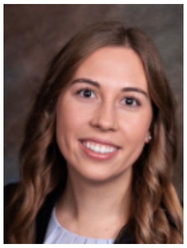
Marketing Corn and Soybeans Using a Portfolio of Strategies

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Abstract

We estimate returns to six corn and soybean crop marketing strategies using cash corn and soybean prices from the northeast Indiana and southwest Indiana crop reporting districts along with Chicago Board of Trade corn and soybean futures prices from the 2004 through the 2023 crop marketing years. Strategies are compared to a baseline strategy of making all cash sales at harvest time. Risk/return frontiers are estimated for each crop and location using a Target MOTAD model. Results confirm that a variety of optimal marketing strategy portfolios can be used to substantially increase prices above those available at harvest time.

INTRODUCTION

Corn and soybean sales are an important income source for U.S. farmers. In 2024, U.S. producers planted 90.6 million acres of corn and 87.1 million acres of soybeans resulting in U.S. corn production of 14.87 billion bushels and soybean production of 4.37 billion bushels (USDA, 2025). Corn and soybean prices received by U.S. farmers throughout the year can vary substantially, thereby contributing to farm income variability. For example, weekly cash corn prices for the northeast Indiana crop reporting region ranged from an average high of $5.35/bushel to an average low of $3.35/bushel during the 2023 crop marketing year, which began the first week of September 2023 and concluded the last week of August 2024. Unsurprisingly, U.S. farmers rank marketing risk as one of the biggest risks they face (Thompson et al., 2019).

Farmers can employ a multitude of strategies to market their farm's crop production to enhance their farm's income and/or reduce risk. However, choosing which strategy (or strategies) to pursue when marketing their crop production is a daunting task because of the uncertainty regarding how prices might fluctuate within the crop marketing year. Previous research by Edwards et al. (2020) examined the returns to storage of corn and soybeans following harvest in Indiana using state-level average cash price data covering the 1988-1989 through the 2017-2018 marketing years. Edwards et al. focused on comparing returns to storing corn and soybeans that were hedged in the futures market vs. unhedged storage, and results indicated that storing both crops on Indiana farms can be a profitable crop merchandising strategy. Strategies examined in their study included 1) storage following harvest with futures hedges placed at harvest time, 2) storage following harvest without futures hedges in place, and 3) using new crop futures contracts to place futures hedges in the spring at planting time, storing the crop at harvest time, and simultaneously rolling hedges forward to a deferred futures contract that expires near the end of the crop storage season. Allyn et al. (2024) updated and extended Edwards et al.'s work by reviewing results for six corn and soybean marketing strategies using cash prices for a more specific region, southwest Indiana, over the 2004-2005 to 2022-2023 crop marketing years. Strategies included 1) fall cash sales without hedging; 2) fall cash sales hedged in the spring planting season; 3) hedging in the spring planting season, then storing unhedged from harvest until late spring; 4) storing at harvest unhedged and selling in the cash market in mid-spring; 5) storing at harvest and simultaneously hedging in a deferred futures contract and selling in the cash market in mid-spring; and 6) hedging in the spring planting season, storing at harvest and simultaneously rolling the hedge forward to a deferred futures contract and selling in the cash market in mid-spring. Allyn concluded that, on average, placing a short hedge in May during planting season, offsetting the hedge in October, and storing unhedged until late in the storage season provided the highest net sale price over the course of the study period. However, results indicated that no single marketing strategy generated the highest net sale price every year for corn or soybeans. Both Edwards and Allyn recommended that instead of selecting a single marketing strategy to pursue when merchandising their crop production, corn and soybean producers should consider using a portfolio approach that combines various strategies into a marketing strategy portfolio. Lenfestey et al. (2024) examined a portfolio of marketing strategies for a southeast Indiana case farm and traced out a risk/return frontier using a downside risk model.

This research examines the trade-off between net return and downside risk and compares results from various corn and soybean marketing strategies with prices received during the typical harvest month of October. Unique to this study is the estimation of optimal portfolios of marketing strategies and comparisons across two distinct marketing regions. The strategies employed by Allyn et al. are used to identify optimal marketing strategy portfolios for farms in northeast Indiana and southwest Indiana. Although there are some differences across the two regions, results confirm that managers seeking to improve returns should consider storing both corn and soybeans until late spring to capture the improvement in basis that typically occurs. Which portfolio of strategies a farm manager should choose depends on their risk preferences. Higher risk, higher return corn marketing strategies were more oriented toward placing hedges in May, lifting hedges in the fall, and then storing corn unhedged from harvest until June. Lower risk, lower return corn strategies relied more on hedging until cash sales are made in June. Similarly, higher risk, higher return soybean portfolios were oriented toward placing hedges in the spring, lifting hedges in the fall, and then storing soybeans unhedged until June. Lower risk, lower return soybean portfolios were oriented more toward storing soybeans unhedged with relatively small percentages of soybeans hedged prior to delivery in June. Importantly, all the optimal marketing strategies rely heavily on storing corn and soybeans until late spring to capture improvements in basis.

DATA AND METHODS

All the historical corn and soybean cash market and Chicago Board of Trade (CBT) futures price data used in this study were obtained from DTN's ProphetX database (DTN ProphetX, 2024). Price data spanned the 2004-2023 crop years for each crop. Wednesday settlement prices were used to compute monthly averages.

