farrowing barns will provide all of the needed weaned feeder pigs to the finishing barns, eliminating the need for importing weaned pigs into North Dakota from neighboring states. For now, we have excluded the possibility of farrow-to-finish operations.

Based on the projections provided in Table 1 for annual consumption of soybean meal per head per year for each enterprise, the 370 2,500-head finishing facilities will require 55,038 tons of meal per year, and the 47 2,500-head farrowing facilities will require 149,000 tons of meal per year. This equates to a total of 259,075 tons of meal per year to operate the 370 finishing barns and the 53 farrowing facilities. Note that in order to determine the how many sows would be required to meet the expansion target for finished hogs, I estimated how many pigs in each litter would have to be held back for breeding purposes. I assumed that 25% of the guilts would be held back to be developed into breeding sows, and 10% of the barrows would be held back to be developed into breeding boars. The result of these assumptions was a reduction in the average piglets produced per litter from 7.7 to 6.35 head per sow. Based on this adjustment, I found that, on average, a sow could produce 13.98 weaned feeder pigs per year. By dividing this into the target expansion of 1.85 million head of feeders, I found that the farrowing industry would need somewhere around 132,375 breeding sows in order to produce the target number of feeder pigs for the finishing sector.

Digging deeper, the results show that in order to meet the target level of expansion, the 2,500-head operations for both finishing and farrowing operations are expected to consume 1.92 million tons of soybean meal each year or 12.61% of total soybean meal produced in North Dakota each year. Although the economics between the size of confined operations (2,500-head versus 5,000-head) will certainly be different for finishing and farrowing enterprises, respectively, the quantity of soybeans required to operate those facilities are not. This is because the total number of 5,000-head finishing and farrowing facilities is exactly half as many at the 2,500-head facilities, while the number of head fed in the finishing facilities are twice as many.

It is important to note there are myriad combinations of swine enterprises that can be evaluated to understand the expected demand for soybean meal that will be produced in North Dakota, even if the projected estimates presented here are somewhat low. However, based on the scenarios evaluated in this study, it appears that production from the two crush plants in North Dakota will be capable of providing plenty of soybean meal each year for a reasonable, yet sizeable expansion of swine production in the state, leaving more than 80% of total production for other livestock enterprises, such as dairy and poultry, and export markets.

As always, feel free to write me with any questions you might have at jon.biermacher@ndsu.edu.

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Forecasting Chinese Corn Imports is Getting Complicated

Frayne Olson, NDSU Extension crop economist/marketing specialist

China has become the second largest U.S. corn export destination in recent years, just behind Mexico, which is the largest U.S. corn buyer. However, U.S. corn exports into China have varied significantly over the past four years and competition is increasing.

China is the second largest corn producer in the world, with 2023-24 marketing year production estimated to be 277.0 million metric tons. The U.S. is the largest corn producer with projected 2023-24 production at 383.8 million metric tons.

However, Chinese total corn consumption has been outpacing production since the 2017-18 marketing year. This has resulted in a slow reduction in Chinese carryover stocks and an increase in feed grain imports, which includes corn, barley and sorghum.

Figure 1 shows the historical production, consumption and ending stocks-to-use ratio for Chinese corn. It illustrates the increase in total corn consumption is faster than the growth in production and the falling stocks-to-use ratio.

It is unclear whether this trend will continue. In January 2022, China's Ministry of Agriculture and Rural Affairs revised regulations to allow the production of genetically modified (GM) crops in China, including corn. Private estimates suggest that about 1% of the 2023 Chinese corn acreage was planted using GM corn. While this is only a small step in GM variety use, adoption rates are expected to increase quickly. Wide spread use of GM corn could substantially increase the 102 bushel per acre national average trend line yield.

