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Evaluating Crop Insurance Options for 2014

Bruce Sherrick and Gary Schnitkey

Department of Agricultural and Consumer Economics
University of Illinois

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The Risk Management Agency (RMA) has now concluded its price discovery period used to determined final prices and volatility factors for federally sponsored corn and soybean crop insurance products for 2014. For the majority of the cornbelt, the approved Projected Price (PP) for corn is $4.62 and the volatility factor is .19. For soybeans, the projected price is $11.36 with a volatility factor of .13. For comparison, the 2013 prices (volatility factors) were $5.65 (.20) and $12.87 (.17) for corn and soybeans respectively. The Projected Prices are used to determine the guarantee revenue indexes based on futures prices, and do not reflect local basis. The Projected Price for corn is determined by averaging the closing December futures price during the trading days of February, and for soybeans by averaging the November Futures closing prices during February. The volatility factors are determined by an average of the most recent five trading days' implied volatility estimates, scaled for the interval of time from now until the middle of October -- the month during which average prices are used to determine Harvest Prices. For both corn and soybeans, the volatility factors have trended downward, and relative to popularly interpreted measures of volatility are considered very low for soybeans in particular. The volatility factor summarizes the market's estimates of the likelihood for price movements of various magnitudes, and has corresponding impacts on premiums paid for Revenue and Harvest Price related products. In 2014, the Projected Prices for soybeans are close to current futures market prices, while corn traded around $.14 higher than the projected price on the first sales date for crop insurance. When actual futures prices are below the projected price, there is a somewhat increased likelihood for experiencing an insured revenue shortfall, and when actual futures prices are higher than the projected price, there is an increased likelihood that products with the harvest price option embedded will have an increase in guarantee value. Beginning with the 2014 crop, the projected prices and volatilities, where relevant, are now common over both farm-level and area-revenue and area-yield policies.

The perennial question faced at this point in the year is: How can one sensibly evaluate their crop insurance options for their own case, reflecting current insurance information, current price expectations, and their own farm's operating conditions? The following materials provide one approach for evaluating the most important crop insurance product and election choices facing corn and soybean producers using the University of Illinois *iFARM* crop insurance evaluator.

The case presented is for McLean Co., a large and high yielding county in central Illinois (this case, and similar analyses for approximately 750 other counties throughout the midwest for both corn and soybeans under both basic and enterprise elections are available at the *farmdoc* website in the crop insurance section).

Importantly, there can be large differences in premiums even over short distances or among contiguous counties, and over the choice of unit and APH endorsement. Thus, while the case farm information provided is helpful in understanding the relationships among choices, it is important to compare to conditions that most closely match your own case. It is also important to carefully discuss final options and decisions with a qualified insurance agent to insure accurate information about the specific costs. The case farm information from McLean County, Illinois and starting price conditions are shown in the table below. It is assumed that the farm qualifies for the Trend Adjusted APH endorsement which takes its average Corn APH from 169 to 178. The county standard deviation of yields is estimated to be about 24.6 bu./acre and the farm yield risk is about 4 bu./acre higher. Some basic risk information is given related to yield risk (e.g., 1 in 10 years the farm yield will be below 137.8, 1 in 5 years the county will be less than 158.77 and so on), and the average gross revenue with no insurance is calculated at $768/acre. The gross revenue calculation reflects the negative correlation between the yield and prices, as well as simulated local basis conditions and starting prices. Importantly, the lower current futures prices have substantially reduced the beginning guaranteed revenue value compared to 2013 values. The average futures price is a result of the process used to model the price distribution implied by the options markets for the settlement period and can differ from current futures prices at any point in time. Consistent with RMA rules, the APH and Trend APH are rounded to nearest whole bushels, and other features of the indemnity calculations are maintained to comply within RMA rules and procedures.

