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INSIDE . . .

UPDATES

The following Information Files and Decision Tools have been updated on extension.iastate.edu/agdm:

B1-21 Livestock Enterprise Budgets for Iowa

B1-65 Value of Manure Nutrients

B1-65 Manure Calculator

B1-79 Assessing Economic Opportunity of Improving Mortality Rate in Breed-to-Wean Swine Production

B1-79 Pig Survivability Project: Wean-to-finish mortality economic modeling

C2-06 Farmland Lease Annual Report

C6-59 Everyone has a Role in Cybersecurity

The following Video and Profitability Tools have been updated on extension.iastate.edu/agdm/outlook.html:

A1-10 Chad Hart's Latest Ag Outlook

A1-85 Corn Profitability

A1-86 Soybean Profitability

A2-11 Iowa Cash Corn and Soybean Prices

A2-15 Season Average Price Calculator

D1-10 Ethanol Profitability

D1-15 Biodiesel Profitability

The acreage debate is still not settled

By Chad Hart, extension crop market economist,
515-294-9911 | chart@iastate.edu

Normally, the June acreage report provides the final numbers for plantings in a given year. But 2022 is not a normal year. While the drought of last year has continued into this year, spring rains were long enough and strong enough to create some significant planting delays. Those delays led producers to partially reverse the changes anticipated from the March planting intentions. In March, farmers across the country indicated they would plant a record amount of soybeans, while reducing corn area to avoid high input costs. Following the planting delays and the great rush to plant in May, USDA's June survey found the reduction in corn was smaller than expected. But the planting delays also translated into a much smaller increase in soybean area. Corn gained 400,000 acres from the March intentions, while soybeans lost 2.7 million acres from March. The shifts put corn back on top in terms of total area (89.9 million versus 88.3 million).

The largest changes were in the Dakotas (especially North Dakota), but there were significant shifts across the country. Figure 1 shows the changes in corn area relative to the March intentions. States in blue planted more corn than the March intentions, states in red planted less, and states in gray planted roughly the intended amount. North and South Dakota dropped area (600,000 and 300,000 acres respectively), but that was more than offset by gains from Iowa (100,000), Missouri (100,000), Minnesota (500,000), and Wisconsin (300,000). Given USDA's June national corn yield estimate of 177 bushels per acre, the additional 400,000 acres translates to an additional 265 million bushels of corn for the market to absorb.

Figure 2 displays the acreage shifts for soybeans, with the same color coding. As the map shows, the reductions in soybean area cover a wide swath of the country, but it was the Northern Plains where the bulk of the losses occurred. North Dakota gave up 1.1 million acres, Minnesota lost 500,000 acres, and South Dakota dropped 200,000 acres. The only major state to add soybean area was Illinois, bringing on

an additional 200,000 acres. Despite the overall losses, Illinois, Kentucky, and Wisconsin set state records for soybean plantings. The decrease of 2.7 million acres from the March intentions lowers expected soybean production by 138 million bushels. Barring any other changes, this would reduce 2022-23 ending stocks below 150 million bushels. So expect some adjustments to soybean usage in the July World Agricultural Supply and Demand Estimates (WASDE) report to avoid setting soybean ending stocks that low.

While these changes were dramatic, the largest surprise in the June Acreage report was the note that nearly 20 million acres nationwide were still to be planted after mid-June, with roughly 4 million headed to corn and 15.8 million destined for soybeans. Given the sheer size of this late planting push, USDA will be gathering additional acreage information in the most delayed states (Minnesota, North Dakota, and South Dakota) through July. If further acreage adjustments are warranted, they will be published in the August Crop Production report and incorporated into the August WASDE tables. So stay tuned, we may not know the planting numbers until combines are preparing to roll.

The delays in planting also impacted the timing of crop ratings. Both the corn and soybean crop condition ratings

Figure 1. US corn acreage, 1,000 acres. Source: USDA NASS.

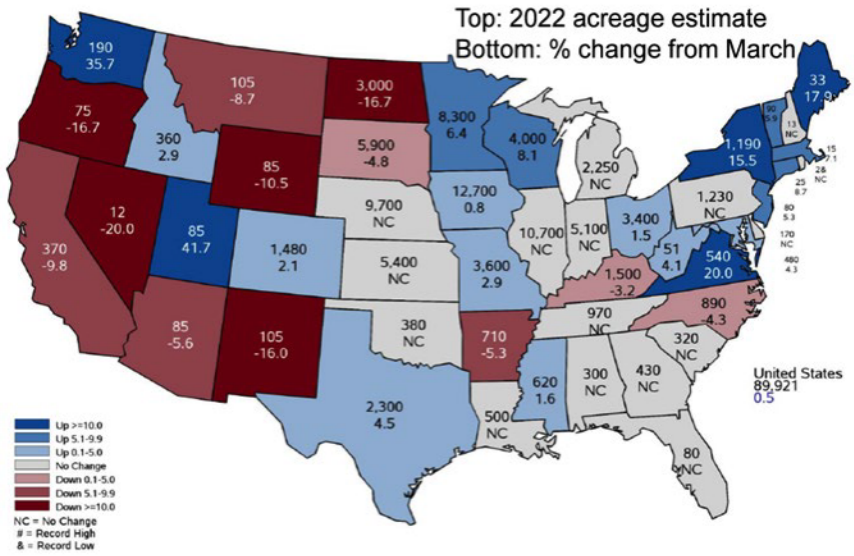
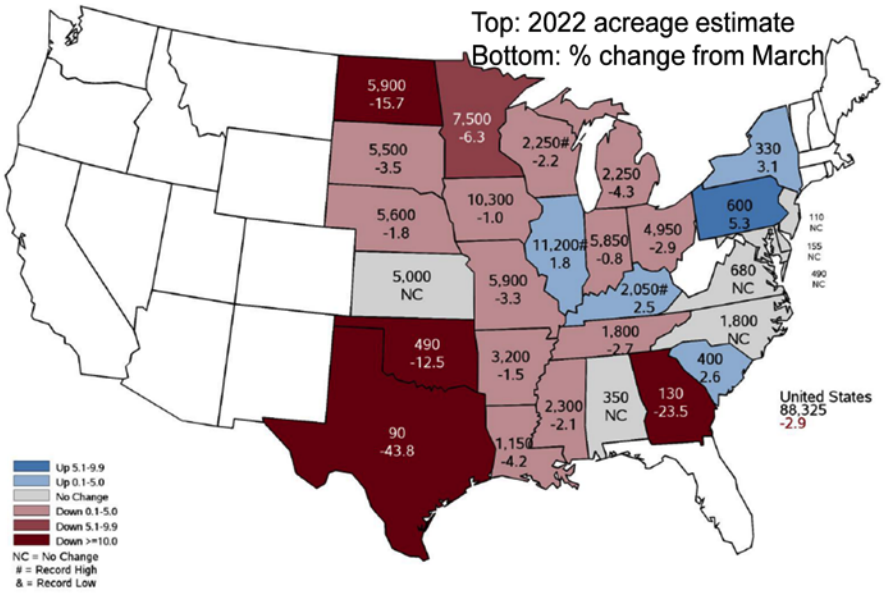