Several key assumptions were made to conduct the analysis. First, to take advantage of available on-farm storage, it is assumed that if corn and soybeans are placed in storage, they will be stored until June of the year following harvest. Second, monthly averages were calculated using Wednesday price data within each month to compute monthly averages by year for both cash and futures prices. This implies that producers following these strategies would only need to make a small number of sales per month to emulate the monthly averages used in this analysis. Fourth, October cash price averages were assumed to be representative of sales made at harvest and were also used to calculate on-farm storage opportunity costs until June. Fifth, pre-harvest corn and soybeans sales were made using the average of May futures settlement prices for December CBT corn futures and November CBT soybean futures prices, respectively, and then offset using October averages of the same futures contracts. Sixth, hedges for corn and soybeans stored from October to June were placed each year using October averages for July CBT corn and soybean futures contracts of the following year, respectively, and then offset using June averages for the same contracts. Seventh, June average cash prices were used to simulate cash market sales for corn and soybeans coming out of storage in June.

Many corn and soybean farms already have on-farm storage facilities available and, as a result, this study assumes an existing on-farm storage facility is used to store corn and soybeans. Grain quality is also assumed to be maintained throughout the storage season. Utility and repair costs from 2023-2024 for a northeast Indiana farm's grain storage facilities were used to estimate variable costs per bushel stored. The cost of repairs and utilities for the entire eight-month storage season averaged $0.09/bushel for both corn and soybeans. The analysis held the $0.09/bushel grain storage system repair and utility costs constant throughout the 20-year period. The USDA's Commodity Credit Corporation's (CCC) borrowing rate for each year was obtained from the USDA's Farm Service Agency and was used to calculate the opportunity cost of having capital invested in corn and soybean inventories during the storage period. Since U.S. farmers can obtain low-cost financing of inventories from USDA, the CCC borrowing rate represents a lower bound for the opportunity cost of having dollars invested in inventories. The CCC's average interest rates for each year were determined by averaging the monthly interest rate from October to June, then this rate was used in the opportunity cost calculations for the eight-month storage period. The storage season evaluated in this study was limited to an eight-month season from harvest in October to delivery in June of the next calendar year for all the storage strategies. The total carrying charge was computed by adding the opportunity cost of capital invested in corn and soybean inventories to the repairs and utilities cost. The total carrying charge was then subtracted from results for the four corn and soybeans strategies that included storage to obtain net sale prices for each strategy.

Six possible marketing strategies were evaluated for both corn and soybeans. Strategies 1 and 2 assumed corn and soybeans were sold in October, while Strategies 3-6 assumed an eight-month storage season with cash sales made in June. Strategy 4 assumed that the crops were unhedged but stored until June. October is a key harvest month for both corn and soybeans in Indiana, and June crop sales take advantage of a seasonal tendency for prices to rise in the spring. June is also near the end of the storage season for many farms in the Midwest. Strategies 2, 3, 5, and 6 utilize futures market hedges where the sales of CBT futures contracts are used as a temporary substitute for cash market sales that will take place at a later date. The study assumes unlimited funds are available to fund futures margin accounts.

Strategies 1 and 2 do not utilize grain storage. In Strategy #1, *Fall Cash Sale,* the commodities are sold during harvest in October at the October Wednesday average cash price. In Strategy #2, *Spring Hedge, No Storage*, a short hedge is placed in May on December CBT futures for corn and November CBT futures for soybeans then offset in October. In October, the grain is sold at the October Wednesday average cash price. The net sale price includes the gain or loss on the hedge plus the October cash price.

Strategy #3, *Spring Hedge & Roll, Storage*, places a short hedge in May using the December CBT contract for corn and the November CBT contract for soybeans, then offsets this initial hedge in October. The futures market hedge is rolled forward by selling July CBT futures contracts in October for both commodities, and the corn and soybeans are placed in storage. Finally, the corn and soybeans are sold at the June Wednesday average cash price, and hedges are offset at the same time. The net sale price is a combination of the gains or losses on the hedges and the June cash price, less the total carrying charge.

Strategy #4, *Unhedged & Storage,* places grain in storage at harvest in October. In June, the grain is delivered for the cash price. This strategy does not use the futures market to hedge sales. The net sale price is the average Wednesday June cash price, less the total carrying charge.

Strategy #5, *Fall Hedge & Storage,* places a short hedge during harvest in October using the July futures and simultaneously places the grain in storage. The corn and soybeans are sold in June at the Wednesday average cash price, and the July CBT futures hedges are offset at the same time. In this strategy, corn and soybean sales are hedged during the storage season but are not hedged during the growing season. The net sale price is a combination of the gain or loss on the hedge and the June cash price, less the total carrying charge.

Strategy #6, *Spring Hedge, Store Unhedged,* places a short hedge in May during planting and then offsets the hedge in October using the December CBT contract for corn and the November CBT contract for soybeans. The grain is placed in storage in October until delivery in June and sold at the June Wednesday average cash price. Strategy #6 uses a hedge during the growing season but stores the grain unhedged during the October-June storage season. The net sale price is a combination of the gain or loss on the hedge and the June cash price, less the total carrying charge.

To estimate optimal portfolios of marketing strategies, we employ the Target MOTAD model. Target MOTAD models can be used to maximize returns subject to a limit on the total negative deviations from a target. Lenfestey et al. (2024) used a Target MOTAD model to examine the trade-offs between net returns and downside risk for a simulated farm based in southeast Indiana. We apply the same model to maximize the marketing year prices received for corn and soybeans in both northeast and, separately, southwest Indiana over the 2004-2023 crop years, subject to a downside risk constraint. The constraint applied is limiting the number of deviations below that region's October average cash price for corn and soybeans, respectively. Each annual downside risk constraint compares a target net return to the actual net returns for the optimal portfolio of marketing strategies. Annual negative deviations are then summed. This sum is divided by the number of years and then used as the x-axis on return/risk charts.

In all portfolio models, there are trade-offs between risk, as measured by the total negative deviations below the target, and prices received. Riskier solutions generate higher prices while less risky solutions provide lower prices. To generate a frontier of optimal strategies for given levels of risk, the constraint that computes the total negative deviations below the target price is relaxed. Solutions that fall below the frontier either provide a lower net price at the same level of risk or the same net price at a higher level of risk.