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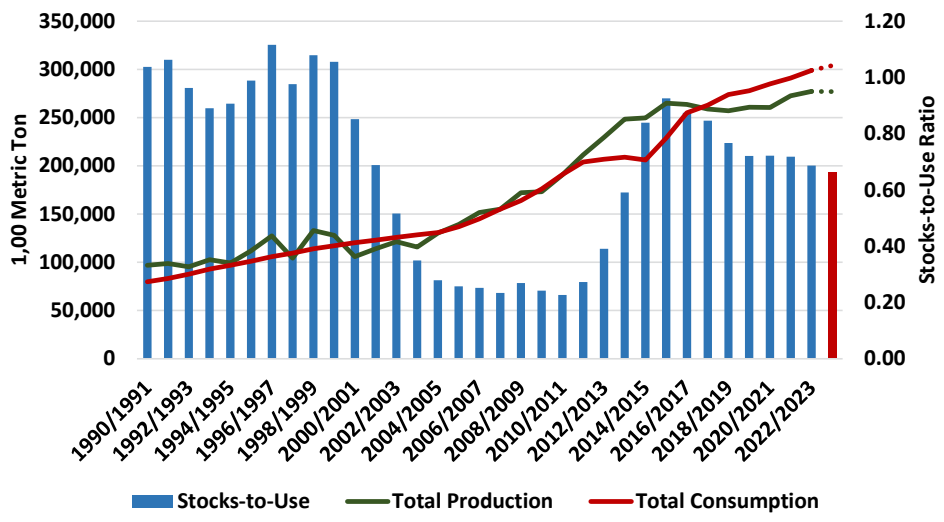
Figure 1 – Chinese Corn Production, Total Consumption and Ending Stocks-to-Use



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Forecasting Chinese Corn Imports is Getting Complicated — continued from page 7

Figure 2 shows historical Chinese feed grain imports for corn, barley and sorghum, which are close substitutes in hog and poultry rations. Chinese barley and sorghum imports have ranged from 5.0 and 12.1 million metric tons since the 2014-15 marketing year, while corn imports have grown from 5.5 million metric tons in 2014-15 to a high of 29.5 million metric tons in 2020-21, with the current USDA estimate for 2023-24 at 23.0 million metric tons.

Another complicating dynamic in global corn trade has been the continued growth in Brazilian and Argentine production and export levels. As shown in Figure 3, the U.S. has historically been the dominant global corn exporter. However, during the 2022-23 marketing year, Brazilian corn export levels surpassed the U.S., and Brazil is expected to remain the top exporter in 2023-24.

While the U.S. is expected to continue to be a primary supplier to China, competition from Brazil and Argentina is increasing. In addition, the 85% Chinese import tariff on Australian barley was recently removed, increasing the potential for additional feed barley to enter China as a competing feed grain.

A final wildcard is the continuing geo-political and trade tensions between the U.S. and China. It is almost impossible to predict if or when these tensions will grow to a point where agricultural trade will be impacted. The U.S. corn market will need to look for new or expanding global markets to maintain export levels if China's demand for U.S. corn falls.

