Module 14

Pre-harvest Marketing Strategies May Increase Net Returns for Corn and Soybean Growers: Iowa and Ohio Case Study, 1985 - 1996

Robert N. Wisner, Iowa State University
E. Neal Blue, Ohio State University
E. Dean Baldwin, Ohio State University

Topics

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Pre-harvest Marketing Strategies Increase Net Returns for Corn and Soybean Growers
by Robert N. Wisner, E. Neal Blue, and E. Dean Baldwin,

For an alternative view of the work presented in this module see:
Market Efficiency and Marketing to Enhance Income of Crop Producers,
by Carl R. Zulauf and Scott H. Irwin.

Introduction

In previous lessons, risks and net returns were determined for different combinations of insurance products and marketing alternatives for selected farm financial scenarios. In **Module 13** the outcomes were examined for 1997, based on market conditions for this one year. In contrast, the analysis in this lesson uses actual market conditions and yields for the 1985 to 1996 time period to determine whether pre-harvest marketing strategies produce greater net returns than 100% harvest sales for corn and soybean producers. We used statistical methods to determine whether the results were due to chance or to repetitive market behavior. In the analysis, hedges were established by taking short positions (selling futures contracts) in the futures market; buying puts; and establishing synthetic puts (combinations of short futures position and buying a call). The pre-harvest strategies did not

involve speculative positions or sales of calls or puts, nor did they prevent farmers from storing. The decision to store is separated from pre-harvest versus harvest strategy considerations (**Module 8** discussed the storage decision parameters in detail). Insurance products were not included in this analysis.

For years, economists have debated whether income gains are possible from pre-harvest pricing. One view is that, with efficient markets, traders would soon discover that such gains were possible and they would disappear. Two papers outlining specifics of contrasting views are available: "Can Pre-harvest Marketing Strategies Increase Net Returns for Corn and Soybean Growers?" by Wisner, Blue, and Baldwin; and "Market Efficiency and Marketing to Enhance Income of Crop Producers, " by Zulauf and Irwin. **(Please use the 800 telephone number that appears on the front page of Managing Risks and Profits to request either or both of these papers.)** Our contribution to the debate was to look at actual possibilities for a corn and soybean farm with various pricing strategies over the last several years. In the main part of this lesson, the procedures for our analysis are described and pre-harvest pricing results are reported. Impacts on net income are reported for 1,000 acre Iowa and Ohio farms, consisting of 500 harvested acres each of corn and soybeans. To get specific results for your farm situation, you would need to include your 10-year moving average corn and soybean yields, costs of production, and financial status. (Methods for calculating your cost of production and financial status were described in prior lessons). Within the next year, we will have a computer program that allows you to simulate specific outcomes for your farm.

The Pre-harvest Versus Harvest Sales Debate *(or go to **Topics**)*

We believe grain producers use pre-harvest marketing strategies to achieve two goals: reduce price risk and enhance net returns or profits. Using hedges, forward contracts and/or options to limit price risk prior to harvest is universally accepted by economists as an attainable goal. The effective use of pre-harvest marketing strategies by producers to enhance net returns or profits remains a debatable topic. Those who believe net returns cannot be enhanced through pre-harvest pricing cite supporting literature that agricultural futures markets are efficient. This means that the markets incorporate all available information into the price formation process and thus, individuals cannot routinely beat or out-predict the market. They argue that selling grain at harvest will result in average net returns that are at least equal to average net returns from any pre-harvest marketing strategy.

Those who believe incomes can be increased by pre-harvest pricing find indications of a possible spring and early summer risk premium in new crop prices related to uncertainty about Northern Hemisphere crop prospects (**Module 2**). As the growing season progresses and more information about crop prospects becomes available, risk premiums tend to disappear. Also, producers make planting decisions based on spring new-crop futures prices. If prices for a particular crop are high before or during the planting season, individual farmers expecting to earn relatively high profits will respond by planting more acres to that crop. If all farmers respond by increasing planted acreage, and normal weather patterns prevail, futures prices will decline as the harvest period approaches. This occurred in 1997 when farmers responded to relatively high soybean prices by switching acreage from wheat and sorghum to soybeans. Soybean futures prices have declined by over $1/bu from pre-harvest spring highs since the onset of harvest. Similar responses occurred in corn and

wheat in 1996.