Tables 1 and 2 highlight the average October and June cash prices for corn and soybeans in northeast Indiana, respectively, from 2004-2023. These tables also indicate the average price change from October to the following June, which corresponds to the storage period examined in this research. On average, cash prices for both crops rise from fall harvest lows to late spring, although there is a lot of variability from year-to-year. The cash price averages suggest a positive gross return to unhedged storage is possible, although the year-to-year variability implies there is notable downside risk.

Tables 3 and 4 focus on the average change in December CBT corn futures contract prices and November CBT soybean futures contract prices from May to October of the growing year. The results indicate that, on average, futures contract prices decline from May to October for both corn and soybeans. Unsurprisingly, there is a lot of year-to-year variability around the mean results for both crops.

RESULTS AND DISCUSSION

Individual strategy results reported here focus on calculations using data from northeast Indiana. Allyn et al. provides comparable individual strategy results for southwest Indiana covering the 2004-2022 crop years. Table 5 summarizes results for the corn marketing strategies. Examining 20 years of returns for the six corn strategies in northeast Indiana, Strategy #1 resulted in the lowest net sale price of $4.18/bu., while Strategy #6 provided the highest average net sale price of $4.90/bu. The average price generated by Strategy #6 was $0.23/bu. higher than the average net sale price of any other strategy.

Corn Strategy #2 *Spring Hedge, No Storage* provided an average net sale price of $4.41/bu., while Strategy #1 *Fall Cash Sale*'s average price was $4.18/bu. For producers who do not have on-farm storage, Strategy #2 yielded the highest average net sale price in 15 out of 20 grain marketing years. On average, Strategy #2 provided a net sale price that was $0.23/bu. higher than Strategy #1 *Unhedged Fall Cash Sale*.

Figures 1 and 2 provide year-by-year results of the strategies without storage and strategies with storage, respectively. Strategy #6 *Spring Hedge, Store Unhedged* produced the highest average net sale price of $4.90/bu. However, it is important to recognize that Strategy #6 was only the top strategy in four out of the 20 years analyzed, and no strategy provided the highest net price in every year.

Table 6 provides the average northeast Indiana net sale prices for soybeans following Strategies #1-6 while Figures 3 and 4 provide the year-by-year returns. Strategy #6 provided the highest net price while Strategy #1 provided the lowest net price. Although the *Spring Hedge, Store Unhedged* strategy yielded the highest average price, there were three years when it provided the lowest price of any strategy. Like corn, no single strategy provided the highest net price during the 20 years studied.

Since no single marketing strategy was clearly preferred, optimal corn and soybean marketing portfolios were estimated for both northeast Indiana and southwest Indiana. Results from the corn and soybean marketing strategies were used to estimate Target MOTAD models where the constraint used was the October cash price. Model solutions provided optimal strategy portfolios at various risk levels where the risk was identified as the number of times the strategy provided a net price below the October average cash price. Figures 5-8 summarize the Target MOTAD results for corn and soybeans in both Indiana regions. The composition of the portfolios at each point on the charts is highlighted with text that denotes the percentage of the portfolio committed to each strategy.

When compared to the October cash price, all of the corn and soybean marketing portfolios provided a higher net price. To simplify the discussion, strategies with the smallest negative deviations from the October cash price are characterized as "lowest risk," while strategies with the largest negative deviations from the October cash price are characterized as "highest risk." The lowest risk corn portfolio provided net prices that were $0.39/bu. and $0.65/bu. higher than the October cash price in northeast and southwest Indiana, respectively. The highest risk corn portfolios provided net cash prices that were $0.71/bu. and $0.84/bu. higher than the October cash price in northeast and southwest Indiana, respectively. Similarly, the lowest risk soybean portfolios yielded net prices that ranged from $1.33/bu. above the October cash price in northeast Indiana to $1.26/bu. in southwest Indiana. The highest risk soybean portfolios provided returns that were $1.69/bu. and $1.67/bu. higher than the October cash price in northeast and southwest Indiana, respectively. Results demonstrate that when compared to a baseline strategy of selling at harvest, Indiana corn and soybean producers can choose from a variety of marketing portfolios that are likely to provide a higher net sale price, all of which require use of storage.

Interestingly, there were some similarities but also some differences in the composition of optimal corn marketing strategy portfolios in the two Indiana market regions. The lowest risk corn strategy in northeast Indiana was weighted heavily toward the spring hedge and roll strategy (Strategy #3, 45%) and fall hedge with storage strategies (Strategy #5, 41%), with the spring hedge and store unhedged filling out the portfolio (Strategy #6, 14%). All three of those strategies make it possible for producers to capture improvements in basis following harvest while limiting exposure to futures price declines. In southwest Indiana, however, the lowest risk strategy did not rely as heavily on hedging to avoid futures price declines. Instead, it emphasized leaving a significant portion of corn unpriced until cash sales were made in June (Strategy #4, 41%). Additionally, 60% of the corn in this portfolio was not hedged from October to June, leaving it exposed to potential futures price declines during the storage season while still making it possible to capture corn basis increases. At the other end of the spectrum, the highest risk corn marketing portfolios in both regions were very similar, devoting a very small percentage of sales to the spring hedge and roll strategy (Strategy #3), with nearly all sales committed to the spring hedge then store unhedged strategy (Strategy #6). The gain in price from adopting the riskiest vs. the least risky corn marketing portfolio was $0.32/bu. in northeast Indiana but was only $0.19/bu. in southwest Indiana. In both regions, the most important takeaway is that storing corn after harvest to capture improvements in basis by either storing corn that has been hedged, or simply storing corn unhedged, is likely to generate a positive return.