Figure 2. US soybean acreage, 1,000 acres. Source: USDA NASS.



were delayed a week at the start of the growing season, reflecting the planting problems. Figures 3 and 4 show the historical patterns for the national crop ratings, the most recent 5-year average ratings, and the ratings for last year's and this year's crops. For corn, the late start didn't negatively impact the crop rating, as this year's crop started with over 70% of the crop rated "Good" to "Excellent". Up until the 4th of July, this year's crop was rated better than the 5-year average and last year's crop. But in the most recent look, the percentage of the crop rated Good to Excellent slipped below the 5-year average and is tied with last year. The general trend in the ratings is for the Good to Excellent percentage to slowly decline over the growing season. This year's crop has seen a quicker downgrade

as dry conditions rebuild around the Corn Belt. And while recent storms have brought beneficial moisture, strong wind events, such as the July 5th derecho across South Dakota and Iowa, may provide additional reasons for continued erosion of the corn ratings. I watch these ratings somewhat closely as the ratings do provide a decent signal on projecting the national corn yield. Based on the historical relationship between the rating and final yields, the current rating suggests USDA's current yield estimate (177 bushels per acre) may be a bushel too high. And any additional drops in the ratings would push the yield estimate lower.

The national soybean ratings have followed much closer to the 5-year average, and this year's crop is still rated above last year's. For soybeans, the percentage of the crop rated Good to Excellent tends to stabilize in early July, holding around 62%. If this year's crop continues to follow the 5-year average, the historical relationship between the ratings and the national yield suggests that, like with corn, the current USDA yield estimate (51.5 bushels per acre) is a bushel too high.

With the seasonal drought outlook expanding drought conditions up along the Mississippi River valley from Louisiana to Illinois, it is likely the crops ratings will decline. That should create a floor for crop prices as the summer progresses, preventing a

Figure 3. US corn crop ratings. Source: USDA NASS.

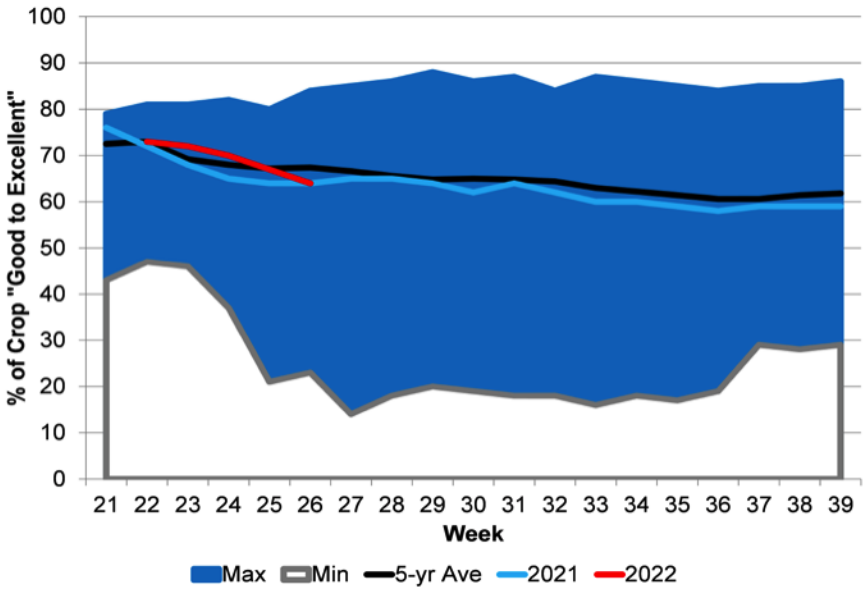
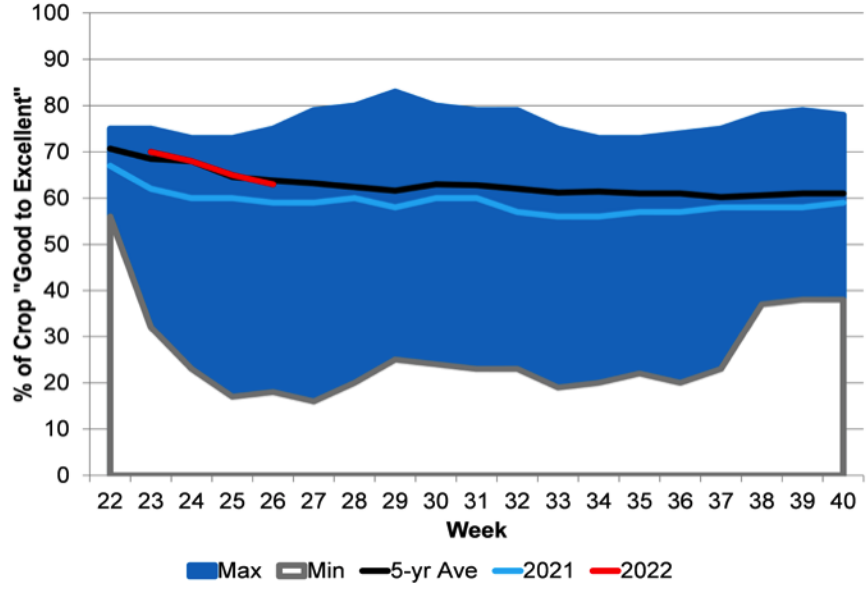
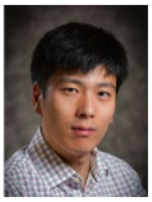


Figure 4. US soybean crop ratings. Source: USDA NASS.



complete loss of the price gains since the beginning of the year. Over the last couple of weeks, corn and soybean prices have fallen sizably as concerns about inflation and recession have sent institutional investors in retreat. In most crop markets, the recent price decline has basically reset prices back to the levels they were just before the start of the Ukrainian war, which was already approximately 15% above price levels at the beginning of the year. So even with the recent setbacks, crop and soybean prices are still at strong levels. And weather conditions still have the potential to send them higher once again.

Listen to the most recent **Crop Market Outlook video**, https://go.iastate.edu/QV9STY, for further insight on outlook for this month.




Comparing the stock market and Iowa land values: A question of timing

Wendong Zhang, extension economist, wdzhang@iastate.edu, Mike Duffy, retired extension economist

This article examines which is a better investment - the stock market or farmland. It is an update of earlier comparisons.

