Implied Probabilities for Corn and Soybeans Prices in 2018

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As crop insurance and crop planting decisions are being made for the 2018 crop year, it is useful to assess possible springtime and harvest pricing information, and understand the impact of market information on crop insurance positions. Average futures settlement prices during the month of February for December 2018 corn and November 2018 soybeans are used to establish Projected Prices used in setting insurance coverage. The volatility factors used in crop insurance pricing are taken from options prices during the final week of the month, and to this point are running at relatively low historical levels which would reduce premiums compared to previous years, all else equal. The combination of futures and options prices allow an assessment to be made about the implied probabilities of possible future prices that can in turn be useful when making insurance decisions, crop planting decisions, and marketing decisions for the upcoming crop year.

A tool called the *iFarm* Price Distribution Tool is available at the *farmdoc* Crop Insurance site. The tool allows a user to select an underlying futures contract and recover the probabilistic price information associated with the market prices at that point in time. It is especially important to understand the information contained in market expectations before crop insurance decisions are made, but it is also very useful to understand evolution of market expectations as growing season uncertainties evolve.

The tool is accessible at: http://farmdoc.illinois.edu/cropins/price-distribution.html

To understand the information provided in the utility, a couple of cases are taken from the site and used to demonstrate the implications for future crop revenue. First consider the December 2018 Corn contract shown in figure 1 below taken from the site on February 20, 2018 (importantly, these update continuously to reflect market information at the time the site is accessed, so results will update as market prices change).

iFarm Price Distribution Tool

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Select Crop:

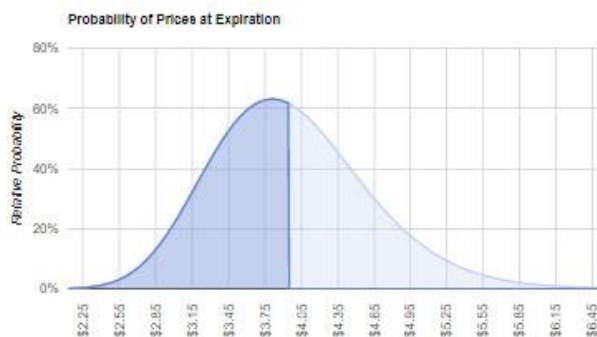| Crop:	Futures Month:	Year:
Corn ▼	Dec ▼	2018 ▼

Results

The charts below show the current Dec 2018 corn price distribution at expiration in two related forms. The top shows the cumulative probability distribution for expiration prices and can be interpreted by identifying a price of interest and reading the associated probability on the left axis. The lower chart contains the same information in a probability density form. The associated tables tabulate the information from the charts by price and probability.

Cumulative Probability of Prices at Expiration

Price at Expiration	Prob Below
$2.75	1.56%
$3.00	5.22%
$3.25	12.82%
$3.50	24.73%
$3.75	39.66%
$4.00	55.24%
$4.25	69.20%
$4.50	80.24%
$4.75	88.10%

Probability of Prices at Expiration

At Expiration	
Prob Below	Price
5%	$2.99
15%	$3.30
25%	$3.50
35%	$3.67
45%	$3.83
50%	$3.91
55%	$4.00
65%	$4.17
75%	$4.37
85%	$4.64
95%	$5.13

Enter Price to Evaluate: [3.95]

The implied distribution indicates that there is a 52.19% probability that the price will be below $3.95 at expiration.

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⊕ CME Group

The top panel shows the cumulative probability distribution for prices at the expiration and can be interpreted by reading the probability on the (left) vertical axis of any price of interest on the (bottom) horizontal axis. In the lower panel, the more commonly depicted bell-shaped curve of probability is provided.

The tables to the right of the graphics provide identical information in two alternative layouts. In the top table, various possible expiration prices are shown on the left and the associated probability of prices below that level at expiration given on the right. For example, the tool indicates that the is about a 25% chance that futures prices will be below $3.50 at expiration, and that there is currently only about a 12% chance that prices will be above $4.74. In the lower table, it can be seen that there is about a 50% chance that expiration prices will be below $3.91 according to the option's market prices, and a 95% chance that prices will be below $5.13. In the case shown, current market prices indicate that there is about 55% chance that the expiration price for the Dec 2018 Corn futures will be below $4.00 – or alternatively, there is a 45% chance that harvest price will be above $4.00. One could assess the

