Simulating the Value of Crop Insurance and Pre-Harvest Marketing

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ABSTRACT

Annualized net return over variable costs, land, and business growth are simulated for a Western Kentucky grain farm for a five-year period. The model incorporates yield, cash price, and forward contract price variability. Risk reduction provided by a pre-harvest marketing plan and by crop insurance is evaluated by simulating price and yield combinations 500 times per year. Production not priced before harvest is sold in equal shares from January through May. The results illustrate that risk management practices can improve average farm profitability and reduce the risk of being unprofitable when analyzed over multiple years.

Introduction

Managers have the challenge of making multiple business decisions daily that may affect the business over several years. Some decisions are made using science-based agronomic research like the choice of seed, fertilizer and chemical packages that will deliver the best yield for the cost. Other decisions, like marketing and risk management, are subjective and rooted in expectations about uncertain prices and yields. The decision of choosing crop insurance coverage levels or making pre-harvest marketing decisions are only evaluated after the fact given the harvested yield and realized price. The multiple-year impact of the risk management decisions is difficult to measure as a risk management decision might be viewed as a failure if there is not a revenue loss at harvest and the risk product was not triggered. Only when there is a revenue loss is the value of crop insurance or forward pricing grain measurable.



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An important part of the management process is evaluating the plan's outcomes and considering adjustments to the risk management plan for the next year. Managers that started growing corn and soybeans during the export-biofuel "boom" from 2006-2013 may have formed price and profitability management plans that are not sustainable in the current market price and cost-structure reality. During the "boom" period, market prices were trending higher with little financial motivation to price before harvest to protect against the risk of lower harvest-time prices. Similarly, revenue protection (RP) insurance protected revenue levels that may have locked in a guaranteed return over production cost and land costs. The grain and oilseed market's adjustment to lower price levels have squeezed profit margins and have motivated the need for managers to incorporate risk management practices like combining crop insurance with pre-harvest marketing into marketing plans.

Making decisions given price and yield uncertainty forces managers to consider the variability of potential yields and prices and to consider the financial impact of realizing a below-average price or yield. This paper uses crop enterprise budgets to develop an expected return over input costs, land costs, overhead, and return to business growth (which may be a proxy for family living expense for the business owner) for 500 combinations of price and yield for a five-year period. A manager could do this analysis in an Excel spreadsheet by randomly changing yield and harvest-time prices to gauge the impact on profitability. Simulation is a tool assisting managers in defining the impact of yield and price variability on profitability by using historical price and yield variability over many growing seasons.

This paper simulates the annual return over input costs, land rent, overhead expense and business growth for a 2100-acre grain farm in Western Kentucky. The analysis is for a five-year period where the annual returns for each year are discounted to a present value and then amortized to an annual payment on a per-acre basis. Each year of the simulation draws 500 yields and harvest-time prices using the manager's expectations of the variability associated with each variable to help in understanding the likelihood of having a financial loss and the expected value of the loss due to lower prices or below-average yields.

This simulation process will help managers understand the multiple-year impact of using risk management practices like increasing the RP crop insurance coverage levels from 60 percent to 80 percent. This increased coverage comes with a more expensive insurance premium but may provide better protection against extreme revenue loss. While many farmers used the proceeds from the profitable years to increase on-farm storage capacity, there are still farmers at Extension meetings that state that they lack on-farm storage. This simulation model can measure the value of changing marketing from selling all of the production at harvest to selling 100 percent post-harvest. While that radical change in marketing is not entirely realistic, another management strategy is to forward price a percentage of expected production at marketing targets based on the farm's cost structure. Extension economists continue to educate managers on the importance of having a marketing plan to develop pricing objectives and to use this plan without defaulting to the raw emotion of daily price movements in the commodity futures market. This spreadsheet model provides the emotionless marketing evaluation as the model prices production when the

pricing objective is reached regardless of the potential for even higher prices.

The objective of this paper is to help managers evaluate the impact of using risk management practices of increased RP insurance coverage levels and forward pricing of planned production on a grain farm's profitability for multiple year periods for various price and yield outcomes.

Data and Methods

The simulation model is based on an enterprise budget for corn and soybeans for Western Kentucky (Halich, 2017). The crop enterprise budget is developed by Extension to help managers define the per acre cost of inputs, land, and overhead expense for a defined level (yield) of corn and soybean production. These budgets are based on agronomic research of the best production practices to produce the expected yield of 170-bushel corn and 55-bushel full-season soybeans.