Based on other arguments and to serve as a guide for developing strategies, we examined seasonal pricing patterns from the 1975-95 period, searching for price risk premium opportunities related to weather and seasonal uncertainty about world crops and producers' expectations. We used this information to make marketing decisions, which included establishing hedges and synthetic puts, or buying puts. Rather than predicting pricing patterns for any given year, we used frequently recurring patterns to take advantage of pricing opportunities with a mix of option and hedge strategies. Using options as part of the marketing strategy establishes a price floor at the chosen strike price, but leaves the upside open. Because of initial purchase costs, the harvest cash sale strategy will outperform the option strategy when prices rise sharply, as happens in one-third to one-fourth of the years. For the remaining years, the options have tended to perform better than harvest cash sales.

Zulauf and Irwin believe a limitation of our analysis is that we do not have at least 30 observations or 30 years of data, the minimum number of observations they feel are necessary for statistical tests. Because new-crop grain and oilseed options first started trading in 1985, we have only 12 years of actual market performance to test. We will continue to add data for other years as it becomes available.

Pre-harvest Pricing Environment *(or go to **Topics**)*

In the analysis, we categorized marketing years by size of the U.S. crop relative to utilization. This is done, not to try to forecast short crops before they occur, but to identify different pricing strategies to be used in years following short crops than in years of near normal crops, and also to visualize gains from using options in short-crop years. For our purposes, short crops are years when U.S. production is below the previous year's total utilization. This definition differs from those based on shortfalls from trend yields. The remaining years are classified as normal-crop years, with a subset called years following short crops, or short-crop ex post years.

The 1975-95 period was used for seasonal analysis because it reflected a global market, in contrast to a traditional, domestic, U.S. government controlled grain market of the 1950s and 1960s. The years, 1972 and 1973 were excluded because they represented a transition from the old to the new global market environment. From 1975 to 1996, normal-crop years and short- crop years occurred about 72 and 28 percent of the time, respectively. They have occurred in these same percentages since 1911.

As examples of price patterns, **Figures 1** and **2** show new-crop futures corn price changes by year for normal and short crops, respectively. Although not shown, similar pricing patterns exist for soybeans. **Figure 1** highlights the spring corn price premium relative to the average corresponding harvest prices. For the 16-year period, corn prices averaged $0.27 more than the corresponding harvest prices in the U.S. planting season. For the same period, soybean prices in the spring averaged $0.82 more than harvest prices. The corn and soybean spring price averages were statistically different from the corresponding harvest prices at the 2.7% and 1.9% levels, respectively. These are indicators of the probability that the respective price differences could happen by chance. During these years, the pre-harvest options/hedging strategies should out-perform the harvest sales strategy provided that the increase in returns from the pre-harvest sales is greater than the cost of the options.

In the six short-crop years of this period, corn prices increased by an average of $0.25 per bushel from the first week of July to the first week of November (**Figure 2**). With the exception of 1975 (which was influenced by global inflation, a dramatically declining U.S. exchange rate, and other unusual global developments), short-crop years were the only years in which new-crop corn futures prices rose from spring to fall. The U.S. harvest-time cash marketing strategy outperforms the pre-harvest options/hedging strategies during short-crop years. In fact, the cash sales strategy performs exceptionally well as it did in 1995, provided the producer is not in an area of crop losses that are driving the market. Although not reported here, similar short-crop year pricing patterns exist for soybeans.

During the short-crop ex post years, December corn and November soybean futures prices were sharply lower at harvest than in late winter before harvest. December new-crop corn futures prices in late February prior to harvest averaged $0.39 per bushel above the December futures price in early November. Based on the t-test, differences between February and November prices were statistically significant at the 6% level. New-crop November soybean prices in February prior to harvest averaged $1.00 per bushel above the November futures price in mid-October, and were statistically different from full prices at the 2% level. Executing pre-harvest strategies during the short-crop ex post year winter months should produce statistically higher net incomes than harvest sales.

