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Estimating costs of crop production vital for 2019 farm businesses

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Estimating costs of crop production for 2019 will be extremely important. With a market outlook for 2019 similar to 2018, there are challenges ahead from a marketing perspective. Marketing strategies for farmers include forward pricing, setting a quantity-only marketing plan, or using the spot market. The price consequences of these decisions are substantial. Having a firm handle on one's cost of production provides a key piece of information in any strong marketing plan. The latest issue of the Iowa State University Extension and Outreach "Estimated Costs of Crop Production" reports average cost estimates for Iowa farms in 2019, and provides guidelines to help farmers calculate their own costs of production.

The estimated costs of production for continuous corn are \$3.93, \$3.91, and \$3.88 per bushel for expected yields of 164, 182, and 200 bushels per acre, respectively.

The estimated costs of production per bushel for corn following soybeans are \$3.39, \$3.39, and \$3.38 assuming 178, 198, and 218 bushels per acre, respectively. Recent projections for the 2019 marketing year average price for corn are near \$3.90 per bushel, showing the potential for a slight profit for most yield levels.

Cost of production estimates, per bushel, for herbicide tolerant soybeans are \$9.21, \$9.04 and \$8.86 assuming 50, 56, and 62 bushels per acre, respectively. The total cost per bushel of soybeans is projected at \$9.13 for non-herbicide-tolerant beans at 56 bushels per acre, according to the report. Recent projections for the 2019 marketing year average price for soybeans give a more negative outlook at \$8.75 per bushel.

Starting in 2019, reference yields for corn and soybean budgets in the annual ISU Extension and Outreach report reflect 30-year trend yields that will be updated

annually (the most recent prior adjustment in reference yields was done in 2010). While total costs per acre will continue to be directly comparable across all annual ISU Extension and

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Handbook updates

For those of you subscribing to the handbook, the following updates are included.

Estimated Costs of Crop Production in Iowa - 2019 – A1-20 (13 pages)

Historical Costs of Crop Production – A1-21 (2 pages)

Suggested Closing Inventory Prices – C1-40 (2 pages)

Please add these files to your handbook and remove the out-of-date material.

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Outreach reports, total costs per bushel under the new approach will have to be adjusted to a common reference yield before running comparisons across years.

The significant increase in reference yields between the 2018 and 2019 reports more than offsets the six to seven percent increase in total costs per acre, resulting in lower total costs per bushel. When looking at specific categories, costs increased for chemical and fertilizer inputs, while seed and fuel costs saw slight decreases.

These cost estimates are representative of average costs for farms in Iowa. The [full report](#) is available online through the Ag Decision Maker website, www.extension.iastate.edu/agdm/crops/html/a1-20.html. The publication includes additional corn and soybean budgets for low-till, strip-till, and non-herbicide tolerant soybeans. Budgets are also available for corn silage, alfalfa hay establishment with an oat companion crop and by direct seeding. Annual production costs for established alfalfa or alfalfa-grass hay as well as a budget for maintaining grass pastures are included. Actual costs can be entered in the column for “Your Estimates”, or by using the electronic spreadsheet [Decision Tools](#) on the Ag Decision Maker website, www.extension.iastate.edu/agdm/crops/html/a1-20.html.

Very large or small farms may have lower or higher fixed costs per acre. “Our annual estimates are to be used as guidelines to help you compare and figure your own costs for your farming operation. For example, if you own the land and you are interested in calculating your accounting cost of production rather than your economic cost of production (which includes the opportunity cost of not renting out your land), then your land cost will likely be much smaller than the cash rent equivalent included in the report. Alternatively, if you are producing crops on leased acres and your cost structure is similar to the one used for the report but your expected yield is much higher, then your projected cost per bushel will be lower than the published one,” says Plastina.

Breakdown of costs for 2019

For corn, land represents approximately 30 percent of the total costs of production (Figures 1 and 2). Values of \$185, \$223, and \$258 per acre rent charges for the low, medium, and high quality land were assumed. The variable costs represent just over 50 percent of the costs of production. Of the variable costs, nitrogen and seed costs are almost half the costs for either continuous or rotated corn. Nitrogen increased 26 percent from 2018, at \$.38 per pound and seed was assumed to cost approximately \$256 per bag, a 2 percent decline.