The University of Kentucky is fortunate to have farm-level financial data for over 220-grain farms that participate in the Kentucky Farm Business Management (KFBM) program. KFBM has helped Kentucky farmers with improved farm financial management practices for over 50 years. Specialists from KFBM have noticed that the machinery depreciation estimates used in Extension budgets tend to undervalue the cost of machinery on grain farms. Managers used the proceeds from profitable years to expand machinery capacity and to capture income tax benefits. The growth in machinery capacity is often more than the increase in acres farmed leading to the growth in machinery overhead costs. KFBM specialists remind farmers that their machinery overhead is about $30/acre above the budgeted value for corn and $25/acre larger than the budgeted value for soybeans (Shepherd). The simulation model increases the machinery depreciation in the crop enterprise budgets based on KFBM recommendations.

KFBM specialists have also noticed the sharp increase in family living expense for grain farms, and it has been a trend at the national level as well (Powers & Martin, 2014; Hoppe, 2014). The amount spent on family living is highly variable with young and beginning farmers likely to spend more than the "empty nest" farmers that do not have the expenses associated with a growing family (clothing, medicine, education) that cannot be economized. Kentucky grain farms, on average, have increased family living expense from $58,000 in 1999 to over $105,000 in 2016. Family living and machinery depreciation are costs that adjust slowly and have a multi-year impact on the business. The simulation model provides pre-harvest pricing targets that include the family living expense, or business growth, pricing objective to help the farm sell at levels that cover this substantial cost for the farm family.

The corn and soybean budgeted costs are listed in Table 1. These budgets are constant for each simulation year and are not adjusted for expected inflation. The budgeted yields are slightly lower than the expected yield of 170-bushel corn, and 55-bushel soybeans as Extension agents in this region indicated best management practices typically result in these yields (Hardy). The business growth expense is budgeted at $85,000 for a 2100-acre grain farm based on the KFBM family living data. This business growth expense is distributed equally between the corn and soybean enterprise at $40 per acre.

Pre-harvest pricing objectives are developed from the enterprise budgets in Table 1. The pre-harvest marketing plan has five price target levels with 10 percent of planned production priced at each target level. The plan is to use cash forward contract to manage price risk without the challenge of matching planned production to the futures contract specification of 5,000-bushel contracts. The use of forward contracts also eliminates basis risk and any cash flow issues associated with paying margin calls on futures contracts.

The pre-harvest marketing plan's first pricing target is $3.84 and $9.16 for corn and soybeans, respectively (Table 2). These prices are the budgeted break-even price to pay for total variable costs, land, and overhead expense (Halich, 2017). The second target is set at the break-even to cover budgeted business growth. Targets 3 to 5 allows for pricing in markets that are providing profit opportunities. Target 3 assumes an additional 10 percent of planned production is contracted at a price 10% above target 2. Target 4 and Target 5 assumes an additional 10% of planned production is contracted at each level when the market is 15 percent higher than Target 4 and Target 5, respectively (Table 2).

If the five pricing targets are realized, the farm will have priced 50 percent of budgeted corn and soybean production (Table 2). This plan is a conservative approach to marketing as the targets are budgeted using a slightly reduced expected yield and quantities marketed below the bushels guaranteed by RP crop insurance. If all targets are realized, the average pre-harvest price is planned at $4.71/bushel and $11.45/bushel for corn and soybeans, respectively (Table 2).

Bushels not priced before harvest are assumed to be stored on-farm at the cost of $0.15/bushel for corn and soybeans based on a decision aid developed by Edwards (2015). Stored bushels are priced in equal quantities each week from January 1 to May 31. This strategy may not guarantee that the farm has priced stored bushels above the budgeted break-even targets in Table 2. However, the focus of the analysis is evaluating pre-harvest risk management and not post-harvest marketing strategies.

The simulation model incorporates price variability observed in weekly price changes in corn and soybean bids in Western Kentucky corn and soybeans. The average weekly cash and forward contracts bids for twelve markets in Western Kentucky are used to simulate price risk for pre-harvest and post-harvest strategies (Kentucky Farm Bureau Federation). The weekly prices are converted into a ratio relative to the harvest-time price the week of Oct 14. This week is associated with more than 50 percent of Kentucky's corn being harvested and about 50 percent of the soybean crop harvested (USDA-NASS). A simulated cash price at harvest is then multiplied by the weekly price ratio to generate the simulated forward contract bids and post-harvest cash prices. The harvest cash price is simulated based on the relationship between the US marketing-year average (MYA) price and the average Western Kentucky cash price at harvest. This simulated cash price at harvest is then multiplied by the price ratios to simulate weekly pre-harvest bids and post-harvest prices.