Iowa farmland and the stock market have recently reached record highs. On January 3, 2022, the S&P 500 closed at a record 4,796. It had reached an inter-day high of over 4,800. Since its high in January, the S&P has shown a downward trend, closing at 4,018 on June 9, 2022.

Iowa farmland value has also posted a record high. The **Iowa State University Land Value Survey**, www.card.iastate.edu/farmland/, reported as of November 1, 2021, the average land value was a record $9,751 per acre. This represented a 29% increase for the year. Several surveys since November have shown land values continue to increase. The **May AgLetter from the Federal Reserve Bank of Chicago**, www.chicagofed.org/publications/agletter/2020-2024/may-2022, reported Iowa land values increased 3% in the first quarter of 2022 and 28% from April 2021 to April 2022.

There are numerous reasons for the increases in both markets. Higher commodity prices, higher returns, low interest rates and other factors all contribute to the records. The recent records raise the question of which is a better investment, Iowa farmland or the stock market. Additionally, with the highest inflation levels in four decades and continuing global economic and political uncertainty, the question of which is a better investment brings renewed interest.

To examine the impact of recent changes and an uncertain future, this article update earlier versions comparing farmland and stock market investments. Our intention is to determine if record high values, a world-wide pandemic, the Russian invasion of the Ukraine, climate change and a host of other factors may alter previous conclusions.

Background

The returns to land or stock shares are composed of two parts. The first is capital gains or the increase in value. Obviously, this also could be a capital loss if values decrease. The second component is yearly returns.

Owning land has an unavoidable annual ownership cost not associated with stocks. Property taxes must be paid and should be included in a comparison of owning stocks or farmland. Additionally, if farmland is held as an investment and not by an owner-operator, there could be a professional farm manager involved and the fee for this service would have to be considered. There is also a need for some maintenance and insurance with farmland not associated with owning stocks.

The data used for this analysis comes from various sources. The Iowa average land values and rental rates come from USDA National Agricultural Statistics Service (NASS) June Area Survey. The average land tax per acre is calculated using data from USDA Economic Research Service (ERS) State-Level Farm Income Statements data, from which taxes per acre were calculated as the yearly Iowa farm real estate taxes and fees paid divided by the total farmland acres for that year. The 2022 values are not available yet, so we assumed a 15% increase from 2021 land value and 10% cash rent based on the new price forecasts from the 2022 Soil Management Land Valuation (SMLV) conference and the most recent 2022 ISU Cash Rent Survey.

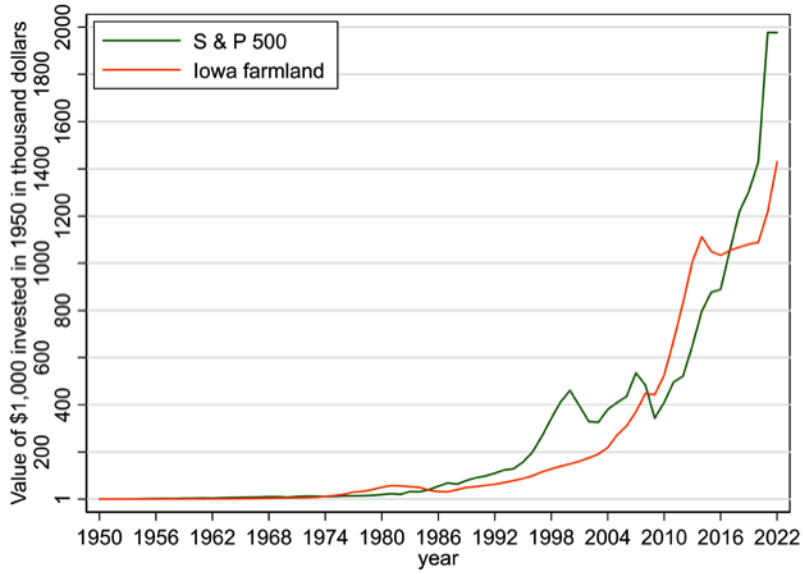
The value used for the stock market is the composite value of the S&P 500 Index average in each June, and the June dividend value for each year is used. These data for 1950 to 2022 were obtained on the **website of Dr. Robert J. Shiller**, www.econ.yale.edu/~shiller, a Nobel-winning economist at Yale University. The June 2022 stock price and dividend were not available at the time of this writing, and the May 2022 S&P 500 Index and March 2022 dividend were used as proxy.

A few assumptions are necessary to determine which provides the better investment. It is assumed $1,000 is invested in each alternative at the end of the year before the analysis begins. The amount of land or stock purchased will depend on the existing value. For example, in 1950 the average farmland value in Iowa was $161 per acre. So, for $1,000, 6.21 acres could have been purchased shortly after June 1950.

A second assumption is that all the net land rent or the dividend earned in any year will be reinvested in the land or the stock market. This will increase the number of units held. To continue the example above, assume the 6.21 acres bought in 1950 could charge rent at the current (1951) levels. The average Iowa farmland rent in 1951 was $12.37 per acre. Average farmland property taxes in 1951 were calculated to be $2.31 per acre. Subtracting taxes, a 7% of gross rent management fee and a 6% of gross rent charge for insurance and maintenance, the net return per acre in 1951 was $8.45.

Recall that the $1,000 investment has been turned into 6.21 acres of Iowa farmland, which would generate a total of $52.47 in net rent for the investor ($8.45 × 6.21 acres). In 1951, the average land value was $188 per acre. If the entire net return were invested back into land, .28 acres could have been purchased ($52.47 / $188 = .29). So, at the end of 1951 the investor would have 6.49 acres worth $1,066 ($1,220 = (6.21 + .28) × 188). This process

Figure 1. Value in each year of $1,000 invested in 1950 in Iowa farmland or the S&P 500.



is repeated each year in the analysis.

The June 1950 S&P share price was $18.74. This means 53.36 shares could have been purchased for $1,000. The June 1951 dividend was $1.56 per share. This means an additional 4.11 shares and a value of $1,233 at the end of 1951.

Land taxes, a management fee, insurance, and maintenance are the only ownership costs considered for land. There is no ownership cost assumed for stocks. No transactions costs or other costs are considered in this analysis.

The annual percentage changes since 1950 in the S&P and Iowa land values reflect considerable yearly variation in both investments. The nominal Iowa land values changed an average of 6.2% with a standard deviation of 10.6%. Yearly percentage change for land ranged from a negative 28.1% to a positive 36.8%. Comparatively, the S&P's yearly closing value showed an average percentage change of 9.2% with a standard deviation of 15.3%. The yearly percentage change in the S&P ranged from a negative 40.0% to a positive 51.7%. Out of the 73 years from 1950 to 2022, Iowa land values saw an increase 55 times, while the S&P increased 54 times.

