



## Updated Expected Price Distributions for Corn and Soybeans in 2014

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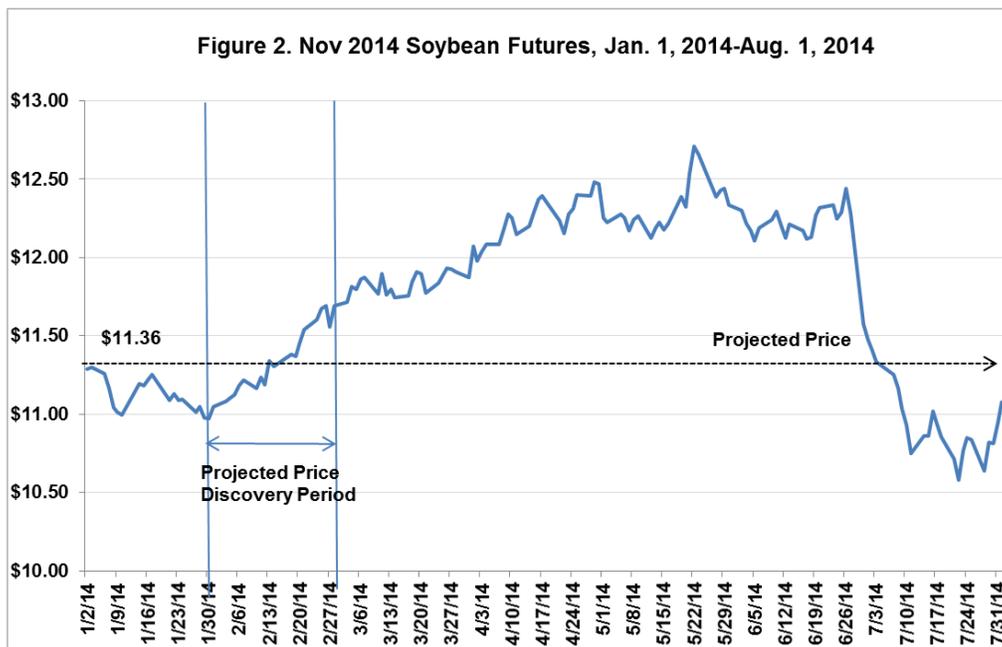
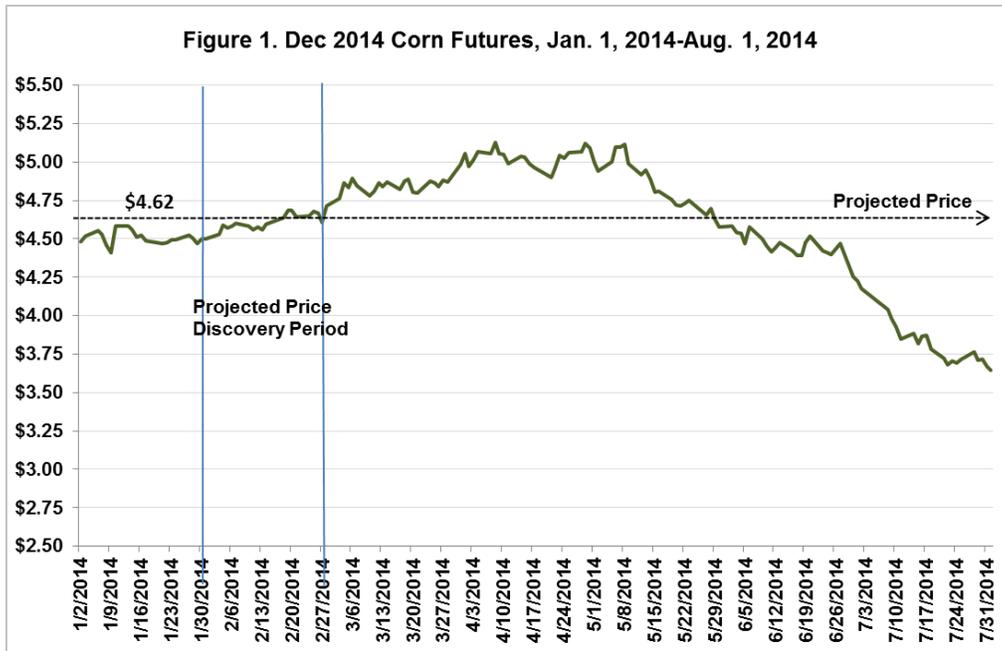
Crop price expectations have generally trended downward throughout the growing season as conditions have been very favorable for large production of corn and soybeans. Futures price expectations and eventual realizations have important risk management implications, and directly affect crop insurance indemnification as well. The establishment of the Projected Prices (PP) used in establishing initial crop insurance guarantees happens in February prior to planting, and reflects the market's best "guesses" about levels of prices and about potential deviations in prices from those levels. Growing season conditions, and the accumulation of other information affecting supply and demand then affect market participant's beliefs about future possible prices. It is generally regarded that futures markets provide the best aggregated beliefs about future prices by market participants, given all currently available information; and that changes in information or resolution of uncertainty are reflected in changing prices of both futures and of options on those contracts. As harvest approaches, the information generally becomes better understood and the possible range of prices shrinks toward the final futures prices as well. In turn, the prices of options on futures reflect the degree of uncertainty about the futures prices and provide a means to recover additional probabilistic information about price uncertainty, or the probability of prices moving to various other levels, either higher or lower than the current futures price prior to expiration.