The risk management potential to price expected corn and soybean production before harvest is shown in Figure 1. Both commodities tend to provide opportunities to contract a portion of production at prices that are 10 percent and 6 percent above the harvest corn and

soybean price, respectively, from 2001 to 2016 in Western Kentucky (Kentucky Farm Bureau Federation). Figure 2 illustrates that Western Kentucky grain farms, on average, benefit from significant price appreciation after harvest. This basis appreciation reduces farmers' motivation to use price risk management to lock in a price that tends to increase after harvest. The average increase in corn price is about 20 percent from October 14 to the following May. The average price increase for soybeans is over 16 percent over the same period based on cash market data from 2001 to 2016 (Kentucky Farm Bureau Federation). Figure 1 illustrates the benefit of pre-harvest marketing for those lacking storage. Figure 2 illustrates the benefit of investing in on-farm storage to benefit from the seasonal tendency of post-harvest price appreciation.

Corn and soybean yields are simulated based on University of Kentucky Agricultural Extension agents' forecast of a most-likely, optimistic, and pessimistic yield that farmers use in developing business plans. The average yield is 170-bushel corn and 55-bushel full season soybeans. A pessimistic yield is 150 and 45, while an optimistic yield is 190/65 for corn and soybeans, respectively (Hardy). The simulation model incorporates additional risk into the yield projections by simulating yields over a range of 140 to 200 bushels for corn and 40 to 70 bushels for soybeans.

The simulation model calculates the annualized present value of returns over total variable costs, land rent, overhead and business growth for corn and soybeans. The crops are evaluated separately to identify any potential differences in management strategies to improve the annualized return, per acre, for each crop.

The following describes how the annualized average per acre return is calculated for corn and soybeans.

- Step 1. Calculate the simulated revenue from forward pricing, cash sales at harvest, and post-harvest sales for each simulated price and yield each year for the five simulated years.
- Step 2. Calculate the return over total variable costs, fixed costs and business growth per acre for each price and yield each year for the five simulated years.
- Step 3. Calculate the present value of the returns for the five-year simulation using a 5% discount rate (Shepherd).
- Step 4. Amortize the present value of the returns and scale to a per acre value using a 5% discount rate (Shepherd).

The simulated indemnities from revenue protection (RP) crop insurance are based on the simulated harvested corn and soybean yields defined above. The actual production history (APH) yield used to establish the revenue guarantee each simulated yield is held constant at 170/55 bushels, respectively, for corn and soybeans.

The simulated crop insurance projected price (PP) is based on the relationship between the December corn and November soybean futures contract prices in February and the respective U.S. MYA price for the 1996 to 2016 crop years. Variability is added to the simulation by adjusting the crop insurance price by the historical percentage deviation in price.

The RP insurance product establishes additional revenue coverage if the future contract prices are higher at harvest as the revenue guarantee is the larger of the projected or the harvest price. The harvest price (HP)

for crop insurance is the average of the December Corn and November Soybean contracts in October (CRB). The harvest price is also used to determine if the realized revenue is below the established revenue guarantee and if an indemnity is triggered. The HP is simulated by the ratio of historical harvest price to projected price. This price ratio reflects the seasonality of the futures contract that tends to decline into harvest but maintains the probability of higher prices at harvest in years of smaller than projected US production.

The crop insurance revenue guarantee is also determined by the coverage level purchased. A coverage level of 60 percent is assumed for the base scenario to reflect Kentucky's historical tendency to purchase lower coverage levels. Farmers increased the coverage level purchased during the "boom" period, but the motivation to buy higher coverage has decreased with commodity prices. Bankers, however, encourage buy-up and may tie operating loan availability to the RP coverage purchased. To evaluate the risk protection of buy-up coverage, Alternative 1 simulates the returns from buying RP insurance at the 80 percent coverage level with cash sales at harvest (Table 3).

Figure 2 shows the average price appreciation from storing corn and soybeans from October harvest to the following May. The benefit from switching from 100 percent harvest sales to 100 percent post-harvest sales combined with RP insurance at the 60 percent coverage level is simulated in Alternative 2. The marginal benefit of purchasing buy up insurance coverage to 80 percent with 100 percent post-harvest sales is simulated in Alternative 3 (Table 3).

The risk protection provided by pre-harvest marketing and post-harvest storage is simulated in Alternative 4. This alternative assumes RP insurance coverage at the lower 60 percent coverage level. Alternative 5 simulates the marginal risk reduction of buy up insurance coverage combined with the pre-harvest and post-harvest price management plans (Table 3).