The yearly return to land after taxes, management fee, and insurance and maintenance has averaged 4.9% of land values since 1950. The standard deviation of the yearly return to land has been 1.3%. The maximum yearly return was 7.0% while the low was 2.1% in 2022. The S&P yearly June dividend has averaged 3.1% of the S&P closing level from 1950 to 2022. The standard deviation was 1.4%, the maximum yearly return was 7.2%, and the lowest yearly return was 1.1% over the same time period.

Analysis

Figure 1 shows the return to $1,000 invested in 1950. At that time, $1,000 would have

purchased 6.21 acres or 53.36 shares of the S&P. Using the assumptions discussed previously, an investor in June 2022 would have 160.6 acres worth $1,429,899. Alternatively, they would have 473.3 shares of the S&P worth $1,976,333. In other words, the value of the S&P investment would be 38% above the value of the land investment in 2022.

Figure 1 reveals the ups and downs of the stock and land markets over a 73-year span. In particular, the S&P 500 returned more following the 1980s farm crisis, but experienced a significant dip in the late 1990s - early 2000s due to the Asian financial crisis and the dotcom bubble. The significant uptake in the investment value for farmland from 2004-2013 also clearly revealed the dramatic increase in Iowa land values since the mid-2000s. The past five years have witnessed the surge in the stock market alongside the recovery of the general economy, while the land market has increased rapidly in the past two years. The return to the stock market appears flat in 2022 due to the small increase, but that was after a dramatic increase since spring 2020.

Figure 2 presents the results of a $1,000 investment had it been made in 1980, near the previous peak in Iowa land values. In 1980, the $1,000 investment in land would have purchased only .54 acres of land or 8.73 shares of the S&P. By 2022, the land investment would have been worth $28,081 while the S&P investment would

Figure 2. Value in each year of $1,000 invested in 1980 in Iowa farmland or the S&P 500.

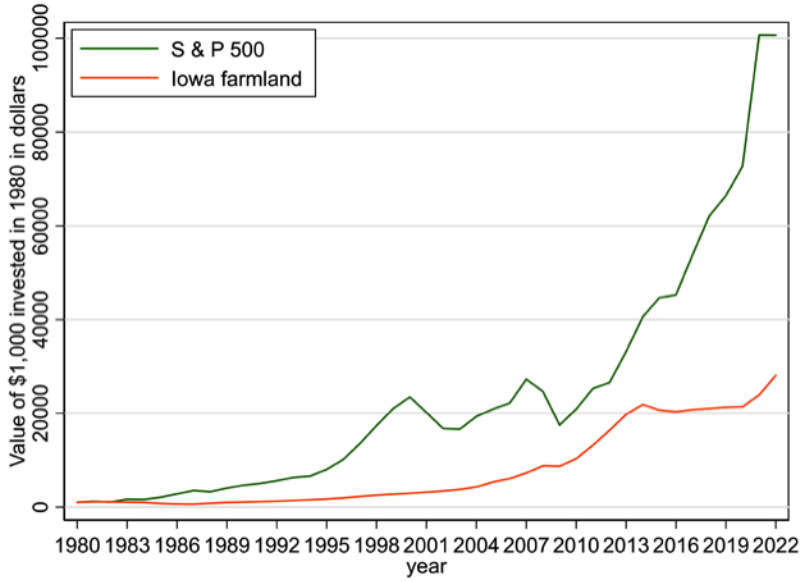
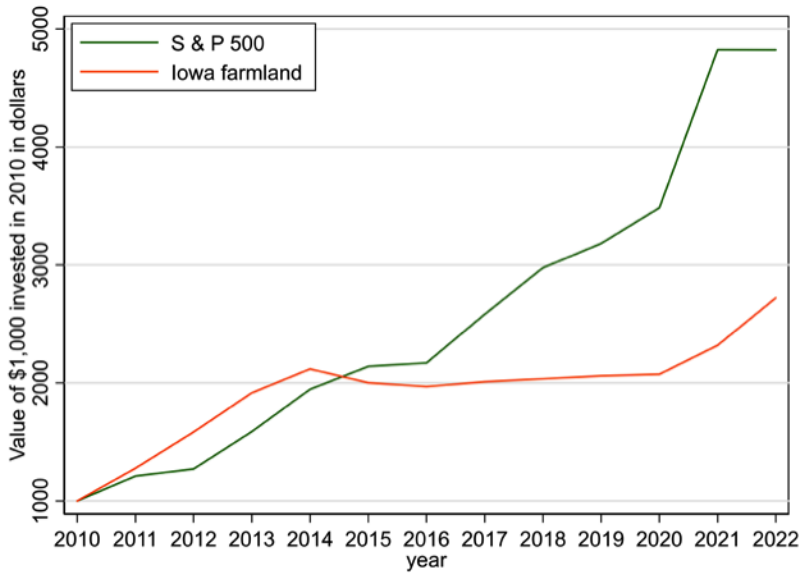


Figure 3. Value in each year of $1,000 invested in 2010 in Iowa farmland or the S&P 500.



have been worth $1,000,668. The land investment would only be 28% of the stock market investment.

Similarly, Figure 3 presents the results of a $1,000 investment had it been made in 2010, following which the land market experienced significant increases until 2014 and then noticeable declines. Before 2014, the land investment would yield a slightly better return than the investment in the stock market. However, Iowa farmland values decreased from $8,320 in 2014 to $7,070 in 2020 and then rebounded in 2021-2022 according to USDA data. Figure 3 confirmed the flat trajectory from 2014 to 2020 for the land investment while the stock investment returned more.

Figure 4 shows a comparison of the values in 2022 based on investing in each individual year. This figure presents the returns to

an investment in the S&P as a percent of the returns to Iowa farmland. In other words, the value for any year would be the present value of an investment in the S&P made in that year as a percent of an investment in farmland made that same year. In Figure 4, if the value is above 100%, then the S&P would have a higher value; conversely, if the value is below 100%, then the farmland investment would have a higher value for funds invested in that year.

Figure 4 shows that the timing of the investment makes a difference in which appears to be a better investment. Land would have been the better investment in most of the years except the period from 1974 to 1984 and most recently 2008 to 2020. This period coincides with the rise in land values during the 1970s era of stagflation. Land values in Iowa began their rapid rise in 1973 and peaked in 1981. Due to historically low interest rates and strong agricultural demand, Iowa farmland values have been at record-high levels since 2003.

While Figure 4 provides a useful perspective on the relative return of the value of S&P or farmland investments, it assumes the asset is held until 2022 and then bases the comparison on the terminal value of these assets in 2022. Further examination of Figure 1 shows that if the farmland or S&P investment initially purchased in 1950 were sold in 2000, the S&P 500 would be viewed as the better alternative. However, if sold in 2010, the farmland investment would show a higher return. In other words, the holding period matters for the relative performance of the farmland versus S&P 500 investment.

