



Updated Expected Price Distributions for Corn and Soybeans in 2015

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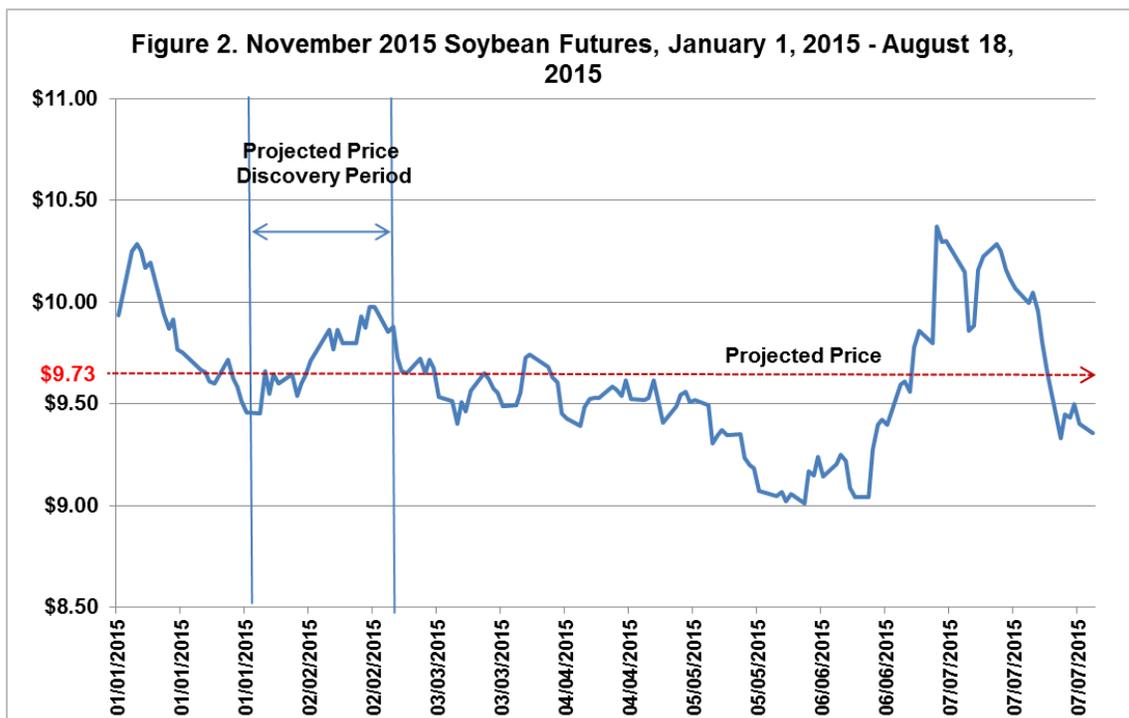
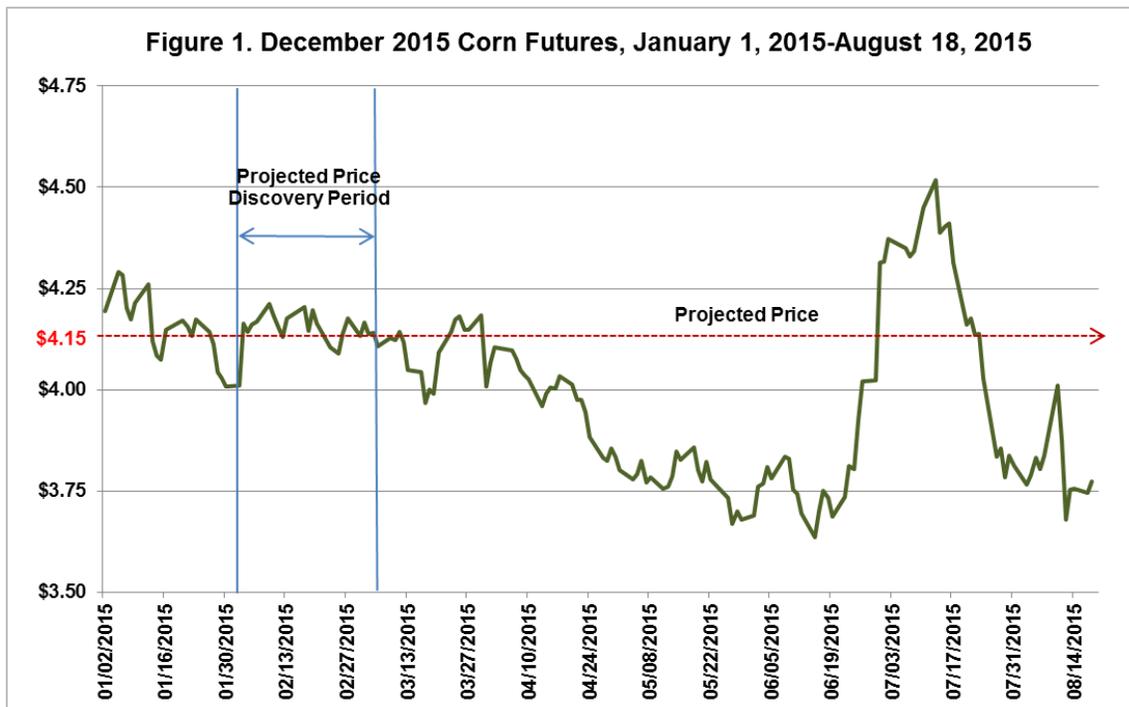
At the end of February, RMA established Projected Prices for crop insurance contract for corn of \$4.15 and for soybeans of \$9.73 for insured production in 2015. The Projected Prices serve as the minimum indemnification prices for most of the insurance contracts sold, but for many insurance contracts, can be supplanted by a Harvest Price if prices during the month of October average higher levels than the PP. During 2015 to date, generally favorable early season growing conditions resulted in increasing expectations about the levels of production which in turn have led to declining prices. During July, a period of greater uncertainty about production potential and some signals on the demand side support prices and both corn and soybeans moved above projected prices, but then fell below again as market understanding of supply potential and demand dampened price expectations. The USDA’s first release of aggregate yield estimates in early August further confirmed information in the market and further impacted estimates of prices possible for harvest.