Crop Insurance Evaluation Model

Case Farm Information

County: McLean	Crop: Corn		Farm Yield	County Yield
Farm Average Yield	**178.5** *bu./acre*		*bu./acre*	*bu./acre*
Farm St. Dev. of yield	**30.40** *bu./acre*	30% of years yields below:	**164.44**	**167.61**
County Average Yield	**178.5** *bu./acre*	20% of years yields below:	**153.64**	**158.77**
County St. Dev. of yield	**24.61** *bu./acre*	10% of years yields below:	**137.80**	**145.58**
Average Futures Price	**$4.71** */bu*	5% of years yields below:	**124.14**	**133.96**
St. Dev. of Price	**$0.99** */bu*	Farm Trend Adjusted-APH	***178***	*bu./acre*
Ave. Harvest Cash Basis	**$0.35** */bu*	County TA Rate	***1.83***	*bu./acre/yr*
Average Gross Crop Rev.	**$768** */acre*	Farm APH (ref)	***169***	*bu./acre*
- case: Enterprise unit on 320 acres. Projected price of 4.62			*as of date:*	3/3/2014

The next table shows approximate premiums and guarantee values for the available products, unit decisions, and coverage levels in this county for the case farm shown. The area products are calculated assuming maximum protection levels in all cases, and maximum protection factor of 1.2 for Area products. Importantly, the revenue guarantee levels are calculated with reference to the underlying Projected Price which does not account for local basis.

McLean Co. Premiums ($/Acre)

	Revenue Protection (RP)			RP- Harvest Price Excl.			Yield Protection (YP)			Area Risk Protection		
Coverage	Opt	Basic	Enterp.	Opt	Basic	Enterp.	Opt	Basic	Enterp.	AYP	ARP-HPE	ARP
50%	$1.34	$0.88	$0.42	$1.07	$0.72	$0.33	$1.11	$0.70	$0.43			
55%	$2.11	$1.42	$0.59	$1.47	$1.04	$0.38	$1.63	$1.08	$0.60			
60%	$2.87	$2.09	$0.85	$1.71	$1.29	$0.41	$2.07	$1.43	$0.80			
65%	$4.33	$3.33	$1.19	$2.38	$1.76	$0.42	$2.93	$2.12	$1.03			
70%	$6.14	$4.99	$1.83	$3.08	$2.46	$0.59	$3.70	$2.83	$1.38	$13.17	$8.38	$15.54
75%	$9.61	$8.20	$3.20	$4.58	$3.92	$1.02	$5.19	$4.15	$2.12	$17.63	$13.67	$24.47
80%	$15.39	$13.78	$6.58	$7.39	$6.59	$2.16	$7.61	$6.34	$3.77	$24.79	$21.63	$35.26
85%	$24.89	$23.36	$14.38	$11.84	$11.15	$5.12	$10.78	$9.43	$6.85	$33.11	$32.55	$56.28
90%										$46.71	$47.69	$78.08

Corn - Enterprise on 320 Acres *Projected Price of 4.62 and vol. factor of 0.19 used.*

Guarantees

Coverage	RP Indem. Revenue	YP Indem. Yield	ARPI-YP Yield	ARPI-RP Revenue
50%	$411	89.0		
55%	$452	97.9		
60%	$493	106.8		
65%	$535	115.7		
70%	$576	124.6	128.3	$593
75%	$617	133.5	137.5	$635
80%	$658	142.4	146.6	$677
85%	$699	151.3	155.8	$720
90%			165.0	$762

These tables allow a quick comparison of the costs and coverages available across alternative products, coverage levels, and unit designations. The farmer-paid premiums and Guarantee levels are based on the case farm and location presented for available products. Estimates are based on current market data as of 3/3/14. These are provided as estimates only. A qualified crop insurance agent should be contacted for final analyses.

As is the case across the majority of the corn production region, the Enterprise policy is often considerably less expensive than Basic or Optional coverage under each of the policy options, both because of the lower risk represented, and the higher subsidy rates associated with Enterprise coverage. Moreover, the policies with the Harvest Price Exclusion are also considerably less expensive. Under Revenue Protection Harvest Price Exclusion (RP-HPE), the guarantee level is dependent on current projected prices and does not increase if harvest prices are higher. Under traditional Revenue Protection (RP), if the Harvest price is higher than the projected price, the guarantee increases to reflect the higher price. Currently, December corn futures prices are slightly above the projected price, thereby increasing the relative attractiveness of RP relative to RP-HPE at the time of signup due to the partial increase in expected revenue implied by that difference. Given the experience in 2012 where harvest prices were significantly elevated due to the drought effects on yield, the RP products continue to be far more popular than HPE products, even if the a priori actuarial features are roughly identical. The Area Risk Protection Products have some differences from their predecessors of GRIP and GRP, but have similar general designs. The Area Yield Protection policy is triggered directly by the county yield shortfall from its guaranteed fraction of the county's expected yield, but paid as a limited fraction of the shortfall. ARP or Area Risk Protection policies can result in very high payments, but also carry fairly high initial premiums as a result. The lower section of the table shows the revenue or yield level guarantee associated with each possible coverage election level. These values reflect RMA's definition of insured yield and revenue and do not translate exactly to minimum receipts for the producer (more detailed price quoting information is also available here at the *farmdoc* website).