Figure 4. Return to an investment in the S&P relative to an investment made in Iowa farmland by year of investment.

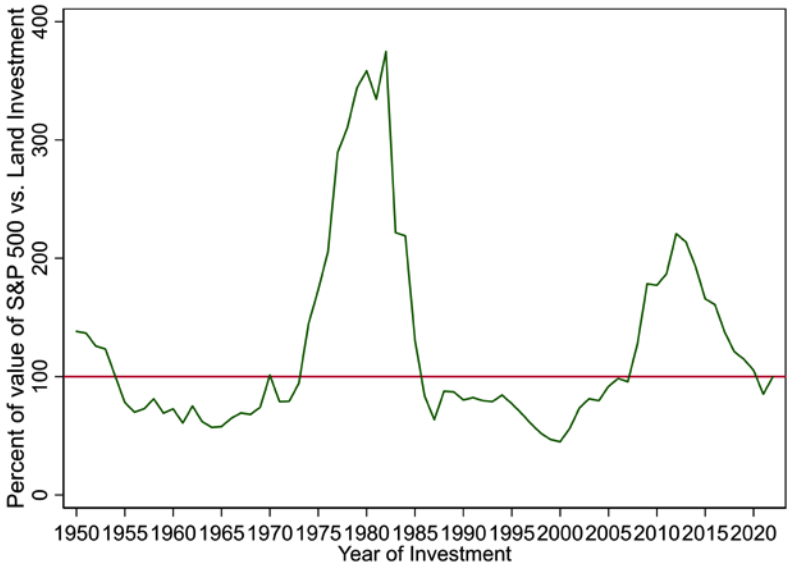


Figure 5. Return to an investment in the S&P relative to an investment made in Iowa farmland by year of investment and year of selling that investment.

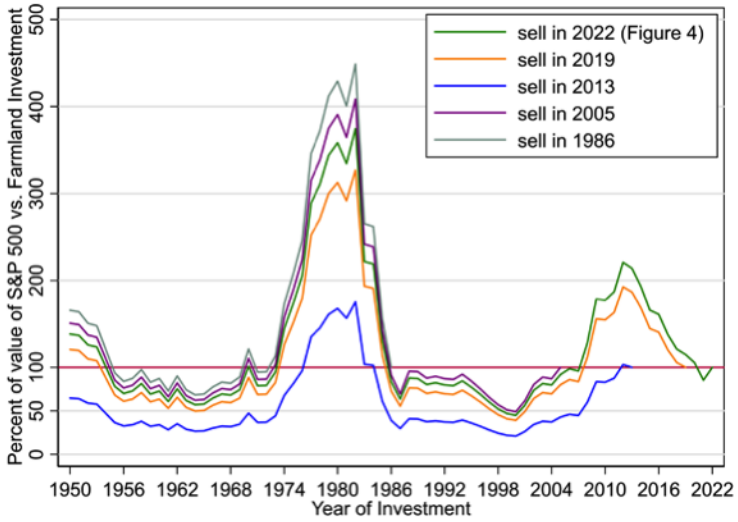


Figure 5 shows the percent of value of the S&P 500 relative to farmland investment sold in 1986, 2005, 2013, or 2019 as opposed to 2022 shown in Figure 4. In particular, the purple line shows that if farmland was purchased in 1980 right before the farm crisis and sold in 2005 right before the farmland values really took off, the value of the S&P 500 investment relative to the farmland investment would be more than four times. In contrast, the blue line shows that if farmland was purchased in the late 1990s and sold in 2013, the return would be 2-3 times better compared to holding S&P 500 stocks for the same period. Figure 5 reveals the volatility in the relative return of the two investments depending on when purchased or sold.

Discussion and conclusions

Which is the better investment, Iowa farmland or the stock market, is a complicated question, and there is no one best answer. Several factors need to be considered when trying to answer this question and several assumptions must be made.

Even with record farmland market and stock highs, the basic findings are similar to previous analyses. The level of the returns depends upon the initial investment year and the year of sale. Farmland purchased during peak value periods produced lower returns than the stock market. As shown in Figure 4, land purchased in the late 1970s and early 1980s and land purchased in 2009 to 2019 show lower percentage returns than S&P stock purchased in similar years.

Land purchased in 2019 or 2020 has shown a greater return due to recent surges. Although given our assumptions, returns to land and stocks are similar for 2022. What analysis in later years will show is uncertain. It appears land will continue to produce higher returns but there are many complicating factors to such conclusions.

Which is a better investment depends in large part on your objectives and the assumptions made in calculating the returns. We assumed financial gains would be the overriding objective. However, for many people simply owning land provides significant value. The 2017 Iowa Farmland Ownership and Tenure Survey shows that half of the land in Iowa is owned by the same owner for over two decades, 82% of farmland is owned free of debt, and 29% of Iowa farmland is owned primarily for family or sentimental reasons. Land ownership can be a means of security, an asset to pass to heirs, or held for certain prestige associated with ownership.

In this article, we assumed real estate taxes, a management fee, insurance, and maintenance were subtracted from the return to land. These were the only ownership costs for land. There would be other costs that would vary with the individual circumstances. This study also does not take into account any transactions costs. There would be costs associated with either the purchase of farmland or the purchase of stocks.

Investing $1,000 in the stock market would not be difficult but investing only $1,000 in the Iowa farmland market would be. Although the methodology employed here could be scaled up to any level of investment, it is simply not possible for the majority of people to find the wherewithal to purchase enough land for a viable farm operation or more likely, it is more difficult to find small enough farmland parcels for sale. We have run the same analysis by assuming a $1 million initial investment amount, and the general insight remains the same.

There are alternatives for farmland investment. Some brokerage houses and other investment services offer the opportunity for farmland investments. We did not include this form of investment in our analysis due to the difference in requirements and potential returns.

Subject to the assumptions made which is a better investment, farmland or the stock market, depends on when the investment was made and the year of the sale. Recent changes in the macro conditions have raised questions about which is the better investment. At this time, many conflicting factors will determine the impact of record highs on the returns. Several factors will continue to impact the returns to farmland or the stock market, including: volatile commodity prices, grain shortages caused by the Russian invasion of Ukraine, increasing interest rates to help curb inflation, record deficits, changes in labor markets, continuing response to COVID-19, US-China relations, and supply chain disruptions. These factors, as well as others not yet known, will influence the answer to the question, which is the better investment. For now, the answer remains the same, it depends on timing.

Note: This article is an update of previous versions. The last version of this analysis can be found in the **Ag Decision Maker newsletter archives**, www.extension.iastate.edu/agdm/articles/zhang/ZhaJul19.html.