Somewhat surprisingly, the lowest risk soybean marketing strategies in both regions emphasized storing soybeans until June without putting hedges in place prior to making cash sales. In northeast Indiana, the model allocated 91% of soybean marketings to Strategy #4, *Unhedged with Storage*, compared with 77% committed to this strategy in southwest Indiana. This stands in contrast to the highest return, highest risk strategy, which allocated nearly all of soybean marketings to the spring hedge followed by unhedged storage until June (Strategy #6) in both northeast and southwest Indiana. The gain in price from adopting the riskiest vs. the least risky soybean marketing portfolio was $0.36/bu. in northeast Indiana compared to $0.41/bu. in southwest Indiana.

CONCLUSIONS

Six corn and soybean crop marketing strategies were evaluated using cash corn and soybean prices from the northeast Indiana and southwest Indiana crop reporting districts along with CBT corn and soybean futures prices from the 2004-2023 crop marketing years. No single strategy provided the best return for either crop or location across the 20 years of data examined. Importantly, some strategies proved capable of providing the best returns in some years while providing the worst returns in other years. These results provided the impetus to examine a portfolio of marketing strategies using a Target MOTAD model that minimized deviations below the October cash price average for each crop and location. When compared to a baseline strategy of making all cash sales in October, all the optimal portfolios of strategies improved returns substantially.

Farm managers seeking to improve net sale prices for corn and soybeans can do so by storing both crops until the spring following harvest since none of the optimal portfolios included cash sales at harvest time in October. The opportunity to capture basis improvements that typically occur in the two markets examined was a key driver in optimal portfolio selection, so managers should pay close attention to local basis patterns. Second, managers should consider adopting a portfolio of marketing strategies to help improve returns while also reducing risk. Strategies that include placement of hedges in the spring can capture seasonal strength in corn and soybean futures prices. However, managers should be cognizant that those strategies can also expose farms to more risk in years when futures prices rally during the growing season. When choosing a portfolio of strategies, managers should carefully examine the historical negative deviations below the October cash price associated with the various strategy portfolios and choose according to their willingness to expose their farm operation to downside price risk. Finally, farms without storage facilities could use estimated returns from this research to analyze the potential profitability of constructing on-farm storage.

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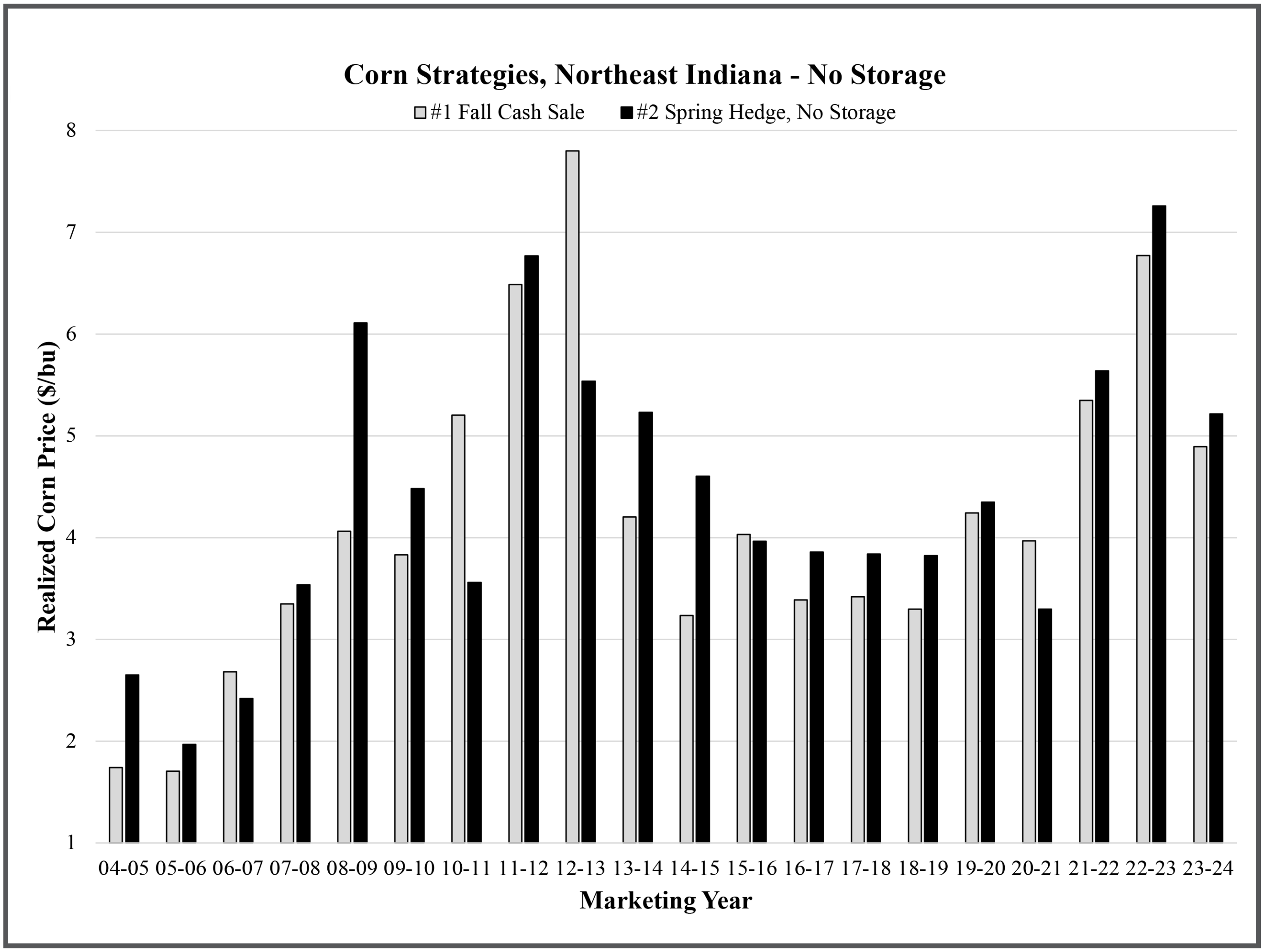