The remainder of the presentation focuses on Enterprise units as many farmers will find Enterprise policies to be a better choice because the policy will be less expensive and more related to overall revenue from the crop insured. Comparable analyses considering Basic units are available at the *farmdoc* website for those interested.

The following table provides the average payments per acre expected if this year's conditions were repeated over and over, a large number of times across all possible outcomes, and the average across all

iterations calculated. As shown in the table, the payments increase as election levels increase reflecting the increased value of coverage for all insurance products. The Yield Protection policy (YP) would be expected to make average payments of $16.27/acre at the 85% election level over a large number of times. Of course, many years the payments will be zero, and some years the payments would be much higher. Notice that the RP policy always is expected to make larger payments than the RP-HPE policy, but not always by as much as the difference in premium costs. Under an 85% election, for example, RP would be expected to make indemnity payments of $21.82 per acre on average over a large number of years, while the RP-HPE policy would make average payments of $14.08. The Area policies (rightmost 3 columns) begin with 70% coverage options and range to 90% unlike farm-level policies that have maximums of 85%. The highest coverage ARP policies also have the highest expected average payments due to the protection factor allowing a 1.2 scaling of payments to help offset the farm-to-county basis risk that remains due to imperfect correlation between the farm and the county yields.

Average Insurance Payments/Acre

Coverage Election	YP	RP-HPE	RP	AYP	ARP-HPE	ARP
50%	$0.23	$0.07	$0.22			
55%	$0.47	$0.18	$0.49			
60%	$0.94	$0.48	$1.04			
65%	$1.83	$1.11	$2.15			
70%	$3.35	$2.44	$4.27	$4.96	$4.45	$10.04
75%	$5.93	$4.75	$7.84	$8.74	$10.12	$19.23
80%	$10.03	$8.45	$13.45	$14.80	$19.73	$33.94
85%	$16.27	$14.08	$21.82	$24.10	$33.77	$55.45
90%				$37.77	$52.77	$84.35

Next, a table is provided with the frequency of payment, or the fraction of years that at least some payment would occur. As can be seen in the table, the YP policy makes payments in about 18.5% of years at an 85% election and virtually never gets triggered at lower coverage levels. The revenue policies increase in frequency faster as coverage levels are increased due to the possibility of price movements also generating claims even under near typical yields. In the case of RP at 85%, a farm with these characteristics would expect to a claim in about 24% of the years. Group policies, while they tend to pay in high frequencies at high elections, are less correlated with revenue shortfalls and thus may provide less risk protection despite the often higher frequencies of being triggered, especially at the highest election levels.

Frequency of payment

Coverage Election	YP	RP-HPE	RP	AYP	ARP-HPE	ARP
50%	0.4%	0.2%	0.4%			
55%	0.8%	0.4%	0.8%			
60%	1.6%	1.1%	1.8%			
65%	2.8%	2.4%	3.5%			
70%	4.8%	4.6%	6.4%	3.5%	4.5%	7.1%
75%	7.9%	7.3%	10.3%	6.2%	9.3%	13.3%
80%	12.3%	11.6%	15.9%	10.6%	16.4%	23.1%
85%	18.2%	17.5%	23.6%	17.3%	25.2%	35.0%
90%				26.7%	35.7%	49.5%

The next table combines information from the previous tables and presents the net cost of insurance expected over time given the starting conditions of the farm and the insurance provisions for this year. Net cost is defined as the farmer paid premium less the average payment received. A negative "cost" indicates that the product pays back more on average than it costs -- as would often be expected given the overall target loss ratio of approximately 1.0, and the fact that the farmer paid portion of the premium is subsidized to encourage participation.