RMA established Projected Prices for corn of \$4.62 (soybeans of \$11.36) by averaging December (November) futures prices during the month of February. The Projected Prices serve as the minimum indemnification prices for most of the insurance contracts sold, but for many insurance contracts, can be supplanted by a Harvest Price if prices during the month of October average higher levels than the PP. During 2014 to date, generally favorable growing conditions have resulted in increasing expectations about the levels of production which in turn have led to declining prices, and somewhat shrinking expectations about volatility.

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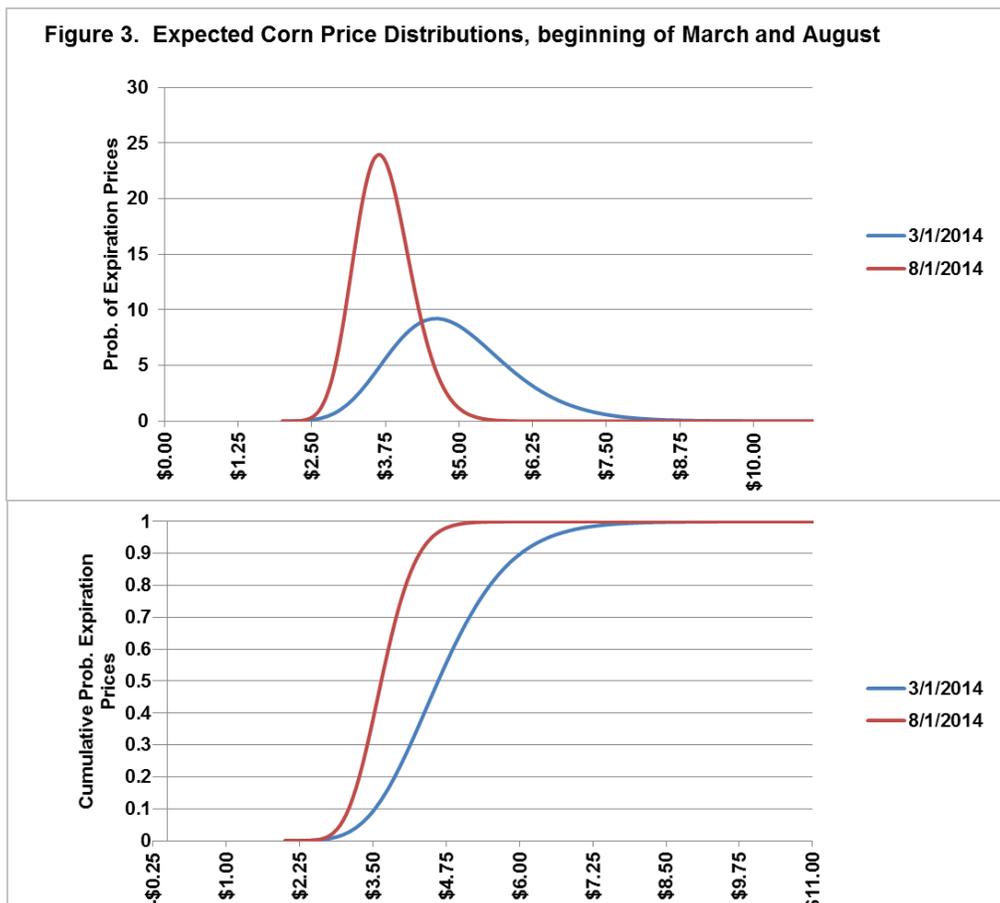