Figure 1. Net sale prices for corn marketing strategies without storage, northeast Indiana, 2004-2023

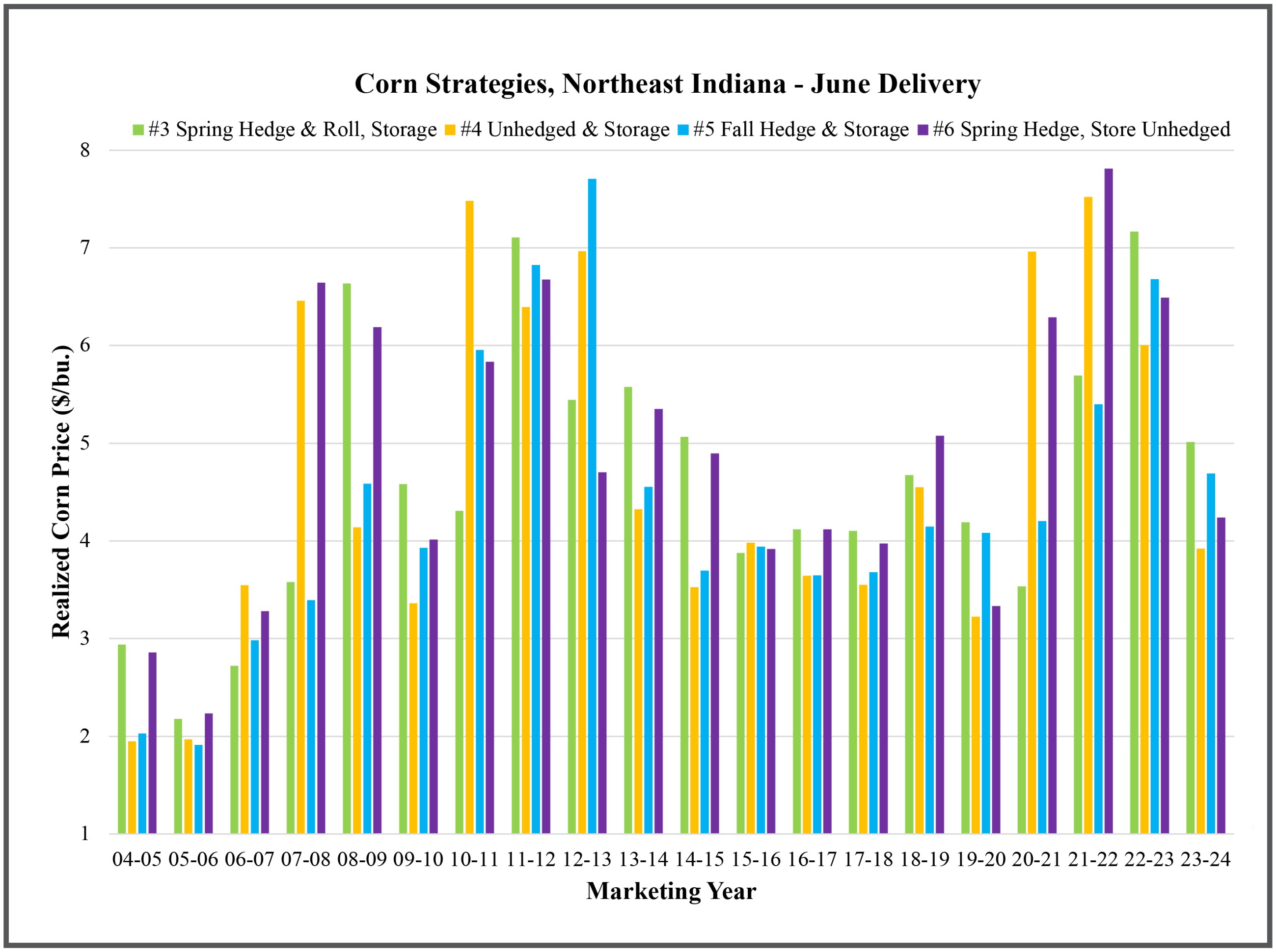

Figure 2. Net sale prices for corn marketing strategies with storage, northeast Indiana, 2004-2023