As shown in the table, Revenue Protection pays back on average about $13.26 more than its premium cost while under RP-HPE a producer in McLean County would expect to gain $7.44/acre over the long run by purchasing RP-85% every year. Although sometimes counterintuitive, numbers in parentheses that are larger are more negative and are thus more preferred. Higher positive numbers are associated with larger net costs through time. A zero would be a breakeven policy that paid back just what it cost over time. Recall that the RP policy pays more on average and in more years, but the lower premium cost of the HPE policy more than offsets the payment differences in this specific case. YP would in this case actually pay back the most on average through time in excess of its lower premiums, but again not necessarily be as correlated with revenue shortfalls. Given the very high premiums for Area policies in McLean, the high payments roughly offset the initial costs and return a bit more than the premium on average for ARP and ARP-HPE, but do not quite cover the average cost of YP. Interestingly, even a few counties away from McLean with similar expected yields can have substantially different patterns, especially in terms of the Area products. Given the subsidy structure, the general findings in most counties is that the average cost of insurance is negative through time as expected, and also that higher coverage options are usually preferred on an actuarial basis.

Estimated Net Average Cost of Insurance

Coverage Election	YP	RP-HPE	RP	AYP	ARP-HPE	ARP
50%	0.20	0.26	0.20			
55%	0.13	0.20	0.10			
60%	(0.14)	(0.07)	(0.19)			
65%	(0.80)	(0.69)	(0.96)			
70%	(1.97)	(1.85)	(2.44)	8.21	3.93	5.50
75%	(3.81)	(3.73)	(4.64)	8.89	3.55	5.24
80%	(6.26)	(6.29)	(6.87)	9.99	1.90	1.32
85%	(9.42)	(8.96)	(7.44)	9.01	(1.22)	0.83
90%				8.94	(5.08)	(6.27)

Net cost does not provide a complete picture of the impact of insurance usage however as it is also important to understand the impact of insurance on the likelihood of experiencing particularly low revenues. For example, one might be most interested in which insurance allows a farmer to bid most for cash rent, or insure that all variable costs can be covered, or do the best job of offsetting particularly low revenue outcomes under hedged production, and so on. One way to begin to understand this type of impact is to examine the VARs or "Values at Risk" under different insurance contracts.

A 5% gross revenue VAR, for example, shows the value at which 5% of the possible outcomes fall below, and 95% of the outcomes exceed – in other words a 1 in 20 worst event. A 1% VaR shows a characteristic of “extreme risk” representing a 1 in 100 year analog probability. The table below shows the 1% VARs for the various insurance products and elections to better help appreciate the relatedness of payments to revenue shortfall. Notice that with no insurance, the 1% VAR for revenue is about $419 meaning that in 1% of the cases, revenue would be below that value. Using YP insurance increases the lower tail to about

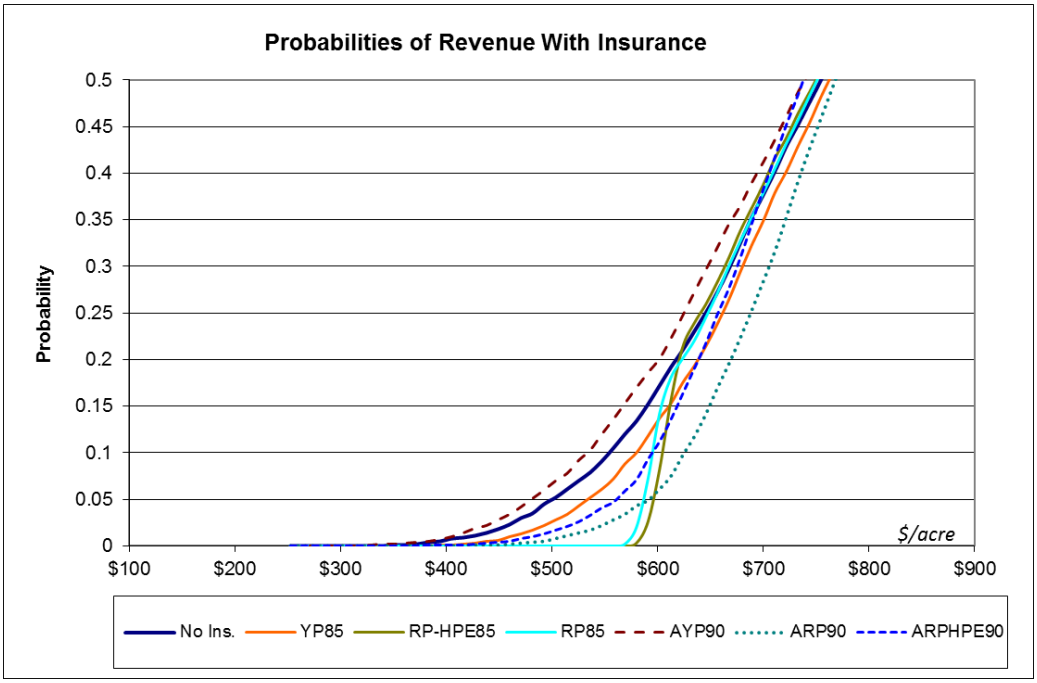
$460. Using ARP would increase that extreme outcome to about $481. However, the RP policies add over $150 to the lowest outcome compared to no-insurance. RP and RP-HPE do a far better job of "cutting off the low tail" of the revenue distribution and provide substantially better downside risk protection due to their ability to trigger based on either yield or price level movements. A producer considering covering $550 in total production costs would thus likely find higher elections of the revenue products most appealing.