Figure 2 – Chinese Feed Grain Imports

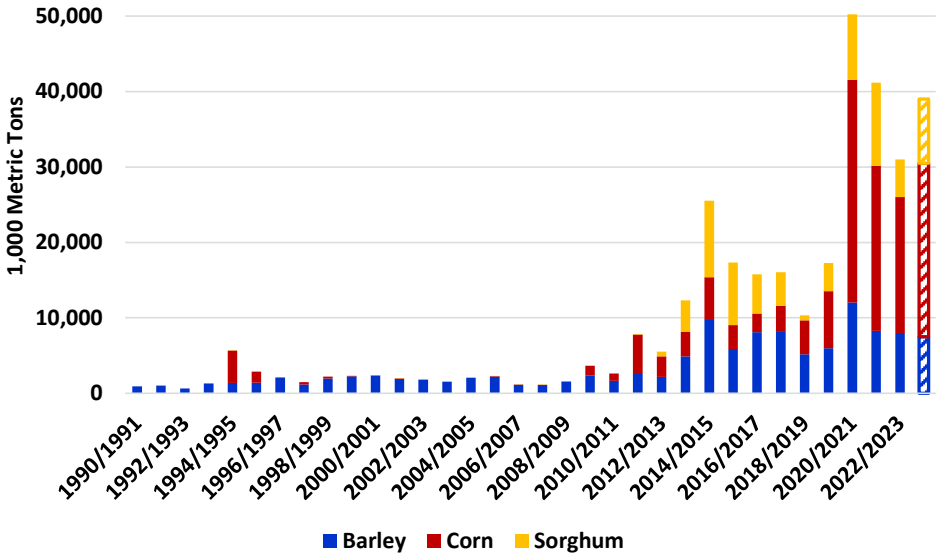

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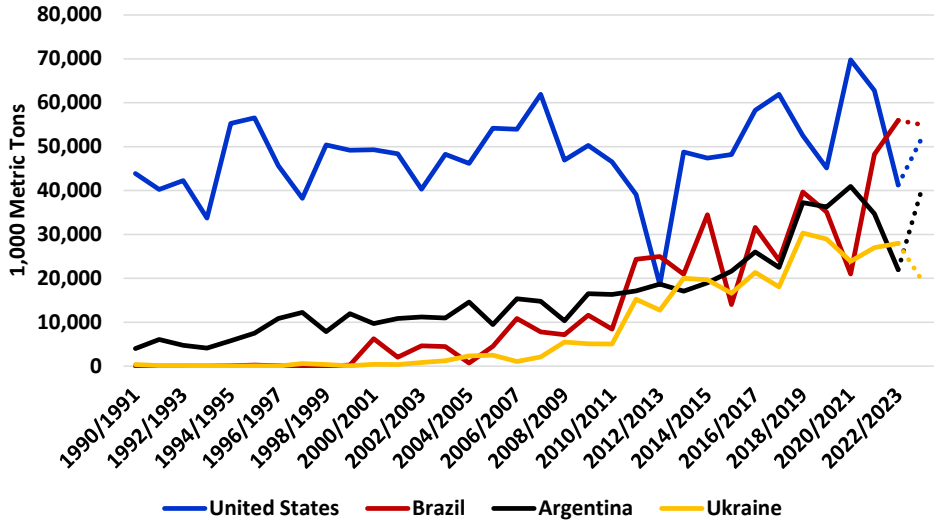
Figure 3 – Major World Corn Exports by Country



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Tax Tips for Retirement Plans

Ron Haugen, Farm Management Specialist, NDSU

The SECURE Act 2.0 became law late last year. It enhances tax-saving benefits and adds new benefits for retirement plans. The SECURE Act 2.0 changes go into effect in 2024.

401(k) Plans:

401(k) plans are salary reduction contributions made on a pre-tax basis. Your employer may also make matching contributions based on compensation.

For 2023, the maximum salary-reduction is $22,500 as indexed for inflation. Anyone age 50 or older can increase the reduction by up to $7,500 as a catch-up contribution. So, the maximum would be $30,000 for those individuals.

For 2024, SECURE 2.0 created another group from 60 to 63 years old for whom the catch-up contribution would increase to the greater of $10,000 or 150% of the regular catch-up contribution made. The $10,000 is adjusted for inflation annually.

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SIMPLE Plans:

The SIMPLE plan (Savings Incentive Match Plan for Employees) is much the same as a 401(k) account. Contributions are made on a pre-tax basis and distributions are taxed at ordinary income tax rates. The plan is available for businesses with no more the 100 employees and the self-employed.

The standard maximum contribution for 2023 is $15,500. Anyone age 50 or older can add a catch-up contribution up to $3,500 for a total of $19,000.

Beginning in 2024, the SECURE Act 2.0 raised the catch-up contribution limit by 10% for employers with no more than 25 employees. Employers with 26 to 100 employees can provide the higher limits if they make a 4% matching contribution or a 3% employer contribution. These figures are adjusted annually for inflation after 2025.

IRAs:

IRAs (Individual Retirement Plans) can be used as a supplement to an employer-provided plan or as an alternative. Contributions may be all or partially tax-deductible depending on the situation. Amounts withdrawn are taxed as ordinary income. The annual contribution limit for IRAs is $6,500 for 2023 and is indexed for inflation.

Catch-up contributions for those 50 or older are set at a $1,000 maximum. The catch-up amount is not indexed for inflation. Thus, the maximum total contribution for 2023 would be $7,500.

With SECURE 2.0, the IRA catch-up contribution limit will be indexed for inflation beginning in 2024 in increments of $100.

The same contribution limits apply to Roth IRAs. Those contributions are not taxable and future distributions are federal income tax free.