Each crop is simulated 500 times per year for five years using the Simetar add-in to Excel (Richardson). For each interaction, the present value return is calculated and annualized to a per acre basis.

Simulated Results

The benefit of a higher realized price from forward contracting or having storage to avoid harvest-time sales are reported in Table 4 based on the simulation for Western Kentucky corn. The spreadsheet only contracts corn when the pricing targets are reached; therefore, the average forward contract price tends to be higher than the harvest-time cash price. For corn, the average benefit of forward contracting corn is about $0.63/bushel with about a four percent probability of having a harvest price greater than the forward contract price (Table 4). Given historical price volatility, there is a 10 percent probability of the simulated forward contract price being over $1.60/bushel higher than the simulated harvest price for corn (Table 4). The volatility of the "boom" years provided pricing opportunities for managers with established pricing targets and who were willing to price at profitable levels.

The average simulated benefit of on-farm grain storage is about $0.60/bushel as compared to the harvest-time price (Table 4). While Figure 1 shows the general tendency for corn price to appreciate by 15 percent to

20 percent from harvest to May, there is a 15 percent probability of the post-harvest price to be less than the harvest price. The post-harvest price includes the $0.15/bushel storage fee, which increases the likelihood of not receiving a higher price from storage in years with limited appreciation in futures prices or basis (Table 4).

Establishing pricing objectives for forward contracting soybeans obtained an average forward contract price that was simulated to be over $1/bushel above the harvest price in the cash market (Table 5). Again, the volatility during the "boom" years provided opportunities for those prepared to sell at defined objectives. Some managers fear the risk of forward contracting too early, and there was about a 20 percent probability of the harvest price being above the forward contract price. Given the volatility in the soybean market, the simulated difference in the forward contract price and the harvest price at the 10th and 90th percentiles was an average of -$0.78 and $3.50/bushel, respectively, for soybeans (Table 5).

The benefit from storing soybeans at harvest and pricing in January through May provided a sales price, net of storage fee, of about $0.90/bushel above the harvest-time price (Table 5). The likelihood of stored soybeans having a lower price than at harvest occurred about 33 percent of the simulated iterations. The 10th and 90th percentiles of the difference between the stored price and the harvest price show the extremes in the simulated return to storage for soybeans as the 10th percentile averaged -$1.40/bushel and the 90th percentile averaged $3.38/bushel (Table 5). Again, the years with increased volatility made soybean storage riskier than storing corn. Table 5 suggests that selling more than 50 percent of planned soybean production at defined objectives before harvest may reduce the effect of storage price risk in soybeans (Table 5). Anecdotal evidence from farmers is that soybeans are typically sold at harvest while corn is stored. The lower risk of storing corn in Table 4 compared to the risk of storing soybeans reinforces this anecdotal farmer behavior.

What are the marginal impacts on profitability and the risk of a financial loss for the simulated Western Kentucky corn farm? Table 6 lists the summary statistics for the change in annualized per acre return from adopting the alternative risk management practices for corn. The scenarios defined in Table 3 are a reminder of the alternatives analyzed.

In general, the value of increasing RP coverage for the simulated corn farm is minimal. Increasing RP insurance from 60 percent to 80 percent coverage improves the average annualized return by about $7/acre and improves the average returns at the 10th and 90th percentiles by about $7/acre and $4/acre, respectively (Table 6). While not a strong motivation for farmers to increase coverage, Table 6 suggests that buying up insurance coverage as part of obtaining operating credit does not have a significant impact on annual returns over multiple year timeframes and may be an incidental cost of obtaining financing.

The value of avoiding sales at harvest cannot be stressed sufficiently. The value of selling 100 percent of production after harvest instead of at harvest (Alternative 2 – Base Scenario) provided an average improvement of annualized returns of over $70/acre per year and a 50 percent reduction in the risk of having a financial loss. This result serves as a signal to managers to monitor for opportunities to add low-cost storage capacity to

the farm business (Table 6). A 100 percent post-harvest sales strategy may not be feasible due to lack of storage and need for cash flow at harvest. Using pre-harvest pricing objectives that are based on budgeted production costs provides an average benefit of $160/acre per year over the cash sales at harvest alternative. The risk of a financial loss is reduced by about 75 percent from the base scenario. Placing targets that sell additional bushels into a rally is important to protect risk at profitable price levels and helps managers to not to be overwhelmed by the emotion in the market (Table 6).