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likelihood of breaking even or of exceeding the projected price in a crop insurance contract for example, in similar fashion by entering the value of interest in the box near the bottom. In the case shown, a price to evaluate of $3.95 was chosen to evaluate (equal to the current estimate by RMA of the Projected Price), with the corresponding regions shaded in the graphic. As indicated in the output, there is just over 52% chance given today's market conditions that prices at expiration will be at or below $3.95.

iFarm Price Distribution Tool

Select Crop:

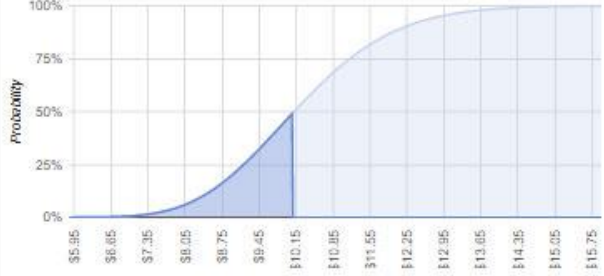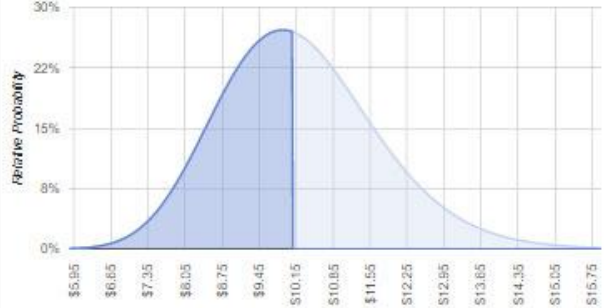| Crop:	Futures Month:	Year:
Soybeans ▼	Nov ▼	2018 ▼

Results

The charts below show the current Nov 2018 soybeans price distribution at expiration in two related forms. The top shows the cumulative probability distribution for expiration prices and can be interpreted by identifying a price of interest and reading the associated probability on the left axis. The lower chart contains the same information in a probability density form. The associated tables tabulate the information from the charts by price and probability.

Cumulative Probability of Prices at Expiration

Price at Expiration	Prob Below
$9.25	27.11%
$9.50	33.44%
$9.75	40.11%
$10.00	46.89%
$10.25	53.60%
$10.50	60.05%
$10.75	66.09%
$11.00	71.62%
$11.25	76.58%

Probability of Prices at Expiration

At Expiration

Prob Below	Price
5%	$7.95
15%	$8.69
25%	$9.16
35%	$9.56
45%	$9.93
50%	$10.12
55%	$10.30
65%	$10.70
75%	$11.17
85%	$11.78
95%	$12.88

Enter Price to Evaluate: 10.09

The implied distribution indicates that there is a 49.33% probability that the price will be below $10.09 at expiration.

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In the case of Nov. 2018 Soybeans shown above, there is approximately 40% probability that expiration prices will be below $9.75, and almost 40% chance that prices will be greater than $10.50. The tables on the right again provide a few other specific examples corresponding to the information in the graphs. In the case evaluated in the lower evaluation box, there is just under a 50% chance that prices will be below $10.09 by expiration.

As the growing season continues and as uncertainty is further resolved about final production and demand, the prices will continue to shift and evolve and collapse on final values.

Importantly, the expected prices that occur during crop insurance sign up can be different from the Projected prices found by averaging the futures prices during February. For example, soybean prices have been moving upward recently and the RMA current estimates of projected prices of $10.09 formed from the average of closing prices through last week is about $.13 below that actual futures prices. This relationship increases the likelihood that harvest prices will be above projected prices, and thus improves the value of insurance products with harvest price protection options. If the other relationship occurred where the current futures prices were below the average from the month of February, then crop insurance products without the harvest price option would be relatively advantaged. When projected prices and volatilities go final this year after the close of markets on February 28, the *farmdoc* Crop Insurance Evaluation tool will be used to create a post describing the methods for evaluating crop insurance options this year given the actual prices and crop insurance offers that result.

The *iFARM* Price Probability tool is intended to provide a simple presentation of the market's estimated prices and their associated probabilities in an easily understood and easily updated form that helps producers make informed decisions about managing their crop risks. Hopefully it is a useful tool to help manage crop revenue risk and to help make better decisions about crop insurance.