Figure 1. Corn following corn, 2019 estimated costs of production

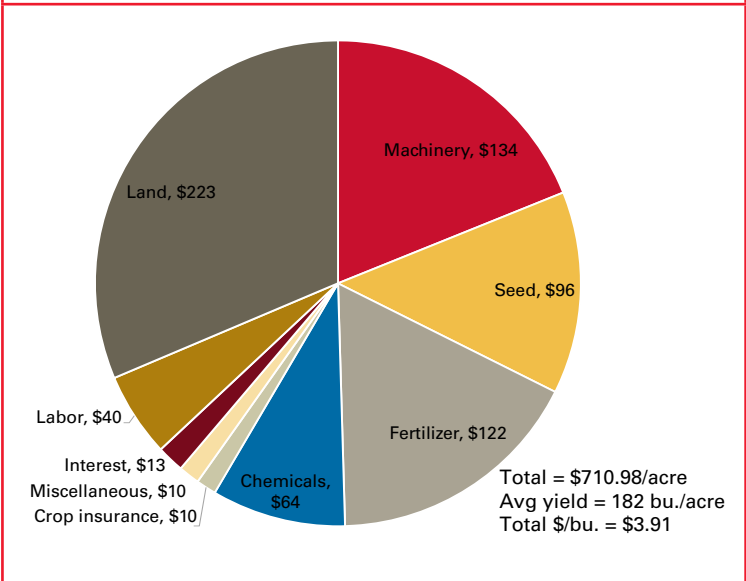
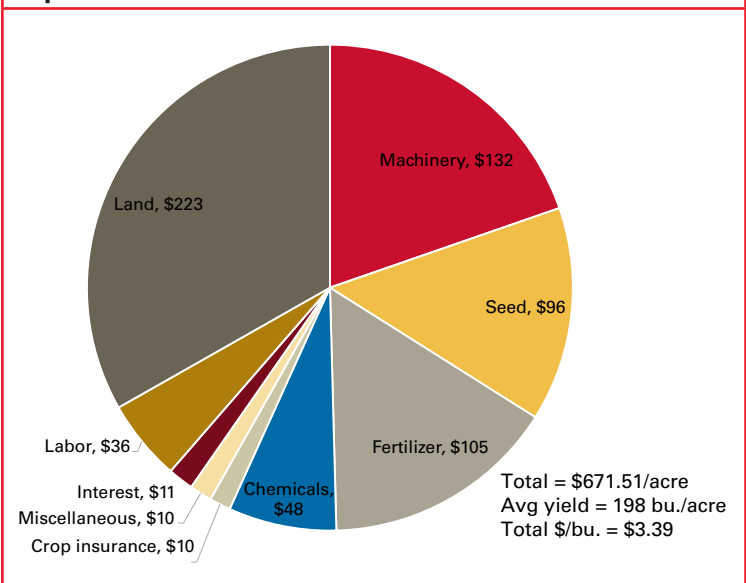


Figure 2. Corn following soybeans, 2019 estimated costs of production



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Land represents just over 44 percent of the costs of production for soybeans (Figure 3), while the variable costs represent 42 percent. Seed and fertilizer are almost half of the variable costs. Phosphorus was charged at \$.42 per pound and potassium at \$.31 per pound, an increase of seven and 14 percent, respectively. Machinery costs were two percent lower compared to 2018 primarily due to lower fuel costs.

Breaking even in 2019

Current costs of production along with a well-planned marketing plan have the potential to result in small but positive profit margins in 2019 for corn but the outlook is not quite as promising for soybeans. Using recent price projections for 2019/20, a rented acre of corn following soybeans would need to produce 172 bushels of corn to breakeven, and a rented acre of genetically modified soybeans would need to produce 58 bushels of soybeans to breakeven. However, a rented acre of corn following corn would need to produce 183 bushels of corn to breakeven.