Much of the market’s aggregate price expectations are summarized in futures prices and the prices of options on futures. The eventual realizations of futures prices through harvest 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 in February prior to planting is meant to reflect the market’s best “guesses” about levels of prices, but thereafter, growing season conditions, and the accumulation of other information affecting supply and demand 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 time goes on, information generally becomes better understood and the possible range of prices shrinks toward the final futures prices. 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.

Figures 1 and 2 display corn and soybean price patterns from January 1 to August 18, 2015 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

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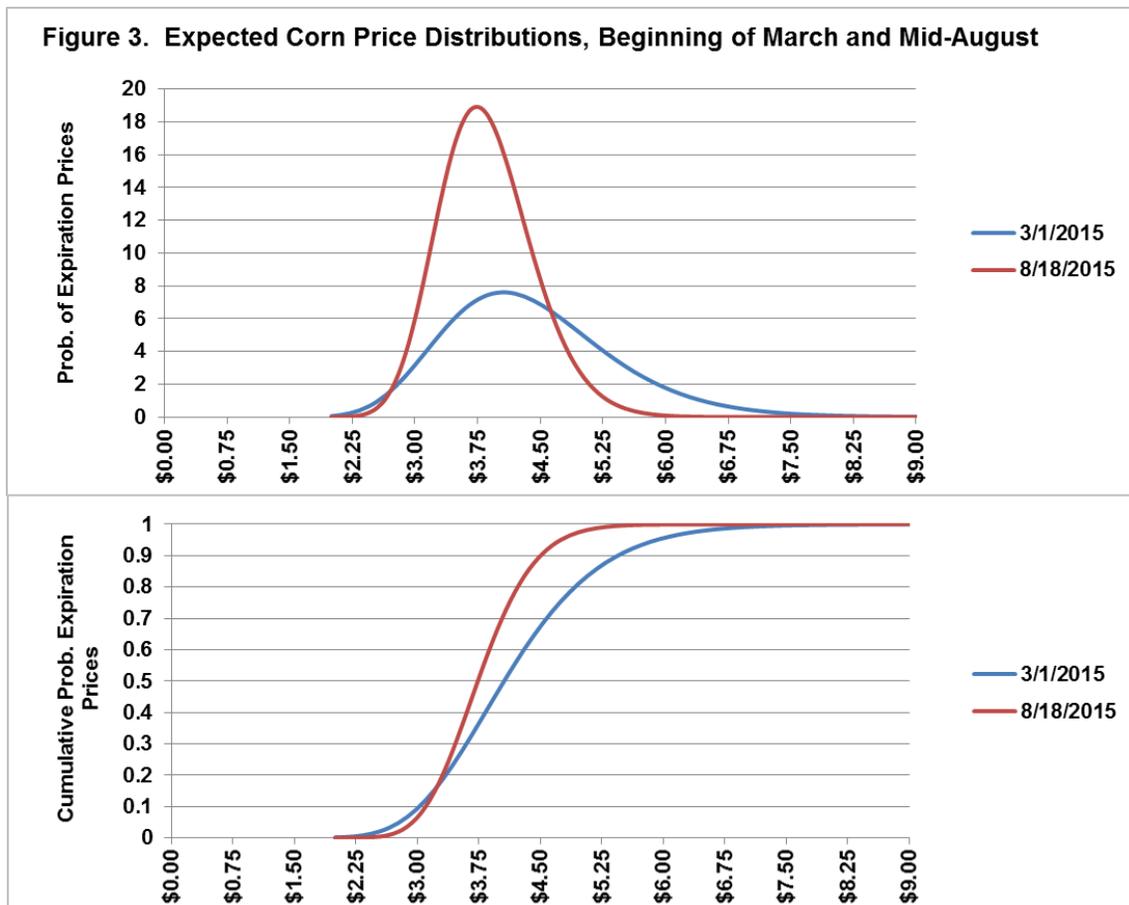
evolving uncertainty around prices – or the market’s expectation of the likelihood for different sized price movements prior to expiration.