Is the Earth's warming just natural variability?

By Don Hofstrand, retired agricultural business specialist
Reviewed by Eugene Takle, retired professor emeritus, Iowa State University

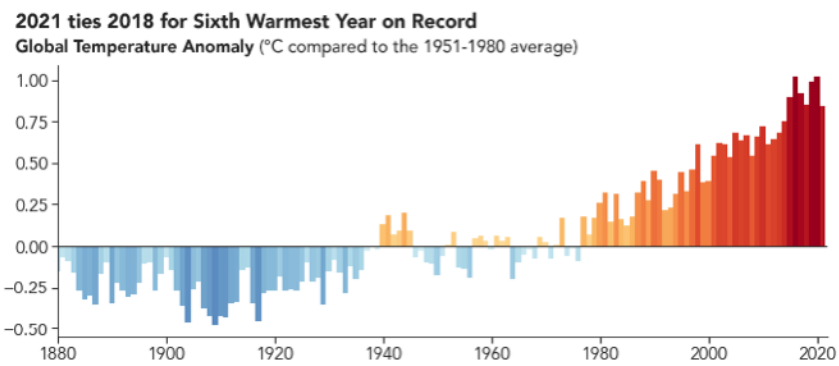
This article is part of our series focused on the causes and consequences of a warming planet.

Could the recent warming of the Earth be caused by natural variability in the Earth's climate? After all, the Earth's temperature and climate have been changing for millions of years, long before humans were on the Earth.

However, just because past warming was caused by natural factors does not mean that human activity is not responsible for the current warming. Using this logic, we would conclude that forest fires cannot be caused by humans because forest fires occurred before humans were on the Earth.

Any of the temperature changes experienced in the past were only regional. For example, the warm temperatures that tempted the Vikings to settle Greenland and visit North America were done during a relatively warm period. However, at the same time, Siberia experience a period of unusually cold weather. Taken together, these two anomalies offset each other and the temperature of the Earth did not change. More recent examples are El Niño and La Niña where the temperature of the Pacific Ocean off the coast of South America warms and cools.

To find the cause for the Earth's warming, we need to look at the evidence. Although scientists have identified the various causes of Earth's warming in its long history, they have found little evidence to support the natural variability argument for the current warming of the planet.



For example, if we look over the one thousand years before 1800 when there was little influence by humans, we see nothing similar to the magnitude or rate of warming experienced in recent decades. So, if the current warming is due to natural variability, there was no sign of it during this previous period, and no known cause for such natural variability since 1800.

Looking even further back in time, there is some evidence that periods of rapid warming occurred over the last 20,000 years as the earth moved out of the ice age. But these changes were accompanied by identified, rapid natural changes in atmospheric and oceanic circulation patterns. No such changes are occurring today.

If natural variability is the cause of the recent warming, it would most likely be driven by changes in ocean currents that warm the ocean surface. If this were occurring, the ocean surface would be warming faster than the land surface. However, we are experiencing the opposite. Land areas are warming significantly faster than oceans.

Therefore, we conclude from the scientific evidence that the contribution of natural variability to the warming of the planet over recent decades is small at best compared to the influence of humans to the Earth's warming.

Furthermore, individuals posing the natural variability argument for global warming implicitly assume that the climate variability will be mild with little impact on human activity. However, past climate changes have been powerful and would cause great damage to human civilization. And, these natural forces would be very difficult to control.

See the **Ag Decision Maker website**, extension.iastate.edu/agdm/energy.html#climate, for more from this series.

Hog producers rationally responding to market signals

By Lee Schulz, extension livestock economist
515-294-3356 | lschulz@iastate.edu

Have you heard the one about the physicist, the chemist, and the economist stranded on a desert island, with nothing to eat? A can of soup washes ashore. The physicist and the chemist devise ingenious ways to open the can like smashing it with a rock or building a fire and heating it. The economist merely says, "Assume we have a can opener."

Obviously, we cannot just assume a can opener and have one appear. Still, economists regularly use analogous assumptions to attempt to portray the real world, substitute for limited or non-existent data, and simplify problems. They hope those assumptions will not substantially affect results of the analysis. Still, that's why economists warn, "Do not question results of the analysis. But poke holes all you want at the assumptions upon which the analysis is based."

Understand cost-benefit tradeoff

Economists often refer to the *rational choice principle*. The concept assumes that individuals will always make prudent and logical decisions that provide them with the greatest benefit or satisfaction. In practice it means weighing the costs and benefits of any endeavor, such as a farmer deciding what and how much to produce. Producers commonly make rational choices by pitting the additional or marginal costs against the benefits of the proposed action and choosing the option with the greatest marginal benefit relative to marginal cost.

How well the real-world approximates the theory depends on many people doing lots of work. In the pork industry this consists of 66,439 hog operations with inventory, identified by the 2017 Census of Agriculture, and the backward and forward linkages in the supply chain. The backward linkages are to purchased and home-grown inputs, supplies, and services producers use. The forward linkages include value-adding economic activities occurring beyond the farm such as slaughter, processing, and preparation to get pork to consumers.

Pork producers contracting

Results from USDA's June survey of hog producers provides insight as to how producers are evaluating and responding to these linkages. The survey results showed the all hogs and pigs inventory down 0.9% from June 1, 2021 (Table 1). The breeding herd was down 0.8%. Producers indicated they intend to farrow 1.0% fewer sows in June-August 2022 and 1.4% fewer sows in September-November 2022, compared to last year. These farrowing intentions for the next two quarters are down 7.4% and 5.0%, respectively, from the same quarters two years ago.

Iowa-Minnesota hog prices during the first half of 2022 averaged 4.6% higher than the first half of 2021 and 62.5% higher than the average of the first two quarters of 2020. Lean hog futures suggest 2022 should tally the second highest annual hog price on record, second to only 2014. Next year's price could be the third or fourth highest.

Producers cutting supply

On the surface pork producers trimming production in the face of continuing strong hog prices defies logic. However, pork producers pulling back in the face of feed costs up almost 20% compared to a year ago and up nearly 80% from two years ago makes perfectly logical sense (Figure 1). Pork producers are calculating how much higher costs are hiking marginal costs to produce pork. Trimming production can improve the marginal benefit to marginal cost ratio. That is a change in supply shifted lower. It is driven by something other than the hog price. That something else is production costs—particularly feed.