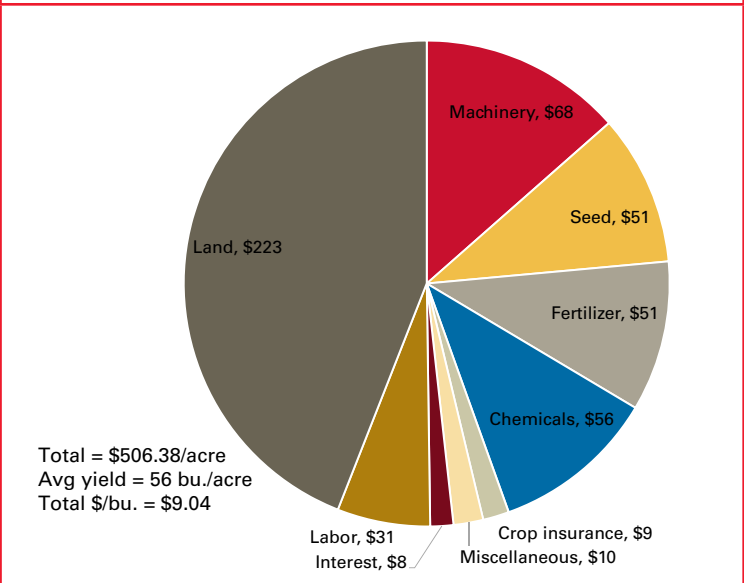
The margin of error in these projections is directly proportional to the margins of error on projected yields, costs, and prices. Given such uncertainties, it is highly recommended that producers visit with trusted agronomists on how to cut costs without hurting revenue potential.

Knowing the operation's cost per acre is critical for creating solid marketing plans and making the necessary arrangements (such as securing operating loans, restructuring machinery or real estate loans, adding non-farm income) to cash flow an operation in 2019.

Conclusions

When using the ISU cost of production estimates for 2019, keep several things in mind. First, fertilizer and lime costs include volume and early purchase discounts. Second, farmers paying land rents higher than the ones projected in the report might face higher costs of production. Finally, starting in 2019, reference yields for the crop budgets line up with 30-year yield trends.

Figure 3. Herbicide tolerant soybeans, 2019 estimated costs of production



While total costs per bushel may look lower in the latest cost of crop production publication due to higher reference yields, total costs per acre are estimated higher than in 2018. Although there is variability across most input categories, increased fertilizer and chemical prices and lower seed and crop insurance costs were among the most variable.

Producers need to have a strong grasp of their own production costs. Costs of production are not seeing the rapid fluctuations that were seen in recent years, but current prices still create a lot of uncertainty when it comes to profitability on individual operations. Knowing costs is key.

Rethinking corn drying: drying throughout the winter using ground-stored heat

A summary of on-farm research funded by USDA-SARE.

By Eric Jellum, Jellum Farm, research project coordinator, jellumfm@gmail.com

Grain drying is energy intensive. Most of the corn grown for grain is dried using large quantities of LP- or natural gas-heated air at or soon after harvest. The rule of thumb using LP for drying is that it takes about 0.02 gallons of LP for each point of moisture dried from corn. Alternatively, some corn is dried in storage bins equipped with drying floors during a short period in the fall using large volumes of air that is heated only several degrees by the heat from fan operation (often called “natural air drying”).¹ Natural air drying can be done for less cost and energy use if grain depth is not excessive. In the Upper Midwest, ambient air conditions between mid-October and mid-November are nearly ideal for drying corn to a moisture content of 15 percent.

Although average temperatures continue to be low enough from November through March² for safe storage and drying of corn that is less than 20 to 22 percent moisture content, during much of the period ambient air temperatures and humidities prevent corn from drying below 18 to 19 percent moisture without supplemental heat. Because the economic advantage of natural air drying diminishes to the extent that expensive heat sources are needed to heat air, it has not been considered to be economically practical beyond late November. Although natural air corn drying is less energy intensive and usually less expensive than LP drying, the time constraints that require large fans for drying result in substantial electricity usage to move the required air volume through the grain at the recommended airflow rates.