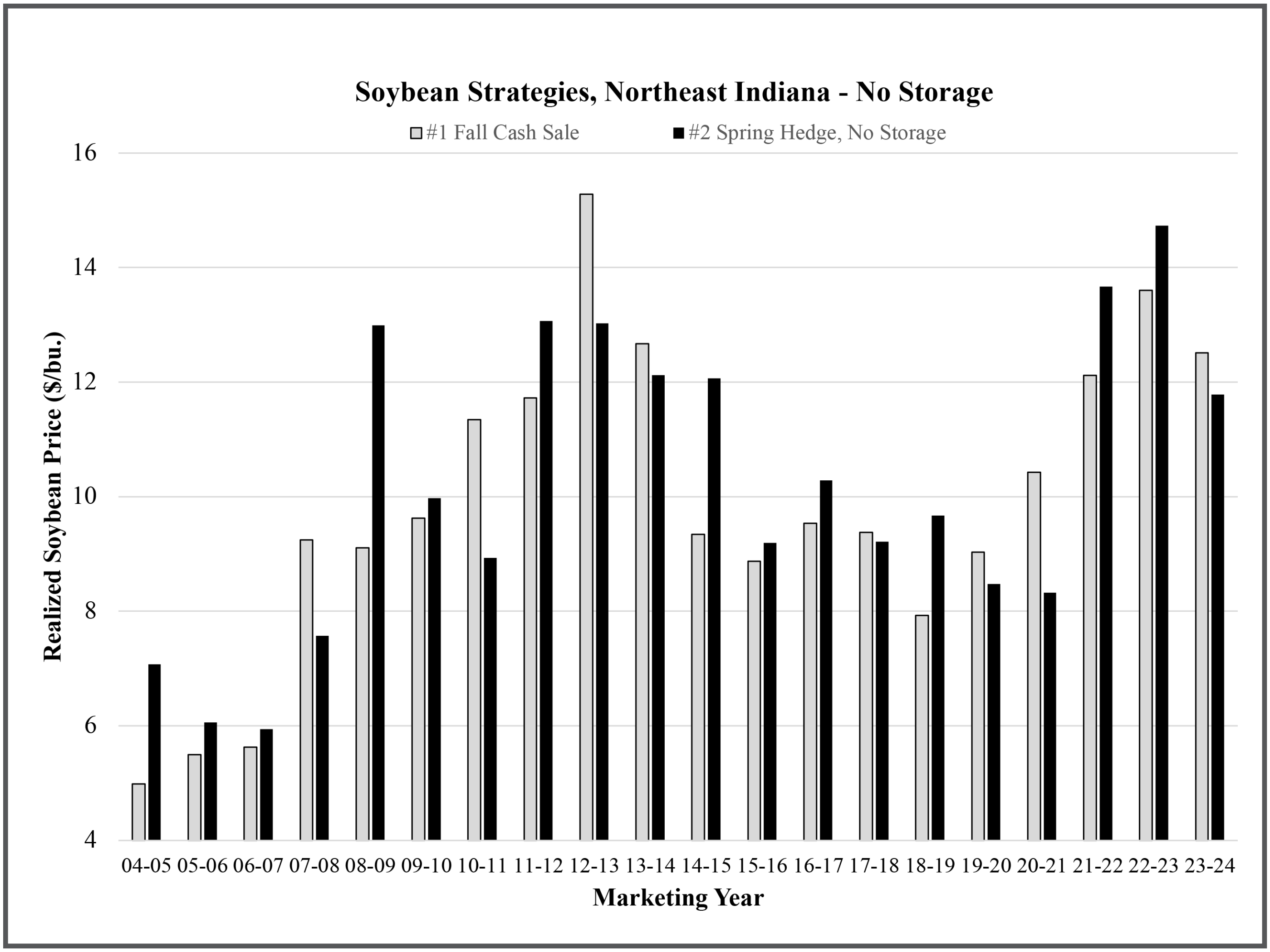

Figure 3. Net sales prices for soybean marketing strategies without storage, northeast Indiana, 2004-2023