Buying higher coverage while using post-harvest and the combined pre-/post- harvest strategies show less than a $1/acre improvement in annualized returns. The increase in coverage may reduce returns at the 90th percentile, as the increase in premium is less than the value of risk being reduced for this simulated corn farm (Table 6). This result matches anecdotal evidence that farmers purchase buy up coverage for corn understanding that the average benefit is minimal but useful in a year like 2012 where insurance sustained farm businesses during a massive drought.

A similar summary of the benefits of alternative insurance and price risk management strategies for soybeans is provided in Table 7. The simulation results show that soybeans rarely trigger indemnities that are larger than the premium paid due to limited yield risk. Again, these results reinforce stories from farmers and Extension agents that buy up insurance coverage does not provide a financial benefit. The value of buying 80 percent coverage reduces the average annualized per acre return by $3 to $4 per acre depending on the pricing strategy implemented (Table 7). As in corn, greater risk reduction is achieved by changing from 100 percent sales at harvest to 100 percent post-harvest improves average annual per acre net return by $43/acre and reduces the risk of financial loss by 21 percent. The combination of pre-harvest and post-harvest risk management increases the average annualized per acre by $91/acre and decrease the possibility of loss by 24 percent from the base case of cash sales at harvest (Table 7).

Conclusions for Managers

The simulated results are like a case study in the sense that the results show what may happen during periods of price volatility and yield risk. The current corn and soybean price outlook are of reduced price volatility, which may limit the pricing opportunities before harvest and returns from storage. As managers cope with tight profitability margins, risk management practices should be a part of the business plan to protect firms from financial loss in an environment where many farms have limited financial cushion to absorb a loss. Managers should consider the following risk management conclusions:

1. Simulated annualized returns show minimal benefits from buying up insurance coverage, as the cost of increased risk protection exceeds the benefit. However, lenders may make operating loans contingent on the level of insurance purchased. The simulated returns indicate a lower annualized return, but the reduced return may be acceptable to gain access to capital. The simulation model does not capture cash flow and impact of risk management on access to operating credit. Improved cash flow from buying higher crop insurance coverage levels may offset the simulated lower returns.
2. The strategy of 100 percent post-harvest sales would not be feasible due to the lack of sufficient on-farm/ low-cost storage. Managers should continue to

monitor the business for opportunities to increase on-farm storage capacity through renting storage from neighbors, renting land with storage, building additional storage, or strategic use of commercial storage.

3. Similarly, managers that know that production will have to be sold at harvest due to lack of storage should consider using of cost-defined pricing objectives. Forward contracts can lock in a cash price before harvest to protect these bushels from expected lower prices at harvest and reduce the likelihood of a financial loss
4. Managers may base marketing decisions on cash flow needs instead of profitability. The pre-harvest targets may help focus price risk management to levels that improve the likelihood of overall farm profitability. The post-harvest marketing was not necessarily cost focused. Future analysis will need to incorporate a similar target pricing mechanism to analyze the risk benefits of cost-based market risk management. Seasonal basis appreciation makes storage profitable versus harvest-time sales. Soybeans are simulated to have more price risk than corn post-harvest. Managers may consider more aggressive pre-harvest marketing plans for soybeans than for corn to increase storage capacity for corn.
5. The annualized per acre returns suggest the use of risk management significantly reduces the risk of being unprofitable. The simulation model did not consider cash flow and that some strategies may have significant cash flow risk as grain is not sold until harvest or post-harvest. Managers should consider low-cost financing options offered through USDA-Farm Service Agency to finance capital investments (like grain storage). Similarly, managers can use the harvested grain as collateral for CCC loans that are low-cost sources of operating credit.
6. Managers should evaluate the effectiveness of crop insurance or price risk management over multiple year periods. Risk management tools, like crop insurance, is not designed to provide annual payments that enhance profitability. Managers should consider the multiple year impacts of insurance on the farm's financial position.
7. Combining crop insurance with pre-harvest risk management allows managers to forward price up to the bushels guaranteed by the insurance coverage. Insurance would allow farmers to become more aggressive in pricing corn and soybeans before harvest at defined objectives as insurance indemnities will pay for unfulfilled bushels in the contract.

Simulation models are a way for managers to test-drive alternative management plans to understand better how price and yield risk can affect the farm business and to measure potential risk reduction. The results did not identify a strategy that is guaranteed to eliminate risk every year. However, diligent management based on understanding actual costs (including family living, machinery costs, and inputs) can assist managers in pricing production at levels that increase the likelihood of overall farm profitability.