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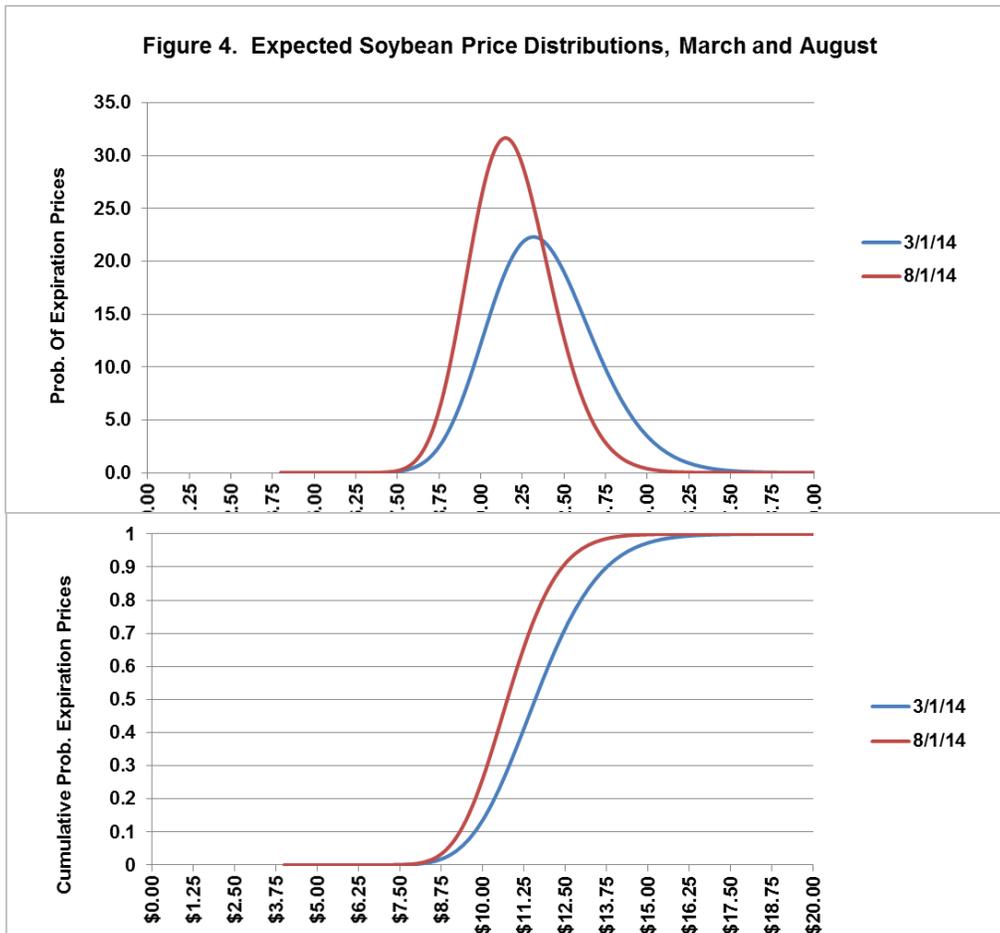
Figures 1 and 2 display corn and soybean price patterns from January 1 to August 1, 2014 along with a visual “window” on the averaging interval for establishment of the Projected Prices. As can be seen, the current prices are substantially lower than the original PP for corn and are somewhat below for soybeans as well. While it is interesting to track the price evolution through time, it is also interesting to depict the evolving uncertainty around prices – or the market’s expectation of the likelihood for different sized price movements prior to expiration.