Table 1. USDA quarterly hogs and pigs report summary. Source: USDA NASS

	United States			Iowa		
	2021	2022	2022 as % of '21	2021	2022	2022 as % of '21
Jun 1 inventory *						
All hogs and pigs	73,153	72,524	99.1	23,700	23,000	97.0
Kept for breeding	6,220	6,168	99.2	910	940	103.3
Market	66,933	66,356	99.1	22,790	22,060	96.8
Under 50 pounds	21,354	21,083	98.7	5,970	5,700	95.5
50-119 pounds	18,919	18,811	99.4	7,200	7,130	99.0
120-179 pounds	13,830	13,737	99.3	5,320	5,050	94.9
180 pounds and over	12,829	12,725	99.2	4,300	4,180	97.2
Sows farrowing **						
Dec–Feb [1]	2,929	2,912	99.4	485	475	97.9
Mar–May	3,034	2,992	98.6	510	505	99.0
Jun–Aug [2]	3,050	3,019	99.0	505	510	101.0
Sep–Nov [2]	3,049	3,007	98.6	525	510	97.1
Mar–May pigs per litter	10.95	11.00	100.5	11.40	11.45	100.4
Mar–May pig crop *	33,233	32,905	99.0	5,814	5,782	99.4

Full USDA report: https://downloads.usda.library.cornell.edu/usda-esmis/files/rj430453j/2v23x176m/jm215w193/hgpg0622.pdf

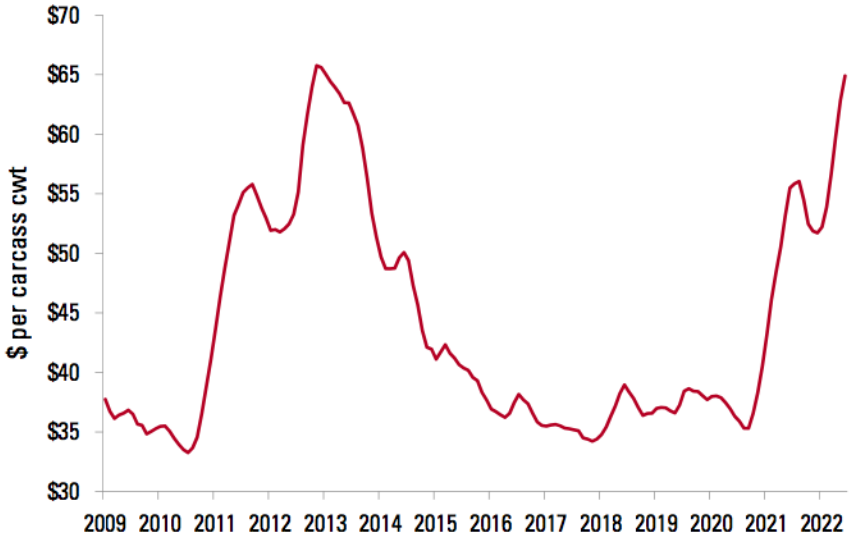
* 1,000 head; **1,000 litters; [1] December preceding year. [2] Intentions for 2022.

Some view the distinction between changes in supply versus changes in quantity supplied as useless nit picking. However, the more clearly one understands the various pork input-output relationships, the more accurately one might be able to forecast future hog price action. The more reliably a producer can predict expected hog prices, the more likely the producer will make suitable production adjustment decisions.

Supply vs. quantity supplied

A change in quantity supplied is pork producers responding merely to a change in hog prices, including expected prices. Higher prices entice producers to produce more. Lower prices trigger production cuts.

Figure 1. Feed Costs–Farrow to Finish, Iowa. Source: ISU Extension and Outreach Estimated Livestock Returns.



A change in quantity supplied is a move along a product's supply curve that is driven solely by a price change with all other factors staying the same.

A shift in supply is a result of a change in one or more production influencers such as technological advances, number of firms producing, the price of inputs, the price of other or alternative products that could be produced, and unpredictable events. Change in hog prices is not one of those factors. A supply shift changes the amount producers are willing to supply at all price levels. The entire supply curve shifts left or right.

Elasticity helps predict response

Supply elasticity of pork measures how much pork producers boost or cut production in response to a change in price only. It measures distance between various price-quantity pairs along an existing supply curve. If a large difference in production matches with a small change in price, supply is said to be elastic. Conversely, if the change in the quantity supplied is small relative to the change in price, supply is said to be relatively inelastic. Generally, a higher price will entice more production. Producers will respond to lower prices by cutting output.

Several factors influence the quantity of pork producers supply in response to changes in hog prices. The factors include time, ability to store, cost structure of producers, ease of changing from production of one product to another, and producer price expectations.

The influence of time may be short-, medium-, or long-term. In the short-term, responsiveness of quantity supplied to a price change tends to be small as changes cannot be made quickly.

Making short-term changes in pork production is difficult. Once a sow is bred, her pigs are almost certain to go to slaughter on a pre-set schedule. The conception to market period for pork is just under a year. With all the market hog weight classes down in the latest Hogs and Pigs report and with fewer sows expected to farrow in the next two quarters, the quantity of hogs producers will supply over the next 12 months will be lower. From another angle, unlike corn, which is a storable commodity, live hogs cannot be stored.

Structural factors

The cost structure of farms can influence supply elasticity. If individual producers can expand easily, then their individual supply curves would be relatively elastic. If most individual producers' supply curves were elastic, then the overall industry supply curve would also be elastic. Expansion decisions take longer to execute than do reduction decisions as, in most cases, production facilities must be built. Expansion decisions potentially have a 20-to 30-year impact on hog supplies since facilities placed into production will likely remain in production even with multiple owners.

If new entrants had cost structures only slightly above existing pork producers, a small rise in price might entice many more farms to enter the industry. This would generate a large supply response in total. As with any industry there are barriers to entry such as economies of size, high capital investment, and permit requirements. Producers need a large movement in prices to make it worth their while to overcome those barriers.

The ease of switching inputs to different uses is related to the influence of cost structure on supply elasticity. Land can flip flop from corn to soybeans relatively easily. They are relatively supply elastic. Sow farms have specialized facilities and equipment. Producers will run at near full capacity all of the time, regardless of price. Inability to switch resources elsewhere makes hog supply inelastic.

Risk reward tradeoff

Producer price expectations affect the supply curve. If many producers consider an increase in market prices to be short lived or too small, then the total supply response would be less. Conversely, if producers expect price increases to remain in the medium- or long-term, the elasticity of the total supply curve may be greater. Recent periods of more input and output

price variability has created a "new price environment." More uncertainty likely alters the risk–reward relationship as producers consider expansion. The more risk and uncertainty producers see, for a given level of expected profit, the more likely they will go slow on expansion.

Pork production is a competitive industry. That means long-run economic profits will gravitate toward zero. Producers will expand when they expect profits. Losses will trigger contraction. That is the hog cycle. It has been around forever.

Current levels of risk, uncertainty, and input costs appear to have producers pulling back, in spite of near record and continuing strong hog prices. We are seeing a change in supply—a retrenching of the industry so to speak. It is not a mere change in quantity supplied as producers indicate they are cutting back despite expectations of strong prices.