Marketing Strategies And Data *(or go to **Topics**)*

To gain the difference between the pre-harvest and harvest prices, we tested 10 different pre-harvest marketing strategies. All showed higher incomes than harvest sales, but several did not pass statistical significance tests. With space limitations, only the best performing strategy is reported here for each crop.

For corn, the best performing strategy is a mixed hedge/put strategy. It was created based on following rules and decisions:

> (1) Rule: to prevent over-hedging only 80% of the 10 year moving average of production is hedged before July.
>
> (2) Rule: only 5,000 bushel contracts can be purchased, thus less than the 10 year moving average is often hedged.
>
> (3) Decision: hedge in February in the short crop ex post years; otherwise
>
> > (3A) Decision: for all other crop years, buy $0.20 out-of-money new-crop puts during the third week of May. The put options were offset (closed) during the second week of October.
>
> (4) Decision: assuming normal crop is developing and crop planted, hedge remaining 20% of expected trend during the first week of July.

For soybeans, the best performing strategy is a synthetic put strategy. It was created based on following rules and decisions:

> (1) Rule: 100 percent of trend line production (up to the amount allowed by 5,000 bushel futures and options contracts) was hedged. The trend line and contract limitations reduce some of the risk of over-hedging during short crop years.
>
> (2) Decision: For ex post short-crop years, hedge 100% of trend line production of soybeans during second week of February and buy $0.25 out-of money new crop calls during third week of May; otherwise
>
> > (2A) Decision: for all other years, hedge 100% of trend line soybeans during third week of May and simultaneously buy $0.25 out-of-money new crop call.
>
> (3) Decision: all calls offset during July.

For both corn and soybeans, the respective combinations of hedges and puts and hedges and calls establishes a price floor to protect against a price decrease that occurs about 72% of the time. These strategies also capture portions of potential price increases that occur 28% of the time. For soybean farms that want or need the opportunity to capture higher prices and thus potentially higher revenue, the calls could be left open until August, September, or expiration. However, it should be noted that lifting the calls in July did provide the highest synthetic put strategy returns for this 12 year period. The above strategies do not protect against the negative affects of two consecutive short-crop years. Placing hedges in February precludes the opportunity to gain speculative profits from rising prices. In a section that follows, we have briefly addressed this issue for soybeans.

To test the net-returns hypothesis for each pre-harvest marketing strategy, two model farms were simulated, one for northwest Iowa and one for Ohio. The Iowa model farm represents weather conditions, yields, production costs, and basis patterns for western Corn Belt farms. (Iowa is the No.1 corn and No. 2 soybean producing state in the U.S.). The Ohio model farm represents weather and economic conditions in the eastern Corn Belt. Production costs were taken from annual extension budgets. O'Brien County yields were used for Iowa and state level average yields were used for Ohio. These yields, particularly for Ohio, understate yield risk of individual producers and an updated version of this study will include individual farm yields.

Production levels for marketing purposes in each individual year were based on 10-year moving average yields. Short futures hedges and options positions were executed up to the highest whole number closest to, but not exceeding the expected production, using 5,000 bushel futures and options contracts. With the upward trend of yields, this procedure provided a built-in cushion to help avoid being oversold (or overhedged) in years of short crops. When an oversold hedging position occurred due to a short crop on the farm, the excess sale was bought back at the harvest futures price (the second week of October for soybeans; the fourth week of October for corn). All cash positions were closed out at these two times for both the pre-harvest and harvest cash market strategies.

For the pre-harvest marketing strategies, closing Thursday cash prices, futures prices, and options premiums were used. Cash prices for those same days were average prices paid to farmers in northwest Iowa and to farmers by ten separate Ohio elevators. If the markets were closed on Thursday, the preceding Wednesday's prices were used. Local basis patterns were incorporated into the analysis. Round turn brokerage fees of $40/contract and $60/contract were charged to the futures and options accounts, respectively, and a 7% initial margin was charged to the futures account. Interest rates for investments in brokerage fees, initial margins, margin calls, and option premiums were charged at the annual U.S. prime interest rate (currently about 6% per year) plus one percent. When futures profits were generated, a risk-free rate, the prevailing three month U.S. Treasury bill rate (currently about 5% per year), was credited to the account. Futures account gains and losses were calculated each week, and the maximum draw-down in the margin accounts was recorded weekly.