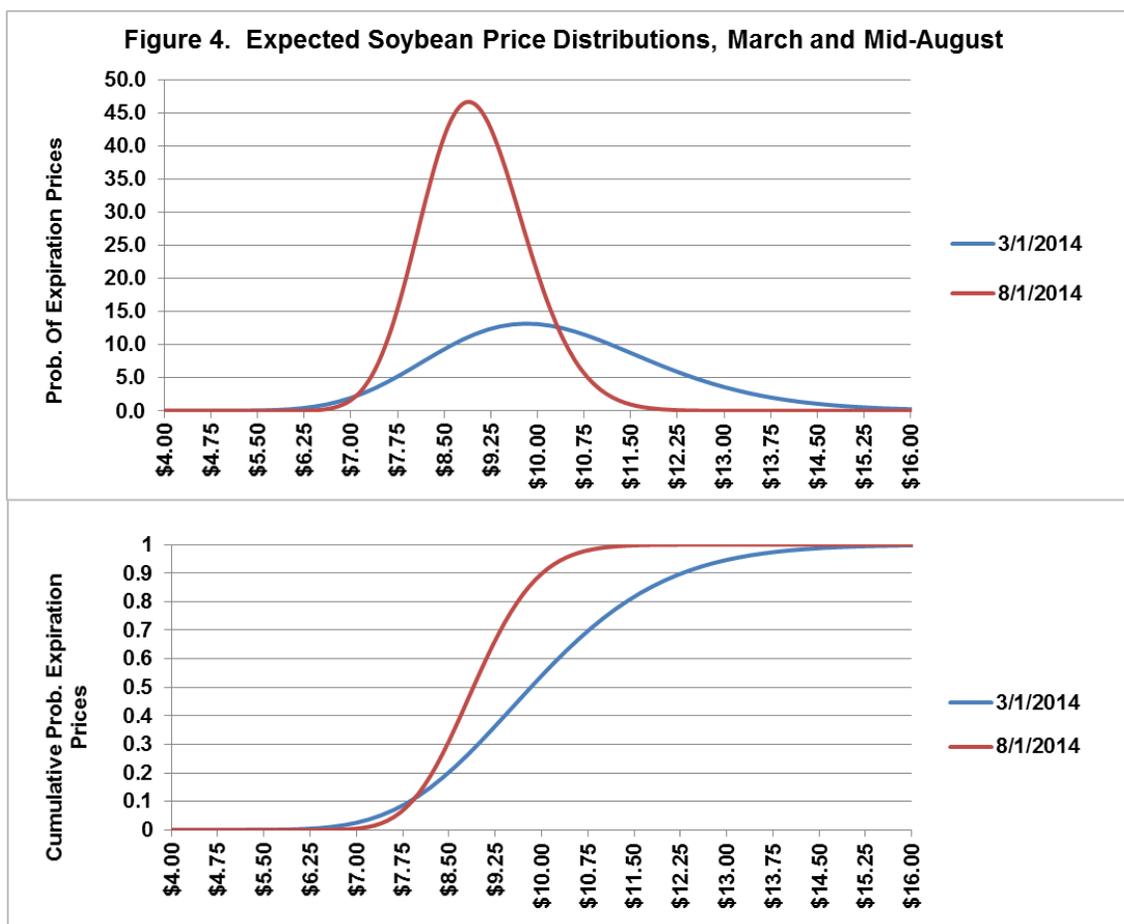


As we have provided in past *farmdoc daily* articles, the following provides a set of related views of price distributions and the confidence around the market expectations of futures prices, taking advantage of the information that is provided through market prices of options. To recover probabilistic 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 August 18, 2015 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. Corn prices at the end of the PP averaging period were below the average price in February, and Soybean prices were actually above the average price in February indicating that the PP was above the market’s aggregate view of corn prices, but below the aggregate view of likely soybean prices at the time the PP s were established.