A different approach to drying corn

The cold winter temperatures in the Upper Midwest provide opportunities to prolong the drying period, at lower airflow rates and at safe storage temperatures, which would save substantial costs and energy use for fan operation. Cutting the airflow rate in half or to one third of the full airflow rate can be done for about 20 percent or eight percent, respectively, of the fan power required for the full rate³. The same volume of air can be moved through the grain operating a smaller fan at half the airflow rate for twice as long or a third of the airflow rate for

three times as long for 40 or 24 percent, respectively, of the energy required for full flow. Yet, meeting targeted goals of 13 to 15 percent moisture content would require drying air temperature increases of six to 12 degrees F to sufficiently lower the relative humidity of ambient air. Using electricity, LP, or natural gas at current prices for heating air would negate much or all of the savings resulting from the lower fan operation’s energy usage. Despite the fact that colder air will hold less moisture than warmer air, drying corn to 15 percent moisture content during the winter would take very little additional air volume compared with drying during the fall. A low cost energy source for heating drying air is key to expanding the drying season from a limited time during the fall to utilizing the entire winter and into the spring.

A solution lies in ground heat (ground-stored solar energy). Ground heat is inexpensive to access and is the reason that ground source heat pump systems are so efficient and have become popular. In the fall, soil temperatures drop slower and reach minimum values later than air temperatures. The difference between cold winter air temperatures and warmer soil temperatures can be used to heat air for low-temperature grain drying, even without using a heat pump, which is the most expensive part of a ground-source heat pump heating system.

On-farm research results

A project funded by USDA-SARE (Project FNC17-1080, [Decreasing Energy Use and Cost of Grain Drying by Extending Drying Period Using Ground-Stored Heat](https://projects.sare.org/sare_project/fnc17-1080/), https://projects.sare.org/sare_project/fnc17-1080/) has provided ample demonstration that low-temperature drying using ground heat to warm the drying air can be done well into the winter using substantially less energy. The drying system included a ground loop (three 800-foot 3/4-inch water lines buried to a depth of 8 feet), an air-to-water heat exchanger, and a 3/4 hp fan that replaced the three hp fan that had been used on the 3000-bushel bin for natural air drying. Operation of a small circulating pump for the ground loop

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delivered enough heat to the heat exchanger in the drying air stream for an average eight to 10 degree F air temperature increase (Table 1). The energy cost for the heat was two to three percent of what the cost would have been using LP at \$1.00/gallon. The objective of the first year of the project was to extend the drying period into the winter. The conclusions after the first year of drying were that drying could be continued throughout the winter into the spring and that better fan selection for the static pressure at the desired airflow rate could further reduce energy costs for drying. The second year of the project is currently underway. A quarter hp fan (309 watt) replaced the larger fan (680 watt) used during the first year, and a second heat exchanger was added to increase heat extraction from the ground loop, which made it possible to decrease the water flow rate by turning the circulating pump from high (87 watt) to low (66 watt). The drying progress in the second year is on schedule to meet the objectives for further reduction in energy use and cost as predicted after the first year (projected to be \$0.004/point of moisture removed compared to \$0.02/point using LP at \$1.00/gallon).

Potential limitations experienced

Drying can continue through the winter at temperatures below freezing, but precautions should be taken when air temperatures are extremely cold to keep frost formation on exhaust ventilation openings in the bin from restricting or stopping airflow. It may be necessary to stop the drying fan at temperatures near zero. There are a number of other reasons that it might be advantageous to interrupt the drying process by operating the fan only within certain parameters:

1. A short interruption each day can assist the local utility to reduce demand during peak demand times, often in exchange for a lower electricity rate for the user.
2. When ambient air temperatures are warm, ground temperatures and ambient air temperatures may be too similar, so that the humidity of the drying air cannot be lowered enough to dry grain to a targeted moisture content. Since the “shelf life” of corn is inversely proportional to temperature and starting corn moisture content, operating the fan when ambient temperatures are too high

Table 1. Nashua* soil (50" depth) and air temperatures averaged by week for the five year period 2014 – 2018

The drying air temperature increase is hypothetical, based on average air temperature over the period and capturing 40 percent of the difference between soil temperature and air temperature. The drying air temperature includes a small increase for heat from the fan operation (3/4 degree F).