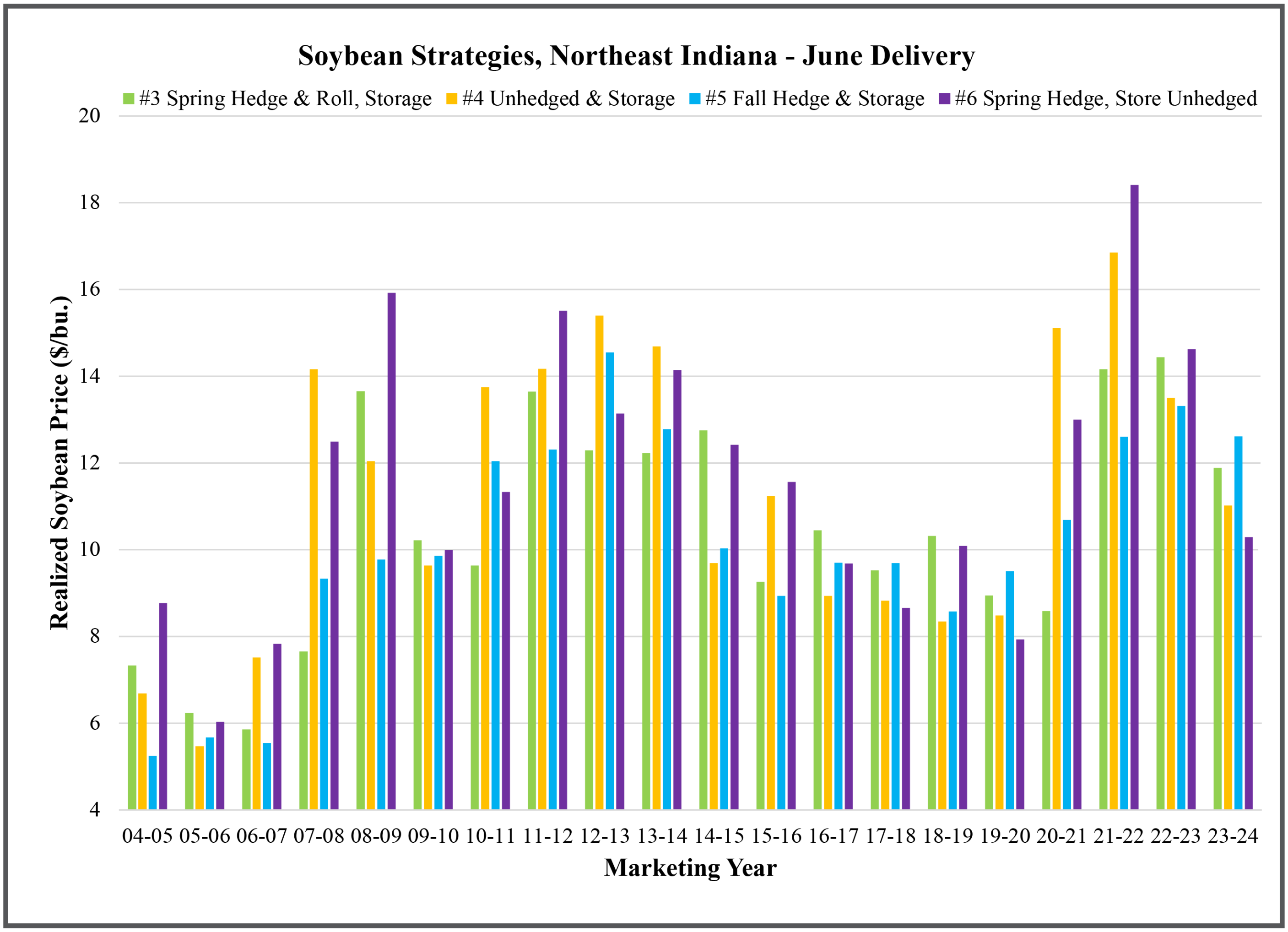

Figure 4. Net sales prices for soybean marketing strategies with storage, northeast Indiana, 2004-2023

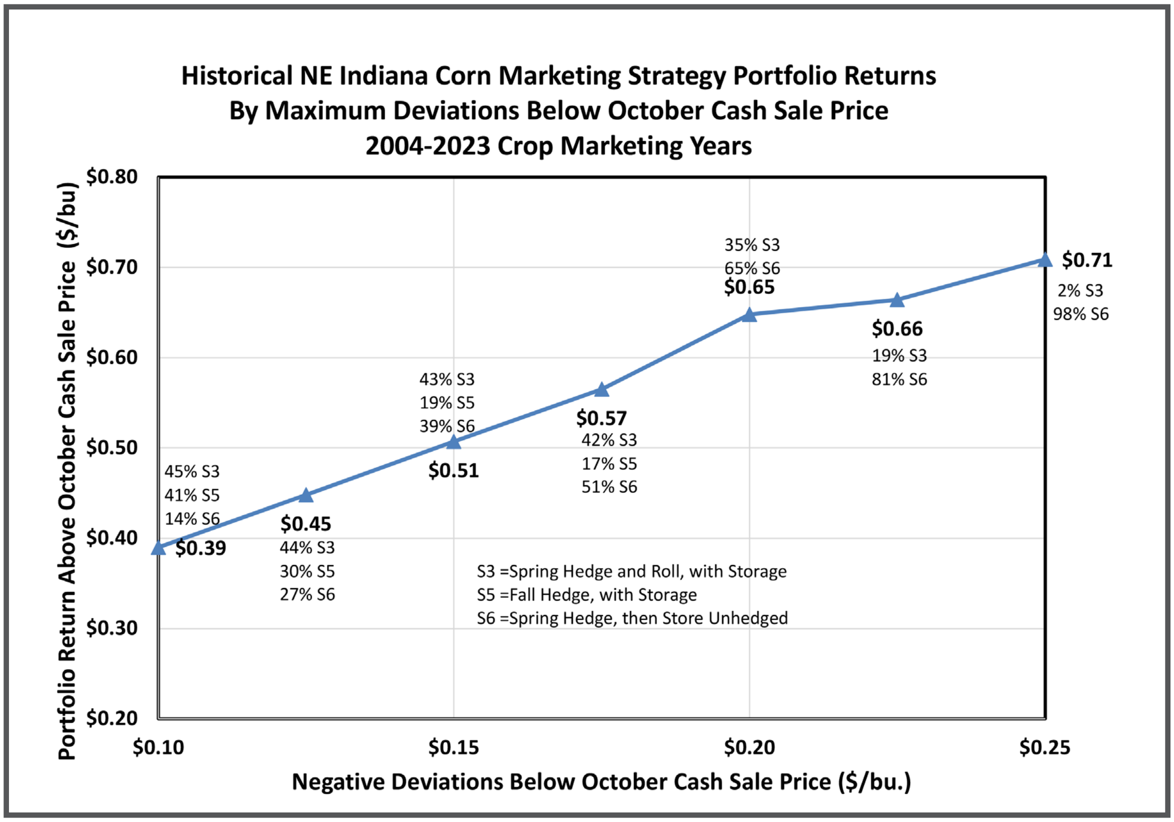

Figure 5. Historical NE Indiana corn marketing strategy portfolio returns, 2004-2023 crop years