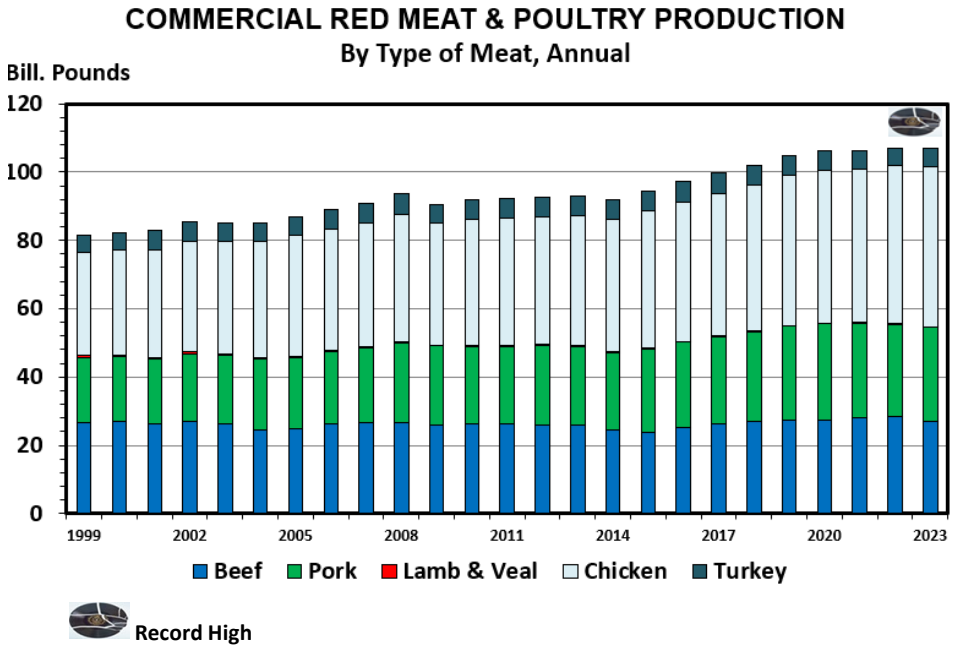
Record High Meat Production/ Record High Prices?

Tim Petry, Extension Livestock Marketing Specialist

U.S. commercial red meat and poultry production has been on a long-term uptrend. That trend culminated with record high production in 2022 at 107 billion pounds.

Beef and chicken production in 2022 were record high at 28.4 and 46.3 billion pounds, respectively. Pork production in 2022 at 27 billion pounds was just under the record high of 28.3 billion pounds set in 2020 but still historically high. Turkey production at 5.2 billion pounds was down from the 6.2 billion in 2008, with lamb and mutton production continuing a long-term decline.

High production usually results in low prices unless demand increases enough to offset the increased supplies.



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Record High Meat Production/Record High Prices?

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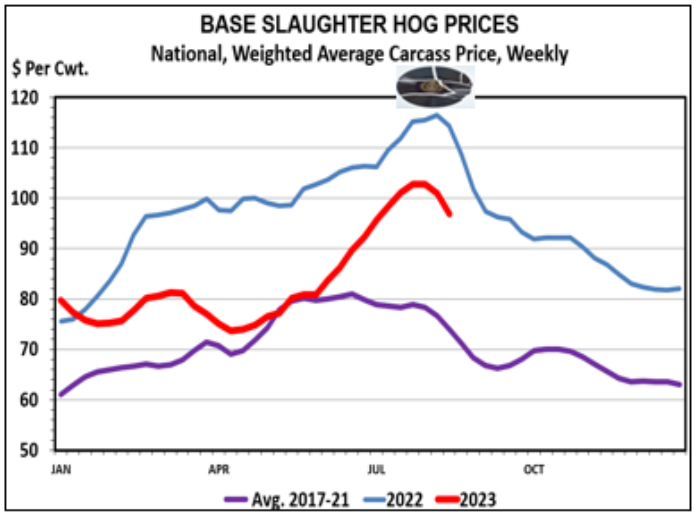