Week	Cumulative days	50" soil temperature	Ambient air temperature	Difference	Drying air temperature increase	Drying air temperature
22-Oct	7	55.8	46.8	9.0	4.3	51.1
29-Oct	14	54.0	44.9	9.1	4.4	49.2
5-Nov	21	52.3	38.2	14.2	6.4	44.6
12-Nov	28	49.9	31.9	18.0	8.0	39.8
19-Nov	35	47.8	29.0	18.8	8.3	37.3
26-Nov	42	46.0	29.2	16.7	7.4	36.7
3-Dec	49	44.6	27.6	17.0	7.5	35.1
10-Dec	56	43.2	27.1	16.1	7.2	34.3
17-Dec	63	43.0	23.6	19.4	8.5	32.1
24-Dec	70	41.8	19.3	22.5	9.7	29.0
31-Dec	77	40.3	7.4	32.9	13.9	21.3
7-Jan	84	39.6	12.9	26.7	11.4	24.3
14-Jan	91	38.7	19.0	19.7	8.6	27.6
21-Jan	98	37.8	22.0	15.8	7.1	29.1
28-Jan	105	37.7	15.9	21.8	9.5	25.4
4-Feb	112	37.5	11.8	25.7	11.0	22.9
11-Feb	119	37.0	19.5	17.5	7.8	27.2
18-Feb	126	36.8	23.4	13.4	6.1	29.5
25-Feb	133	36.7	19.5	17.2	7.6	27.1
Average		43.2	24.7	18.5	8.1	32.8

* Northeast Iowa Research and Demonstration Farm in Nashua, Iowa

** Relative humidity of ambient air during this period would average about 80 percent. The drying air temperature increase would reduce the relative humidity of the drying air to approximately 57 percent, which would equilibrate with corn at a moisture content just under 15 percent.

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would unnecessarily shorten the allowable period for drying the corn. Although operating the fan at night if needed to keep grain cooler might still make sense.

- 3. Another way to increase the drying air temperature besides artificially heating it is to operate the fan only during a warmer or less humid fraction of each day. Although this might require a larger fan to compensate for the shorter duration of fan operation, total cost may remain low because of the decreased capital cost for heating.

Under any of these circumstances it may be necessary or advantageous to exercise control (e.g. with thermostat or humidistat) over when to shut the drying fan off.

Cost and energy savings

Unlike with conventional dryers, energy costs have become so minimal for the system developed in this project that capital cost is the larger component of the total cost of grain drying. The research focus will shift to optimizing capital and total costs.

Energy use comparisons among drying systems are difficult because net energy values for delivered LP or natural gas are difficult to find and electricity can be produced with either fossil or alternative energy. Direct energy use comparisons between electric and LP heat sources have been avoided in this article. Emphasis has been on energy costs rather than energy usage, with the assumption that the correlation of cost and energy use is reasonably close.

It should be emphasized that both cost and energy consumption are very important, and the intent of the research has been to decrease both.

Conclusion

The ultimate goal of the research is to develop a low-cost and energy efficient drying system that is easy to use and provides grain with safe conditions throughout the drying process. All producers are concerned with controlling costs and should want to assess whether this system can fit into their operations. Most people are concerned with energy conservation for reasons beyond simply lowering costs, either for ecological reasons such as climate change or geopolitical reasons, such as excessive dependency on foreign fossil fuel sources. The shift in the proposed drying system from most of the cost being for purchased energy inputs (mainly LP or natural gas) to most of the cost being for capital cost (using local contractors) results in greater support for local economies. Whether for one or all of the above reasons, drying corn in the manner proposed should lead to a more sustainable and profitable agriculture and less impact on the environment.

References

1) Low Temperature & Solar Grain Drying Handbook (Midwest Plan Service #22), www-mwps.sws.iastate.edu/
2) Iowa Environmental MESONET, Iowa State University, https://mesonet.agron.iastate.edu/
3) University of Minnesota Fan Selection for Grain Bins, https://bbefans.cfans.umn.edu/

Updates, continued from page 1

Internet Updates

The following Decision Tool has been updated on www.extension.iastate.edu/agdm.

Estimated Costs of Crop Production in Iowa - 2019- A1-20 (Decision Tools)

Current Profitability

The following tools have been updated on www.extension.iastate.edu/agdm/info/outlook.html.

Corn Profitability - A1-85

Soybean Profitability - A1-86

Iowa Cash Corn and Soybean Prices - A2-11

Season Average Price Calculator - A2-15

Ethanol Profitability - D1-10

Biodiesel Profitability - D1-15

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