References

Commodity Research Bureau. "Daily Corn and Soybean Futures Data for All Contracts from 1980 to 2017." http://www.crbtrader.com. Accessed June 1, 2017.

Edwards, William M. "Cost of Storing Grain." Ag Decision Maker website. Iowa State University Extension. https://www.extension.iastate.edu/agdm/crops/html/a2-33.html. Accessed June 1, 2017.

Halich, Greg. "University of Kentucky Crop Enterprise Budgets for 2017." University of Kentucky Extension. http://www.uky.edu/Ag/AgEcon/extmgmt.php. Accessed June 1, 2017.

Hardy, Clint. ANR Extension Agent for Daviess County, KY. Email message to author, July 12, 2017.

Hoppe, R. A. 2014. "Structure and Finances of U.S. Farms: Family Farm Report, 2014 Edition." *Economic Research Service*. Num. 132. December. https://www.ers.usda.gov/webdocs/publications/43913/50364_eib-132.pdf?v=42103.

Powers, L., and S. Martin. 2014. "Family Living." *Kentucky Farm Business Management Program*. http://www.uky.edu/Ag/AgEcon/pubs/kfbmaec2015-1747.pdf

Kentucky Farm Bureau Federation. "Daily Corn and Soybean Price Data for Western Kentucky Markets from 2000 to 2017." Email message to author. July 1, 2017.

Pierce, Jerry. "Preliminary Grain Analysis for 2015." *Kentucky Farm Business Management Program*. http://www.uky.edu/Ag/AgEcon/pubs/kfbmkfbmpregreain1538.pdf.

Richardson, James. *Simetar*. Vers. 2016. Simetar, Inc. 2017. Computer software.

Shepherd, Jonathan. KFBM Specialist. Email message to author. June 15, 2017.

USDA-NASS. *Crop Progress*. Weekly Reports from 1996 to 2016. https://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1048

Figure 1. Western Kentucky weekly average forward contract bids as a percentage of harvest-price from 2001-2016 for corn and soybeans. Source: Kentucky Farm Bureau Federation

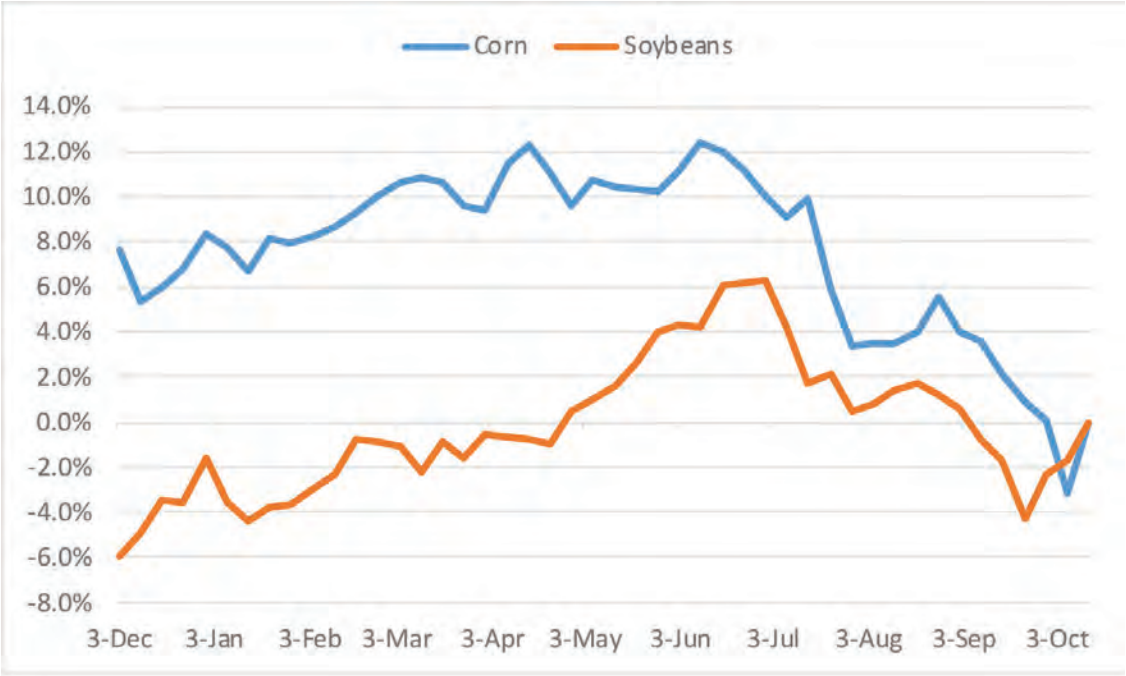

Figure 2. Western Kentucky weekly average cash bids as a percentage of harvest-price from 2001-2016 for corn and soybeans. Source: Kentucky Farm Bureau Federation