The following provides a set of related views of price distributions and the confidence around the market expectations of futures prices, taking advantage of the information that is provided through market prices of options. To recover probabilistic information from options markets, a technique is used that identifies a best fitting distribution given observed prices of both puts and calls across the set of actively traded strike prices. The specific approach used is somewhat akin to using a variant of the Black-Scholes option pricing model, but solving it “backwards” across all options simultaneously.

Figures 3 and 4 provides more complete information about the market’s assessment of possible prices using market data from March 1 when Projected Prices were first known and market information after the close on July 31, 2014 reflecting the current information set of market participants. The upper panel of each figure shows the probability images associated with the markets assessment of possible futures prices by the expiration of options, and the lower panel shows the same information in cumulative probability form under which one can more directly identify the implied probability associated with each price of interest and vice versa. In both cases, the information has resulted in a “collapsing” of the probability distribution from March to present with the visual effect of the range of possible outcomes shrinking substantially and the relative probability of prices near the current price increasing or becoming more “peaked”. In both cases, the centers of the distributions have shifted substantially to the left reflecting stronger beliefs that prices will remain lower than the PP.





In the tables below, additional comparisons are made between the information in the market's expectations between March 1, and current (Aug. 1, 2014). The tables are organized with two panels. The left side shows a set of prices with the associated probability the market assigned to that level as of each date. For example, in March, the market viewed there to be about a 50% chance that expiration prices would be below Projected Price in corn, but by August, that had increased to 97% as the market is settling in on its expectations of a larger crop and associated lower prices. For soybeans, the upward trending prices during the establishment of the PP led to the market's expectation that there was a 44% chance that final prices would be below the PP, but by August, that likelihood had been revised to 69%. The right hand panel of each table shows the same information but organized across probability levels. Highlighted are the interquartile cutoffs of 25% and 75%. As shown in the table, in both cases the range has declined substantially and to lower levels.

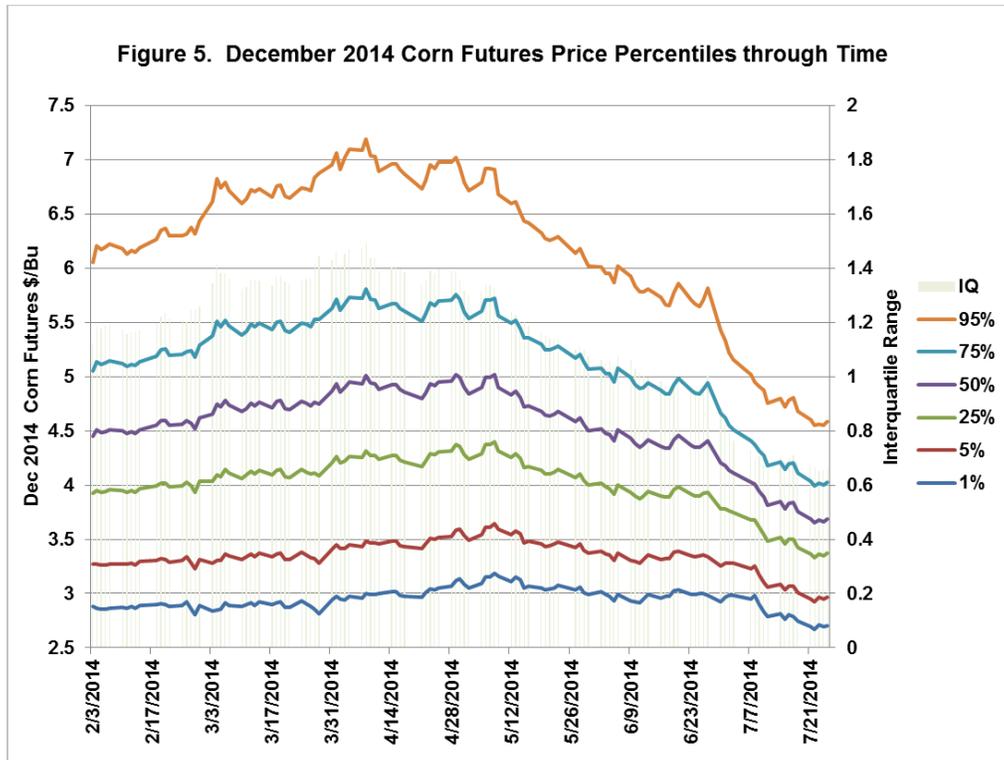
**Table 1. Implied Corn Price distributions, March and August**