Commercial slaughter and price forecasts

Table 2 contains the Iowa State University price forecasts for the next four quarters. Prices are for the Iowa-Minnesota producer sold weighted average carcass base price for all purchase types. Basis forecasts along with lean hog futures prices are used to make cash price projections. The table also contains the projected year-over-year changes in commercial hog slaughter.

Table 2. Commercial hog slaughter projections and price forecasts, 2022-2023

	Year-over-Year Change In Commercial Hog Slaughter (%)	ISU Model Price Forecast, IA-MN Base Price, All Purchase Types ($/cwt.)	CME Futures (6/29/22) Adjusted for IA-MN Producer Sold Weighted Average Carcass Base Price for All Purchase Types Historical Basis ($/cwt.)
Jul-Sep 2022	-1.09	97-101	98.59
Oct-Dec 2022	-0.36	83-87	85.07
Jan-Mar 2023	0.06	85-89	87.45
Apr-Jun 2023	-1.01	92-96	94.07

Evaluating production metrics in relation to sustainability in a wean-to-finish barn

By Erika M. Johnson, Garland R. Dahlke, Lance H. Baumgard and Jason W. Ross, Iowa Pork Industry Center

Improving the sustainability of US pork production requires a better understanding of the relationship between the environment and production practices. Pork producers play a crucial role in environmental stewardship, however, the impact of production efficiency on greenhouse gas production has not been well established. Interpreting the influence of specific production metrics on greenhouse gas (GHG) production is essential for benchmarking and improving the environmental sustainability of pork production.

During the growth period, pigs generate three major greenhouse gases: carbon dioxide, methane, and nitrous oxide. Carbon dioxide is produced as a byproduct of maintenance and growth and is emitted through exhalation during respiration. Methane and nitrous oxide are generated by manure and output of these gases are dependent on the type of manure management system implemented in the barn.

The **Wean-to-Finish Pork Sustainability Calculator**, www.ipic.iastate.edu/info/WFPorkSustainabilityCalculator.xlsx, was designed to provide producers with a tool to estimate the impacts of various levels of production efficiencies (i.e., feed efficiency and mortality), allowing them to determine how specific improvements in finishing can influence the environmental footprint. The calculator provides insight into greenhouse gas production at the individual and barn level to enable continuous improvement of pork production.

Wean-to-Finish Production Metrics

Data was collected for baseline closeout weight and days in the barn until market for wean-to-finish pigs (MetaFarms Production Index: Nursery, Finishing, Wean-to-Finish Closeout Performance, and Market Hog Sales, 2019). Baseline average daily gain, dry matter intake, and feed efficiency curves were obtained for the wean-to-finish stage (PIC 2019 Wean to Finish Guidelines, 2019).

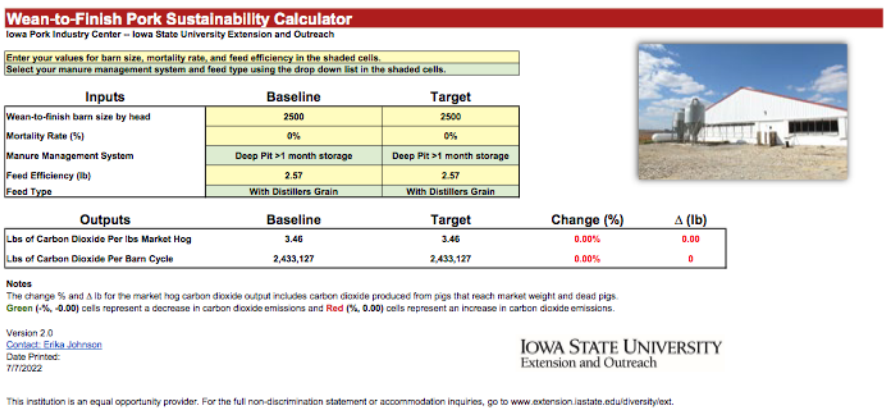
A mortality equation was designed to assume production of GHG from respiration, feed, and manure management system; calculated only for the period of time the animal is alive.

Total GHG emissions are sourced from the amount of gas emitted by live and dead pigs. Estimates for GHG production by live pigs follows the assumption that the pig reached market weight (281 lbs.). Estimates for GHG production by pigs that died follows the assumption that the pig reached the halfway point (140.5 lbs.). Barn size and mortality is set by the user.

$$\text{Mortality} = \frac{\text{Total GHG emissions from pigs}}{\text{281 lbs. x Barn size x (1 - Mortality x 0.01)}}$$

Summary

From these assumptions, GHG emissions can be calculated based on mortality, manure management systems, feed efficiency, and feed type. All of which can be applied within specific production parameters set by the user. The calculator can be manipulated to compare current production practices and target closeouts for the



Wean-to-Finish Pork Sustainability Calculator

Iowa Pork Industry Center – Iowa State University Extension and Outreach

Enter your values for barn size, mortality rate, and feed efficiency in the shaded cells.
Select your manure management system and feed type using the drop down list in the shaded cells.

Inputs	Baseline	Target
Wean-to-finish barn size by head	2500	2500
Mortality Rate (%)	0%	0%
Manure Management System	Deep Pit >1 month storage	Deep Pit >1 month storage
Feed Efficiency (lb)	2.57	2.57
Feed Type	With Distillers Grain	With Distillers Grain

Outputs	Baseline	Target	Change (%)	Δ (lb)
Lbs of Carbon Dioxide Per lbs Market Hog	3.46	3.46	0.00%	0.00
Lbs of Carbon Dioxide Per Barn Cycle	2,433,127	2,433,127	0.00%	0

Notes
The change % and Δ lb for the market hog carbon dioxide output includes carbon dioxide produced from pigs that reach market weight and dead pigs.
Green (-%, -0.00) cells represent a decrease in carbon dioxide emissions and Red (%, 0.00) cells represent an increase in carbon dioxide emissions.

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barn. A percent change is generated to demonstrate the potential improvement or decline of the different production metrics' influence on emissions.

The calculator allows producers to understand how specific improvements in finishing can influence the environmental footprint of that barn. They can change production parameters such as mortality and feed efficiency and see the effect of those changes.

This Excel-based calculator provides changes in percentages and weight of carbon dioxide based on baseline and target values entered by the user. It offers insight into the level of greenhouse gas production at the individual barn level to enable continuous improvement and can be used at any time to gauge potential change implications.

Visit the **Iowa Pork Industry Center website** for additional details on sustainability in the pork industry, www.ipic.iastate.edu/news/PorkLifeCycleSustainability.html.

Ag Decision Maker is written by extension ag economists and compiled by Ann Johanns, extension program specialist, aholste@iastate.edu.