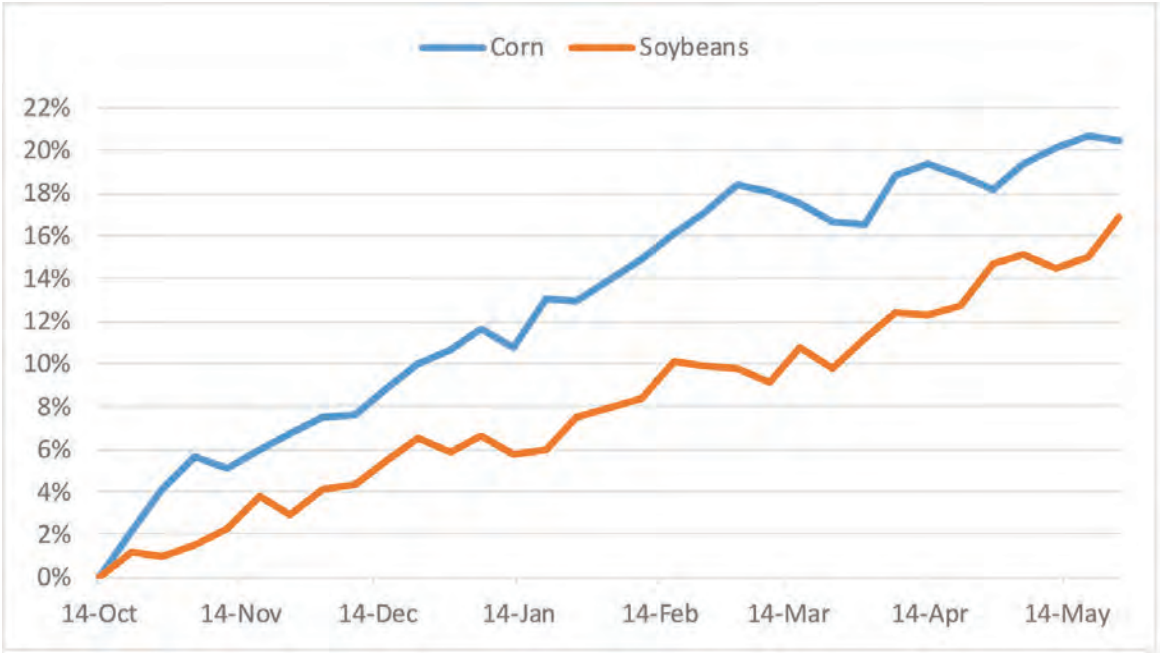

Table 1. Western Kentucky corn and soybean enterprise budgets

	Corn		Soybeans	
	$/Acre	$/bushel	$/Acre	$/bushel
Total Variable Costs	$376	$2.35	$235	$4.69
Land Cost	$150	$0.94	$150	$3.00
Overhead Costs	$88	$0.55	$74	$1.47
Business Growth	$40	$0.25	$40	$0.81
Total Costs	$655	$4.09	$499	$9.97
Budgeted Yield	**160**		**50**	

Source: University of Kentucky Extension, Kentucky Farm Business Management Program.

Table 2. Corn and soybean pre-harvest marketing plan with pricing objectives and quantities priced.

	Pricing Points ($/bushel)		Bushels Priced		
	Corn	Soybeans	Corn	Soybeans	Pricing Objective
Pricing Target 1	$3.84	$9.16	16,800	5,250	Cover total inputs, land, and overhead
Pricing Target 2	$4.09	$9.97	16,800	5,250	Target 1 + business growth
Pricing Target 3	$4.50	$10.97	16,800	5,250	Upside potential 10% above Target 2
Pricing Target 4	$5.18	$12.62	16,800	5,250	Upside potential 15% above Target 3
Pricing Target 5	$5.95	$14.51	16,800	5,250	Upside Potential 15% above Target 4
Potential Realized Price	**$4.71**	**$11.45**			
Potential Bushels Priced			**84,000**	**26,250**	
Percentage of Expected Production			**50%**	**50%**	

Table 3. Scenarios simulated for Western Kentucky corn and soybean profitability and risk management analysis