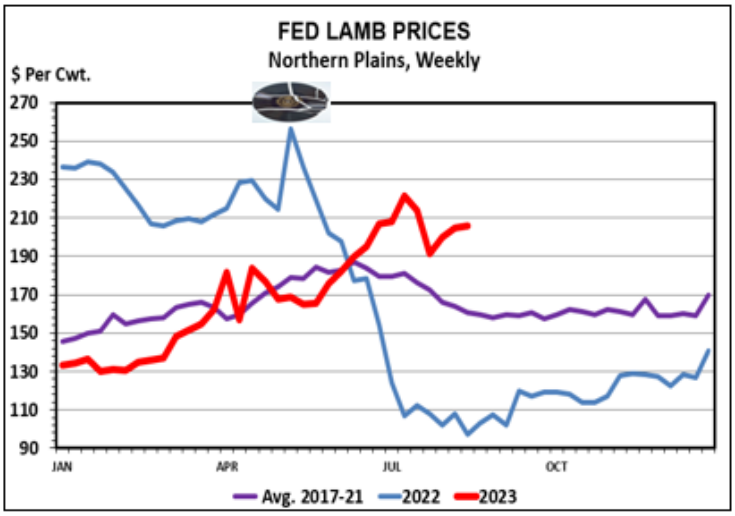

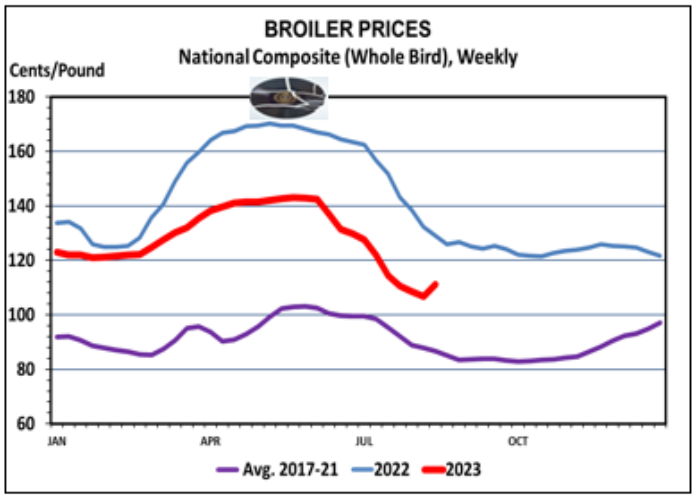

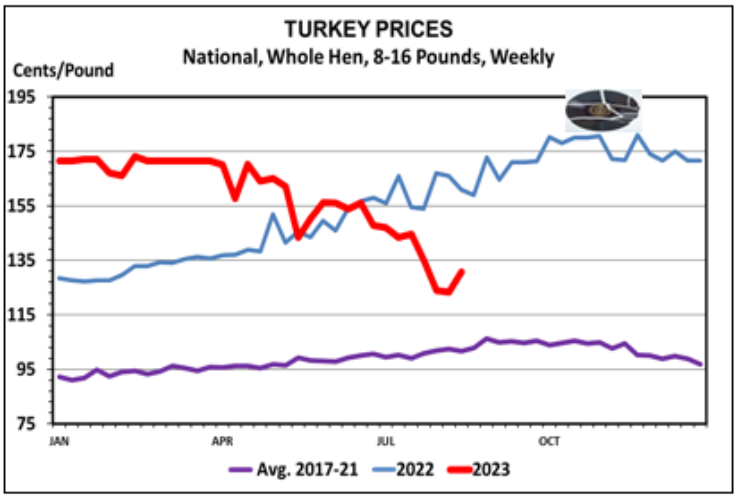

Interestingly, hog, lamb, chicken and turkey prices all reached weekly record highs in 2022 in spite of record meat production.

High prices were buoyed by strong consumer demand, at least in part due to some normalcy returning to food purchasing patterns after the COVID-19 pandemic subsided. For example, the reopening of restaurants caused large purchases of meat to restock coolers that were shut down when restaurants closed.

Export demand in 2022 was strong, too, with chicken exports setting a record high and pork exports the third highest ever.

Cattle prices increased cyclically over 2021 levels but were not record high in 2022. Domestic beef demand was strong and beef exports were record high.

But the record high beef production spurred by historically large beef cow and heifer slaughter held cattle prices in check. Drought in much of the U.S. caused forced beef cow liquidation and heifers into feedlots. By October 2022, 75% of the beef cow herd was located in an area affected by drought.

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Record High Meat Production/Record High Prices?

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The number of heifers on feed is historically high at 39.9% of total cattle on feed.

The United States Department of Agriculture is forecasting 2023 red meat and poultry production to increase slightly and remain record high (www.usda.gov/oce/commodity/wasde).

Pork production is expected to be up 1%, chicken production 1.7% higher, turkey production increasing 6.9%, and lamb and mutton production to remain unchanged.

Prices for those commodities are under the 2022 record weekly highs but still above the 2017 to 2021 averages.

Beef production in 2023 is forecast to be down 4.63% from last year's record high level. Five years of cyclically declining beef cow numbers and improving drought conditions in parts of cattle country are causing lower cattle slaughter and beef production.

If drought conditions continue to improve, interest in beef herd rebuilding will increase. Lower beef cow slaughter and more heifers retained for replacements would cause 2024 beef production to be lower again.

The bottom line for cattle prices from a supply standpoint is that the smaller beef cow herd, calf crops, and beef production are supporting prices. Declining supplies along with good beef demand and beef exports have resulted in fed cattle prices increasing to record high levels. Calf, feeder cattle and cow prices have the potential to set annual record highs next year.