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Introducing the Gardner Farm Income and Policy Simulator

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With today's article, the Gardner Agriculture Policy Program introduces a comprehensive tool for farm income, economics and policy analysis (*farmdoc daily*, [January 27, 2017](#)). The Gardner Farm Income and Policy Simulator (GFIPS) simulates farm financial performance for five years beginning with current year balance sheet and farm size information. It is designed to analyze farm financial scenarios for two purposes. First, the GFIPS can be used for benchmark financial performance given scenarios of prices and yields in the future, thereby allowing an assessment of future financial health of farmers. Second, the GFIPS can be used to evaluate the impacts of various policy alternatives on the financial health of farms.

In this article, we use this model to simulate a 1,700 acre central Illinois grain farm from 2017 to 2021. These projections suggest eroding working capital and deteriorating financial position if yields are at trend levels while corn and soybean prices remain relatively low. Future articles will explore specific policies and analyze the impact on farm income and financial health.

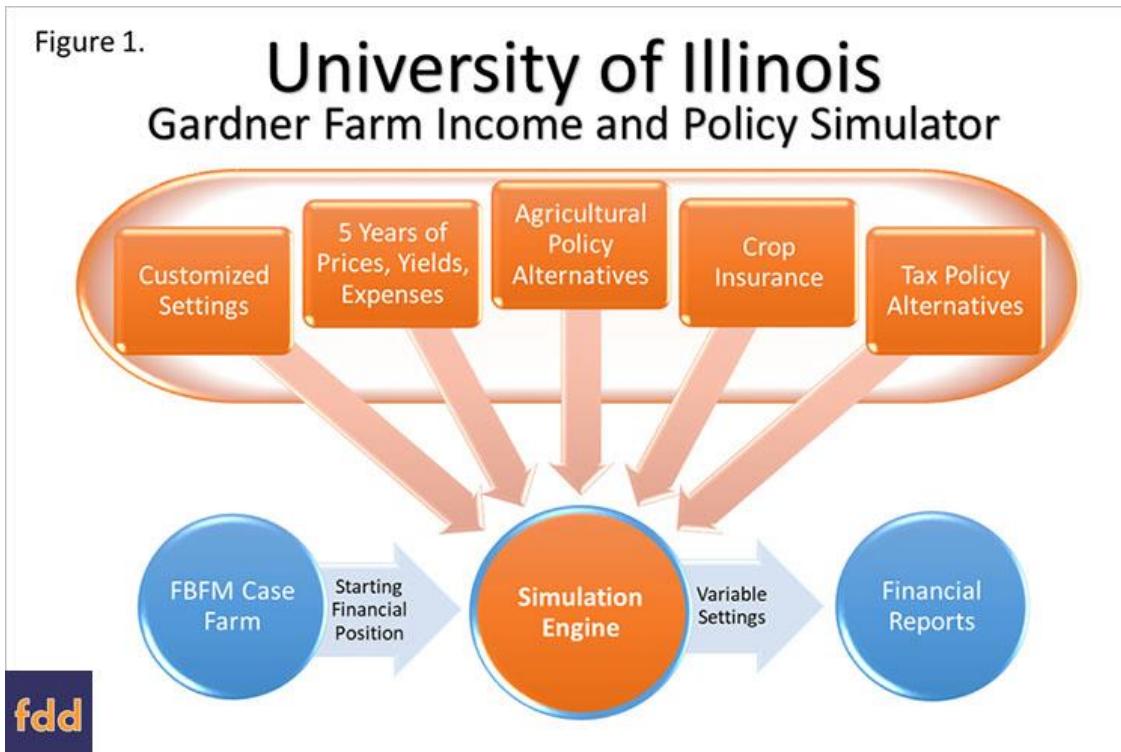
The Gardner Farm Income and Policy Simulator

GFIPS works through detailed economic and financial modelling using a case farm developed from data collected by the Illinois Farm Business Farm Management Association (FBFM). Therefore, the case farm provides a unique representation of actual Illinois grain farms under real-world economic conditions. Case farms have been developed for three specific cases: 1) northern Illinois, 2) central Illinois with high-productivity farmland, and 3) southern Illinois. The case farms vary in size, tenure, and debt-to-asset position, real-world conditions that have noticeable impacts on farm financial health.

GFIPS generates a set of financial statements over a five-year projection period. The financial statements include a balance sheet, income statement, cash flow, and debt capital repayment report. The financial statements can be used to evaluate financial health, risk and performance over the five-year projection period and includes measures of income and expenses, cash flows, repayment capacity, balance sheets and financial ratios. Detailed description of how the model works can be found in the [documentation](#).

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When simulating performance, the user enters expectations of yields and prices over the next five years into the model. Yields and prices can be changed to quantify yield and price impacts on financial performance. The simulation engine also includes different agricultural policy scenarios (e.g., Agricultural Risk Coverage and Price Loss Coverage), crop insurance products (Revenue Protection (RP), RP with harvest price option, and Yield Protection), and tax policies. These selections formulate the scenario applied to the case farm in the simulation engine to produce five-years of financial statements (see Figure 1 for a graphical depiction of the model).