Scenario	Description
Base Case	100% cash sales at harvest with RP @ 60% coverage level
Alt. 1	100% cash sales at harvest with RP @ 80% coverage level
Alt. 2	100% post-harvest sales with RP @ 60% coverage level
Alt. 3	100% post-harvest sales with RP @ 80% coverage level
Alt 4.	Pre-harvest marketing plan with post-harvest sales with RP @ 60% coverage level
Alt 5.	Pre-harvest marketing plan with post-harvest sales with RP @ 80% coverage level

Table 4. Comparison of simulated forward contract price and post-harvest price to the harvest-time price for Western Kentucky corn by simulated year

	Year 1	Year 2	Year 3	Year 4	Year 5
Simulated Difference between Forward Contract Price and Harvest Cash Price					
Average	$0.62	$0.65	$0.60	$0.65	$0.61
Probability Cash Price > Forward Contract Price	4%	4%	5%	5%	4%
10th Percentile	$0.00	$0.00	$0.00	$0.00	$0.00
90th Percentile	$1.64	$1.63	$1.58	$1.63	$1.57
Simulated Difference between Post-Harvest Price and Harvest Cash Price					
Average	$0.58	$0.61	$0.62	$0.59	$0.61
Probability Cash Price > Post-Harvest Price	15%	14%	14%	15%	15%
10th Percentile	-$0.02	-$0.02	-$0.02	-$0.02	-$0.02
90th Percentile	$1.34	$1.47	$1.41	$1.37	$1.40

Table 5. Comparison of simulated forward dontract price and post-harvest price to the harvest-time price for Western Kentucky soybeans by simulated year

	Year 1	Year 2	Year 3	Year 4	Year 5
Simulated Difference between Forward Contract Price and Harvest Cash Price					
Average	$1.20	$1.20	$1.11	$1.07	$1.13
Probability Cash Price > Forward Contract Price	16%	19%	22%	21%	18%
10th Percentile	-$0.43	-$1.01	-$0.96	-$0.93	-$0.59
90th Percentile	$3.57	$3.69	$3.39	$3.35	$3.50
Simulated Difference between Post-Harvest Price and Harvest Cash Price					
Average	$0.93	$0.96	$0.94	$0.95	$0.93
Probability Cash Price > Post-Harvest Price	33%	35%	31%	31%	32%
10th Percentile	-$1.34	-$1.82	-$1.33	-$1.24	-$1.27
90th Percentile	$2.98	$3.98	$3.18	$3.37	$3.37

Table 6. Change in annualized net return from changes in insurance and price risk management strategies ($/Acre) for simulated Western Kentucky corn farm

	Change in Average Return	Reduction of Probability of Loss	Change in 10th Percentile	Change in 90th Percentile
	Simulated Annualized Net Returns ($/Acre) for Corn			
Value of buy-up RP insurance with 100% cash sales at harvest (Alt 1- Base Scenario)	$6.96	-3%	$7.50	$4.48
Value of selling 100% post-harvest vs. 100% at harvest at 60% RP insurance (Alt 2 - Base)	$76.94	-50%	$50.56	$108.22
Value of buy-up RP insurance with 100% post-harvest (Alt. 3 - Alt. 2)	$0.74	-2%	$2.59	$0.68
Value of pre-harvest and post-harvest risk management with 60% RP Insurance (Alt 4. - Base)	$160.07	-75%	$106.11	$211.88
Value of buy-up RP with pre-/post- harvest price risk management? (Alt. 5 - Alt 4)	$0.75	0%	$1.18	-$3.06

Table 7. Change in annualized net return from changes in insurance and price risk management strategies ($/Acre) for simulated Western Kentucky soybean farm

	Change in Average Return	Reduction of Probability of Loss	Change in 10th Percentile	Change in 90th Percentile
	Simulated Annualized Net Returns ($/Acre) for Soybeans			
Value of buy-up RP insurance with 100% cash sales at harvest (Alt 1- Base Scenario)	-$3.45	3%	$3.04	-$6.62
Value of selling 100% post-harvest vs. 100% at harvest at 60% RP insurance (Alt 2 - Base)	$43.43	-21%	$36.75	$55.15
Value of buy-up RP insurance with 100% post-harvest (Alt. 3 - Alt. 2)	-$3.45	2%	-$3.93	-$4.81
Value of pre-harvest and post-harvest risk management with 60% RP Insurance (Alt 4. - Base)	$90.63	-24%	$52.02	$142.41
Value of buy-up RP with pre-/post- harvest price risk management? (Alt. 5 - Alt 4)	-$3.74	2%	-$6.44	-$4.51