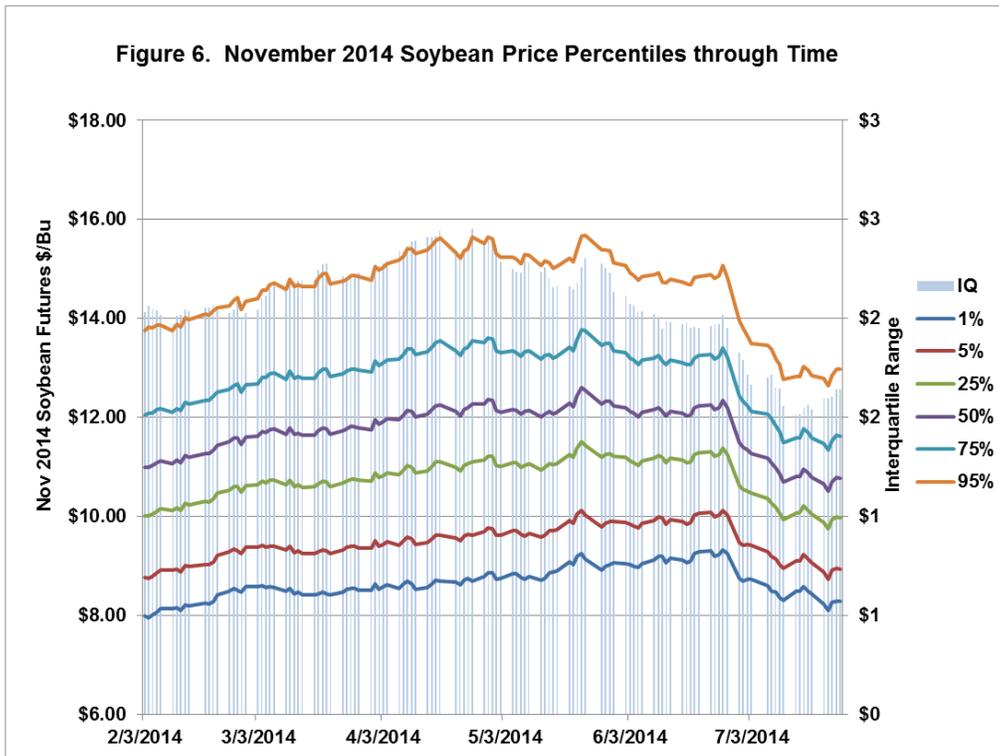
Price	Prob. below Price		Price at Given Prob.		
	March	August	Prob	March	August
\$ 2.25	0.0%	0.0%	1%	\$2.84	\$2.70
\$ 2.50	0.2%	0.2%	2%	\$3.01	\$2.79
\$ 2.75	0.6%	1.5%	5%	\$3.28	\$2.94
\$ 3.00	1.9%	6.7%	10%	\$3.53	\$3.09
\$ 3.25	4.6%	18.9%	20%	\$3.87	\$3.27
\$ 3.50	9.2%	38.0%	<b>25%</b>	<b>\$4.01</b>	<b>\$3.34</b>
\$ 3.75	16.0%	59.0%	30%	\$4.14	\$3.40
\$ 4.00	24.7%	76.7%	40%	\$4.37	\$3.52
\$ 4.25	34.7%	88.5%	50%	\$4.61	\$3.64
\$ 4.50	45.3%	95.0%	60%	\$4.86	\$3.76
<b>\$ 4.62</b>	<b>50.4%</b>	<b>96.8%</b>	70%	\$5.14	\$3.90
\$ 4.75	55.7%	98.0%	<b>75%</b>	<b>\$5.31</b>	<b>\$3.97</b>
\$ 5.00	65.2%	99.3%	80%	\$5.49	\$4.06
\$ 5.25	73.4%	99.8%	90%	\$6.02	\$4.30
\$ 5.50	80.2%	99.93%	95%	\$6.49	\$4.50
\$ 5.75	85.6%	99.98%	99%	\$7.48	\$4.92