Results *(or go to **Topics**)*

Net returns over variable costs from the pre-harvest marketing strategies were compared with those from harvest cash marketing. For 1985-1996, the averages and variances of net returns for each strategy were computed. If a statistically significant difference was observed, the hypothesis that the pre-harvest net average returns were greater than the harvest cash sale strategy net returns was accepted. Otherwise the hypothesis was rejected. The variances and the coefficient of variation (CV) are also reported. These are measures of how much variation occurs in net returns from one year to the next on the average, with the coefficient of variation being in percentage of income. Other results reported include activity in hedging margin accounts and volumes of over/under hedging. Note that these pre-harvest strategies would not prevent storage, and that there was no exposure to spread risk. Spread risk created the crisis last year in the U.S. through multi-year, hedge-to-arrive (HTA) contracts. Producers sold several years of production on higher-priced old-crop futures contracts, hoping to roll those positions into distant crop years at a later time at a more favorable old-crop to new-crop spread. Instead, the spreads became less favorable, creating large futures losses.

Soybeans *(or go to **Topics**)*

For Iowa's model farm, the average net annual returns from the synthetic put strategy exceeded similar returns for the harvest cash marketing strategy by $7,282 ($80,046 - $72,764) at a significance level of 1.1% (**Table 1**). Ohio average net annual returns were increased by $6,600 ($59,280 - $52,680) with a significance level of less than 1%. Thus, the hypothesis that this pre-harvest marketing strategy increased net returns relative to naive cash marketing was accepted for the 1985 to 1996 time period. There is about a 1.0% chance that the difference could be explained due to random chance. However, it is important to note that these findings are for only a 12-year period.

Higher soybean yields in Iowa produced higher net returns than the model farm in Ohio. Differences in yields and basis (basis equals the difference between the cash and future price, **Modules 6** and **8**) between the two states may explain the differences in the variance of net returns as measured by the standard deviation and a risk index. Statistically, the risk index is the coefficient of variation (CV). For Ohio, both the standard deviation and the risk index were smaller for the synthetic put strategy than for the for the harvest cash sale marketing

strategy. Thus in Ohio, the pre-harvest strategy increased average net returns and reduced the yearly variation around the average net return. That is, both the price risk and income enhancing objectives were achieved during the 1985-1996 time period for Ohio. For Iowa, the standard deviation (STD) of net returns and the risk index was higher for the synthetic put strategy relative to the STD and CV for the harvest cash marketing strategy. Since the risk index was about 1.2% higher for the pre-harvest strategy, net returns in Iowa increased with a marginal increase in variance about the mean or a slight increase in the price risk. Assuming that the distribution is normal, the standard deviation is the range within which net returns can be expected to fluctuate two-thirds of the time. The risk index (CV) is the standard deviation divided by the average income, and let's us compare income volatility from different marketing strategies where the average incomes are different.

Pre-harvest marketing strategies with hedges (sales of futures contracts) add short term cash flow margin risks and over-hedging risks. Cash flow margin requirements are short-term risk because losses in the futures market are offset by gains in the cash market as long as the farmer has not sold more than he/she produces, plus or minus any basis change. These are risks because the producer must be able to meet the cash flow requirement or the futures account will be terminated. In this lesson, underhedging is defined to occur when more soybeans are produced than are marketed with futures or options contracts. Overhedging is defined to occur if production falls below the moving average production and is less than the amount sold through futures or options market positions. Overhedging and underhedging have different definitions in the hedge ratio literature. Over- or underhedging risks are real as losses or gains from the futures market are not offset by gains or losses in the cash market. In **Table 2**, the cash flow margin risk is identified as the drawdown in the futures account. Over- and underhedging in bushels is also reported in **Table 2**. In Iowa, the average annual maximum margin call was $7,709. In 1995, the maximum requirement was nearly $30,000. Because of lower yields, the average margin requirement and the standard deviation were somewhat smaller for Ohio than Iowa; however, the drawdown was the same for each state. These findings suggest that to use the pre-harvest marketing strategy, the farmer must provide financing for about $30,000 to cover the maximum margin call for 500 acres of soybeans. Alternatively, if adequate crop insurance is provided, a lender must understand that this is an acceptable cash flow requirement for a farmer who is attempting to reduce risks and to enhance profits.