In the tables below, additional comparisons are made between the information in the market's expectations between March 1, and current (August 18, 2015). 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 54% chance that expiration prices would be below Projected Price in corn, but by August, that had increased to 76% 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 47.8% chance that final prices would be below the PP, but by August, that likelihood had been revised to 83.5%.

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 width of the range has declined, and the values decreased to lower levels as well. In corn, for example the interquartile range, or the area containing 50% of the probability, moved from \$3.48 to 4.74 (\$1.26 range) to \$3.39 to \$4.12 (\$.73 range) since March.

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 in July, and in periods around last week's release of the USDA production report. 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 50th percentile, even if the levels change through time.

Table 1. Implied Corn Price distributions, March and August

Price	Prob. below Price		Price at Given Prob.		
	March	August	Prob	March	August
\$3.00	9.3%	6.5%	1%	\$2.38	\$2.67
\$3.25	16.5%	16.7%	2%	\$2.54	\$2.78
\$3.50	25.8%	32.4%	5%	\$2.79	\$2.95
\$3.75	36.4%	50.8%	10%	\$3.03	\$3.10
\$4.00	47.4%	67.8%	20%	\$3.35	\$3.31
\$4.15	53.8%	76.3%	25%	\$3.48	\$3.39
\$4.25	57.9%	81.1%	30%	\$3.60	\$3.47
\$4.50	67.3%	89.9%	40%	\$3.83	\$3.60
\$4.75	75.3%	95.0%	50%	\$4.06	\$3.74
\$5.00	81.8%	97.7%	60%	\$4.30	\$3.88
\$5.25	86.9%	99.0%	70%	\$4.58	\$4.04
\$5.50	90.7%	99.6%	75%	\$4.74	\$4.12
\$5.75	93.6%	99.8%	80%	\$4.92	\$4.23
\$6.00	95.6%	99.9%	90%	\$5.45	\$4.50
\$6.25	97.0%	100.0%	95%	\$5.92	\$4.75
\$6.50	98.0%	100.0%	99%	\$6.92	\$5.24

Table 2. Implied Soybean Price distributions, March and August

Price	Prob. below Price		Price at Given Prob.		
	March	August	Prob	March	August
\$7.25	4.0%	1.4%	1%	\$6.56	\$7.17
\$7.65	7.5%	5.2%	2%	\$6.88	\$7.36
\$8.05	12.6%	14.1%	5%	\$7.38	\$7.64
\$8.45	19.3%	29.0%	10%	\$7.86	\$7.90
\$8.85	27.4%	47.9%	20%	\$8.49	\$8.23
\$9.25	36.4%	66.5%	25%	\$8.74	\$8.36
\$9.65	45.9%	81.2%	30%	\$8.97	\$8.47
\$9.73	47.8%	83.5%	40%	\$9.40	\$8.69
\$10.00	54.0%	89.8%	50%	\$9.83	\$8.89
\$10.40	62.8%	95.5%	60%	\$10.27	\$9.10
\$10.80	70.7%	98.2%	70%	\$10.76	\$9.33
\$11.20	77.4%	99.4%	75%	\$11.05	\$9.46
\$11.60	83.0%	99.8%	80%	\$11.37	\$9.61
\$12.00	87.5%	99.9%	90%	\$12.28	\$10.01
\$12.40	91.0%	100.0%	95%	\$13.08	\$10.35
\$12.80	93.6%	100.0%	99%	\$14.72	\$11.03