VAR at 0.01 *McLean Co. Illinois -- Enterprise Units*

Coverage Election	YP	RP-HPE	RP	AYP	ARP-HPE	ARP
50%	$426.69	$411.58	$421.41			
55%	$432.03	$411.53	$425.69			
60%	$433.01	$433.16	$432.72			
65%	$439.59	$458.63	$457.86			
70%	$441.27	$487.97	$486.73	415.85	439.60	436.42
75%	$447.08	$520.78	$518.60	413.50	451.69	446.84
80%	$453.61	$553.28	$548.86	408.77	468.17	461.27
85%	$459.05	$584.81	$575.55	408.37	479.54	465.36
90%				401.94	498.11	480.99
1%	Value at risk without insurance		419.00			

The final information presented in the graph below helps summarize the impacts across the lower tail of the revenue distribution. The bottom axis gives levels of gross revenue with insurance payments, less premiums paid. The vertical axis shows the probability of occurrence. Because distributions with higher likelihood of higher revenue are preferred, lines to the bottom and right are preferred to those above and to the left in this graph. The dark blue line provides the possible revenue outcomes with no insurance. For example, there is about a 5% chance of revenue with no insurance being below $535 and a 10% chance of revenue being below $580, a 25% chance of being below $660, and so on without insurance. Purchasing insurance has two types of consequences on the revenue distribution -- first, it shifts the whole schedule left by the amount of the premium. Then, it adds back payments to outcomes covered by insurance, there by shifting specific portions of the revenue distribution back to the right. Ideally, insurance should make payments when revenue is lowest and not make payments when revenue is highest resulting in an overall shift in the revenue distribution to the right at lower revenue levels, and resulting in lower revenues when only premiums are paid and no indemnities are paid (top portion of the curves are not shown in the graph, but would be shifted to the left of the no-insurance case). As can be seen in the graph, AYP actually reduces the revenue distribution relative to no insurance over most of the lower half (probability less than 50%) of the revenue distribution. YP (omitted from the graph) has almost no effect compared to no insurance, roughly covering its own cost, but not much more or less. RP 85% and RP-HPE 85% do the best job of "cutting off the tail" of the revenue distribution with minimum revenues of roughly $580-600 guaranteed in most cases. The ARP outcomes are interesting in that they pay back more than premiums over a large range of revenues, but do not protect against particularly severe revenue shortfalls. Further, in years with high crop revenue they actually cost the most in terms of total revenue due to their higher initial premiums.

Similar patterns to these results occur with soybeans, although with more muted magnitudes, and in many locations with relatively less valuable Area Protection options. These cases, and cases involving Basic units are also provided at the *farmdoc* website for most counties covering the majority of the corn belt plus Maryland.



Crop insurance is increasingly viewed as providing the cornerstone for active risk management programs, and its importance is elevated in environments with higher input costs and greater margin risk. The differences in underlying rates and starting price and volatility conditions can substantially impact the relative performance of the alternatives from year to year, and across different operations within a given year. Hopefully the *iFARM* Crop Insurance Tools will provide producers with insights needed to make informed crop insurance decisions most suitable for their own operations.

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