On average, actual production exceeded the amount of crop sold in the futures and options markets. This occurred in a majority of the years for the farms in both states, with an annual average of 3,875 bushels for Iowa and 3,625 bushels for Ohio that were not forward priced. The gains or losses from over/underhedging were included as a part of the net returns. In the short-crop years, 1988, 1991, 1993, and 1995, overhedging was a problem especially in Iowa (see negative numbers under the maximal values in the over/underhedging section in **Table 2**). Overhedging can be a problem if actual production falls short of the amount of crop sold in the futures markets and the futures prices are rising at the same time. Holding a call during these periods offsets much of the short futures hedging losses.

Corn *(or go to **Topics**)*

The mixed hedge/put strategy generated an average net return equaling $62,591 for Iowa and $62,284 for Ohio (**Table 1**). The mixed hedge/put strategy increased net average revenues for Iowa and Ohio by $9,340 and $8,343 versus harvest sales, respectively, at

significance levels of 3.5 and 3.8% levels, respectively. Thus, the hypothesis that the pre-harvest strategy would increase net average revenues was accepted. The standard deviation and coefficient of variation for Ohio are smaller than for Iowa. This suggests production and basis risk are greater in Iowa than in Ohio. The production risk difference may reflect the difference in the two processes. Since production data were collected for one county in Iowa and were an average for Ohio, the averaging affect in Ohio may eliminate some of the variability that is actually experienced by Ohio's farmers. Future research will compare like counties between the two states.

For Ohio, the standard deviation and coefficient of variation for the mixed hedge/put strategy were very close to that for the harvest cash harvest strategy. For Iowa the standard deviation (CV) for the pre-harvest strategy was higher (lower) than for the harvest sale strategy. Thus, the pre-harvest strategy generated higher returns while reducing the percentage level of risk associated with net returns.

Since puts were used to protect 80% of the expected production and only 20% of expected production was hedged in normal years, margin calls averaged less than $4,723 and $5,377 annually, for Ohio and Iowa, respectively (**Table 2**). The maximum margin call that occurred using the mixed hedge/put strategy was $40,194 and $47,502, for Ohio and Iowa, respectively. These large margin calls arose from selling December corn futures contracts in February 1996 to hedge the 1996 crop, which followed the short crop year of 1995. The sole use of futures contracts in 1996 combined with the rapid rise in the December corn futures price resulted in the large futures account draw down in the spring. However, when the futures positions were closed at harvest in 1996, the December futures prices were much lower than they were in February 1996. Nonetheless, most farmers would need financing to meet this extreme margin call; otherwise, the futures position would be closed out by the broker. The lender must recognize that there may be times when it is necessary to finance hedged margin calls if the farmer-borrower is using these risk/profit managing pre-harvest strategies. Financing concerns could have been reduced by purchasing out-of-the-money calls to retain upward price flexibility. In that case, the losses on the futures margin account would be partially offset by options gains.

In some years, modest overhedging occurred; however, heavy use of the put strategy and very limited use of hedging limited losses or gains from overhedging. With underhedging, income gains were not maximized in years where prices were declining.

Results for the Farms *(or go to **Topics**)*

The best-performing strategies generated average annual net returns over variable costs for the 1,000 acre Ohio and Iowa farms that were $14,943 and $16,622, respectively, above those from the speculative strategy of harvest cash marketings. For the 12-year period, the pre-harvest marketing strategy generated about $200,000 each for the two farms relative to harvest sales. At the same time, the coefficients of variation were lower or about the same for both farms than with the harvest cash sale alternative, and t-tests indicate the probability of income gains occurring by chance were in the 2-3% range. Thus, the hypothesis that pre-harvest marketing strategies could increase net returns above those for a harvest cash sale strategy was accepted for this 12-year period. Futures account drawdowns were not a major problem in most years, with the maximum averaging $4,723 ($0.08/bushel) and $6,533 ($0.37/bushel) for Ohio corn and beans, respectively. For the Iowa farm, the futures

account average maximum drawdowns were $5,377 ($0.09/bushel) and $7,709 ($0.38/bushel), for corn and beans, respectively. The amount of potential risk should not be ignored because in 1996, futures accounts reached a maximum drawdown (corn plus soybeans) of $70,189 and $77,497, respectively for Ohio and Iowa model farms. Thus, the lender must be willing to help finance if risks and profits are to be managed.