Central Illinois High-Productivity Farmland Case

Table 1 shows the simulation of the central Illinois case farm with high-productivity. This farm has 1,700 acres, with 11% owned, 44% share-rented, and 45% cash rented. The average cash rent is \$273 per acre in 2016. This farm represents the average of 1,500 to 2,000 acre farms in McLean County, Illinois. Actual, average results are available for 2016. In this year, the farm had \$77,982 of net farm income and net worth of \$3,760,000. The farm's current ratio was 1.78, the debt-to-asset ratio was .269, and the debt-to-coverage ratio was 151.4%. All of these values are based on averages of central Illinois farmland with between 1,500 and 2,000 acres. More detail on the inputs can be found in the documentation.

Even though 2017 has ended, financial results for 2017 still are simulated by the model. FBFM has not summarized financial results for 2017. Net income is projected to decline from \$77,592 in 2016 to \$57,459 in 2017. Lower yields and slightly lower prices contribute to lower incomes. Corn yield of 228 bushels per acre occurred in 2016 while 2017 corn yield is projected at 215 per bushel. Corn price is slightly lower: \$3.35 in 2016 and \$3.30 in 2017. Also, Agricultural Risk Coverage (ARC) payments are projected lower in 2017 than in 2016.

Further declines in income are projected in 2018 through 2021. Incomes are projected to fall to \$4,226 in 2018, and then proceed lower into negative territory: -\$17,600 in 2019, -\$13,320 in 2020, and -\$3,401 in 2021. Most of these declines are occurring because of lower projected yields. Corn yields are between 200 and 210 bushels in 2018 through 2021, compared to 228 bushels in 2016 and 215 bushels per acre in 2017. Yields used in 2019 through 2021 projection years follow a longer term trend, estimated using a formula accounting for historical yields and prices, and are much lower than recent yields experienced on Illinois farms. The 2018 yield projection is also close to trend expectations. Prices remain low and are based on projections made by USDA Office of the Chief Economist Long-Term outlook released in

November 2017. Moreover, further declines in farm revenues projected in 2018 is due to expectations that ARC-County will issue payments at the simulated yields and prices.

Table 1 also includes three key ratios representing the financial health of the farm: current ratio, a measure of liquidity; debt to asset ratio, a measure of solvency; and debt coverage ratio, a measure of yearly cash flow. Current ratio equals current assets divided by current liabilities and is a measure of working capital. The current ratio erodes over time from 1.78 in 2016 to 1.19 in 2021 indicating that working capital is declining. Similar to the other two ratios, the current ratio is color coded to represent an acceptable range (green), questionable range (yellow), and warning zone (red). The case farm begins strong enough at year-end 2016 to weather the first part of the projection period, maintaining a range of liquidity that would be generally be acceptable to lenders. However, weaknesses become apparent beginning in 2020 when the current ratio drops to 1.35; notably below the 1.50 threshold that lenders may consider a turning point in quality.

The debt-to-asset ratio equals debt divided by assets. Higher debt-to-asset ratios mean higher debt relative to assets. Over the five-year simulation, the debt-to-asset ratio increases from .269 in 2016 (in the acceptable range) to .338 in 2021 (in the questionable range). The farm accumulates debt over the five-year period.

The debt coverage ratio measures the farm's ability to provide for debt payments. A value of 151.4% means the operation generates 51.4% more funds than is sufficient to cover debt obligations. Values below 100% mean that the operation is not generating sufficient funds to cover debt payments. Over the five-year simulation, debt coverage ratio decreases from 151.4% in 2016 (in the acceptable range to 55.1% in 2021 (in the warning zone).

Financial simulation results present a picture of caution. If relatively low prices and trend yields occur over the next five years, deterioration in working capital, debt-to-asset position, and debt coverage will occur. Of course, higher yields like those in 2016 and 2017 could continue in future years. Alternatively, prices could increase.

Table 1. Financial Performance of Central Illinois case farm "Central High 1" with Gardner Farm Income & Policy Simulator
University of Illinois Gardner Farm Income & Policy Simulator

<i>Central High 1</i>	Base Year 2016	2017	2018	2019	2020	2021
Corn Price/Yield (bu/acre)	\$3.35 / 228	\$3.30 / 215	\$3.30 / 210	\$3.35 / 201	\$3.35 / 203	\$3.40 / 205
Soybean Price/Yield (bu/acre)	\$9.50 / 69	\$9.35 / 67	\$9.30 / 63	\$9.45 / 61	\$9.45 / 61	\$9.50 / 62
Net Farm Income	\$77,892	\$57,459	\$4,226	-\$17,600	-\$13,329	-\$3,041
Net Worth (Millions)	\$3.76	\$3.76	\$3.71	\$3.63	\$3.55	\$3.47
Current Ratio	1.78	1.76	1.72	1.55	1.35	1.19
Debt/Asset Ratio	26.9%	26.9%	27.6%	29.0%	31.5%	33.8%
Debt Coverage Ratio	151.4%	111.3%	66.2%	46.9%	49.0%	55.1%

Summary

GFIPS is capable of generating detailed financial statements for a five-year projection period for representative Illinois grain farms. Using FBFM data to develop case farms provides an accurate reflection of current conditions. The projections facilitate comprehensive analysis of farm financial health for benchmarking purposes and for risk analysis, as well as evaluating federal policies. The simulation engine applies a set of prices, yields, expenses, and policy settings to the case farm to estimate future financial performance under the specified set of conditions.

GFIPS can be used to generate other case farm examples to evaluate estimated future financial performance of farms in other size groups, other regions, or with different simulation engine settings. The simulation engine's input settings provide many options for future study of how changes to agricultural or tax policy could impact future farm level financial health.

References

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