Figure 5. December 2015 Corn Futures Price Percentiles through Time

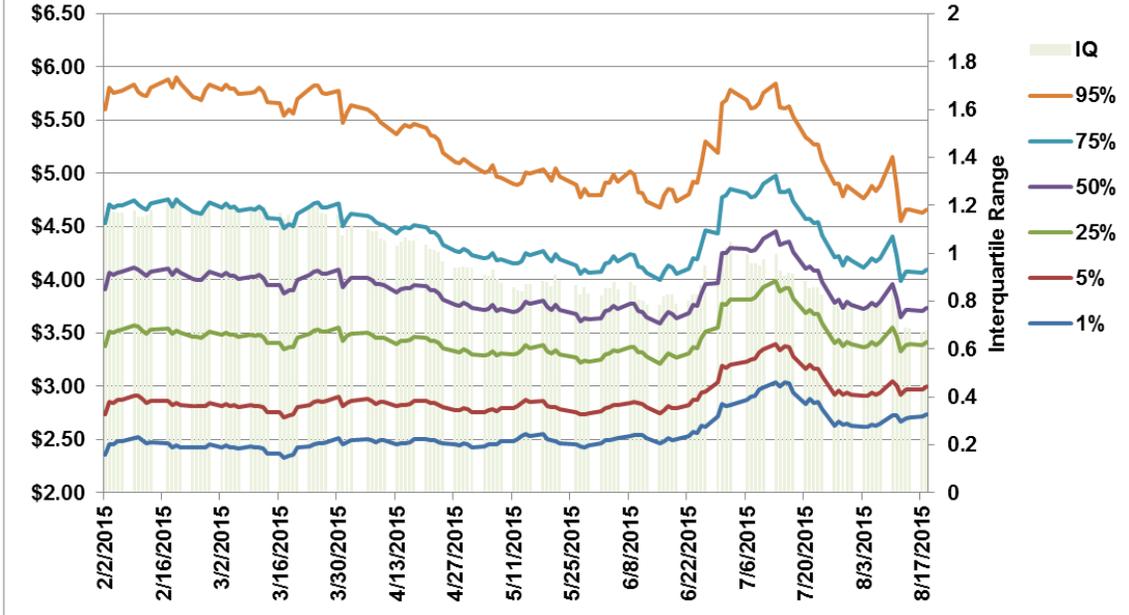
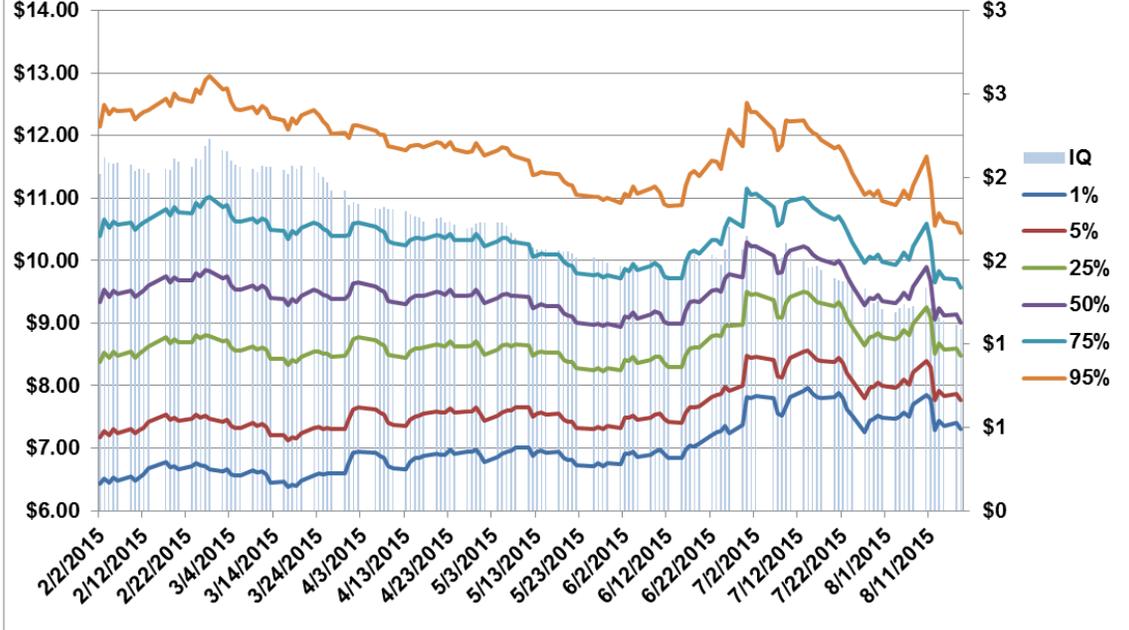


Figure 6. November 2015 Soybean Price Percentiles through Time



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, and thus the effective price for much of the crop insurance coverage is likely to be at the original Projected Prices. The probability ranges have also tightened substantially as was the case in 2014 as production prospects became more certain through the growing season and as the risk of substantial interruptions in production at this point appear to the market to be relatively low.