Total bushels underhedged averaged 10,791 for the Ohio farm and 11,237 for the Iowa farm--approximately two contracts underhedged. Actual losses or gains to over-and underhedging were included as part of the analysis. Interest costs on hedged positions were very minor relative to total costs invested in producing the crops

To this point, this analysis has ignored fixed costs. All results have been reported as total revenues over variable costs. Pre-harvest pricing strategies are not a "magic bullet" that will offset the losses from a poorly managed farm. In most years, returns over total costs were negative based upon average fixed costs and cash flow obligations for both Iowa and Ohio, when government payments were excluded. However, pre-harvest pricing returns were not as negative as those from harvest cash sales. The exception is the Iowa soybean producer who earned a profit in most of the 12 years through pre-harvest pricing.

Results: Brief Overview for Marketing During Ex Post Short-Crop Years *(or go to* ***Topics*** *)*

The above analysis hedged soybeans in February following short-crop years or ex post short-crop years and attaches a call in the following month of May. This strategy was followed because back-to-back short-crop years rarely occur. The above ex post short-crop hedging strategy contains an inherent risk for producers who hedge in that the strategy cannot take advantage of higher prices if back-to-back short-crop years occurred. To avoid this risk, the results for a new strategy were tested. That is, a $0.25 out-of-the-money call was also purchased when the hedge was placed. The call was closed in July. Protecting against such an occurrence is the additional cost of the premium which is primarily time value. The producer who followed this strategy increased his/her net incomes relative to the speculative cash soybean marketings by about $6500 for each state. This outcome for each state was statistically significant at less than a 3% level. The cost to the producer to have this additional protection was less than $390 per year. Acceptance of this additional protection would depend upon the producer's financial status and his/her aversion to risk.

Conclusions and Implications *(or go to* ***Topics*** *)*

We find some evidence that weather price premiums existed in the corn and soybean futures markets during the 1985-1996 time period. We also conclude that carefully structured pre-harvest pricing with options and futures, when combined with attention to production risks, is a logical approach to corn and soybean marketing. For the years analyzed here, these strategies would have helped reduce price risk and increase net profits. It should be recognized that wide dissemination of information reported here could change future patterns of price behavior. Hence, past market performance is not a guarantee of future performance. Also, we recognize that a 12-year time period may not be long enough to have complete confidence in all statistical tests. One implication from this study is that additional research should be done, and results from these strategies should be updated annually. Second, the analysis performed here does not suggest that producers should be discouraged

from using pre-harvest marketing strategies to enhance profits. The 22-year period we analyzed for seasonal patterns showed much higher prices in the U.S. spring and early summer 72% of the time than was available at harvest. Options markets can help provide flexibility to follow markets higher in the other 28% of the years. Two final cautions: (1) poorly planned and organized pre-harvest marketing strategies can increase a producer's risk, just as in other farm management decision areas and (2) a good marketing plan will not offset the losses for a poorly managed farm. The market pays economic profits to only a few very efficient producers. Thus, a well executed overall business plan is a must for your farm in the 21st century.

A business strategy for managing risks and profits requires a complete analysis of the farm business. This means knowing your cost and cash flow obligations, what risks you can and are willing to take, and knowing how to incorporate this information into a marketing plan to control risk and lock in profits. In the monitoring portion of your plan, it is recommended that you record the returns to speculation separately from those from options or other methods for reducing downward price risk. Unhedged storage returns are speculative, as are harvest cash sales, price-later contracts, and use of basis contracts where the price level has not been established. Futures hedging or forward contracting also has a speculative dimension if not coordinated with a suitable crop insurance program, as **Module 13** demonstrated. Remember, you don't have to farm to speculate! Also, remember that using a harvest sales marketing strategy is a speculative strategy in which one out of four years earns high prices.

End of Module *(or go to **Topics**)*

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