**Table 2. Implied Soybean Price distributions, March and August**

Price	Prob. below Price		Price at Given Prob.		
	March	August	Prob	March	August
\$ 8.00	0.3%	0.4%	1%	\$8.49	\$8.28
\$ 8.50	1.0%	1.8%	2%	\$8.81	\$8.53
\$ 9.00	2.9%	5.7%	5%	\$9.30	\$8.94
\$ 9.50	6.9%	13.6%	10%	\$9.76	\$9.31
\$ 10.00	13.5%	26.1%	20%	\$10.35	\$9.78
\$ 10.50	23.1%	41.8%	<b>25%</b>	<b>\$10.59</b>	<b>\$9.96</b>
\$ 11.00	34.9%	58.2%	30%	\$10.80	\$10.13
<b>\$ 11.36</b>	<b>44.1%</b>	<b>69.0%</b>	40%	\$11.20	\$10.45
\$ 11.50	47.7%	72.7%	50%	\$11.59	\$10.75
\$ 12.00	60.3%	83.7%	60%	\$11.99	\$11.06
\$ 12.50	71.5%	91.1%	70%	\$12.43	\$11.40
\$ 13.00	80.5%	95.5%	<b>75%</b>	<b>\$12.68</b>	<b>\$11.59</b>
\$ 13.50	87.3%	97.9%	80%	\$12.97	\$11.81
\$ 14.00	92.1%	99.1%	90%	\$13.75	\$12.41
\$ 14.50	95.3%	99.6%	95%	\$14.44	\$12.92
\$ 15.00	97.3%	99.9%	99%	\$15.81	\$13.95

Figures 5 and 6 summarize similar information through time by repeating this process for each trade date and graphing selected percentile levels through time which can be interpreted as the market's estimate of the value at which there is the associated percentile chance of being below by expiration. It is interesting to note the collapsing of each distribution through time, but also to note selected "shocks" showing up in each market as "jumps" and shifts in the price percentiles estimated, especially for soybeans which experienced a more rapid decline as an understanding of crop conditions solidified. Additionally, the interquartile range (IQ) is provided, or the distance between the 25th and 75th percentile prices is plotted on the right scale. It is generally the case that the interquartile range tends to decline through time as uncertainty is resolved during the growing season. Likewise, the high and low "bands" in the price distribution tend to narrow toward the median or 50<sup>th</sup> percentile, even if the levels change through time.





As the growing season continues and as uncertainty is resolved about final production and demand, the prices will continue to shift and evolve and collapse on final values. It is increasingly unlikely that harvest prices will be greater than projected prices. The probability ranges have also tightened dramatically relative to typical years as the risk of dramatic interruptions in production at this point appear to the market to be historically low.

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