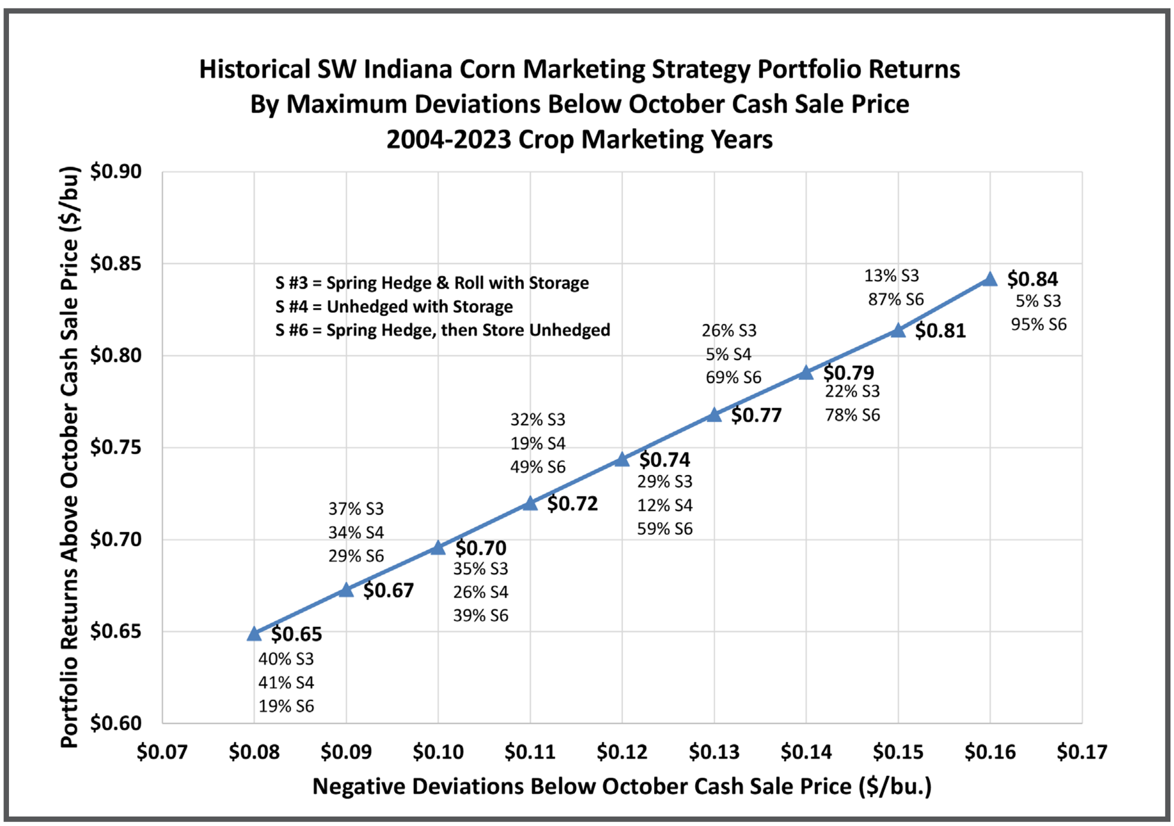

Figure 6. Historical SW Indiana corn marketing strategy portfolio returns, 2004-2023 crop years

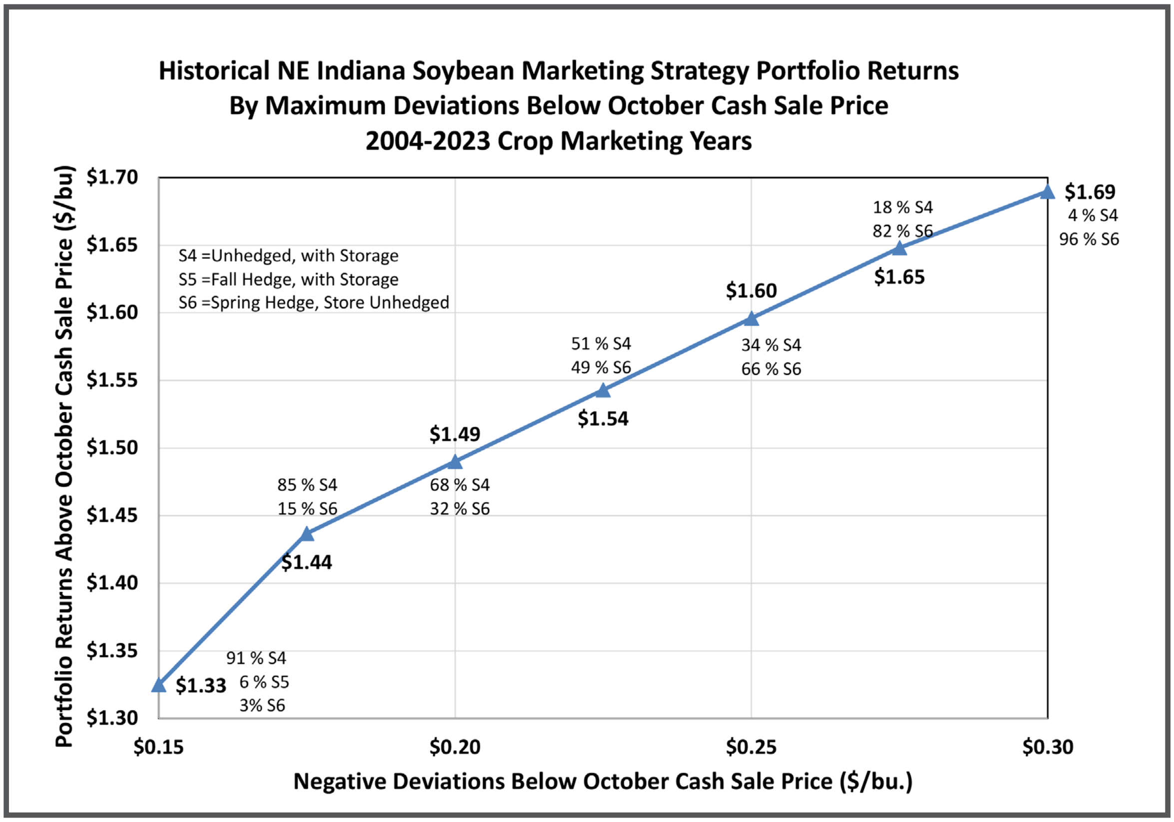

Figure 7. Historical NE Indiana soybean marketing strategy portfolio returns, 2004-2023 crop years

Figure 8. Historical SW Indiana soybean marketing strategy portfolio returns, 2004-2023 crop years

Table 1. Average Northeast Indiana Cash Corn Prices, 2004-2023 Crop Years			
Time Frame	**Average ($/bu.)**	**Minimum ($/bu.)**	**Maximum ($/bu.)**
October Cash Price	$4.18	$1.70	$7.80
June Cash Price	$4.83	$2.09	$7.65
Range (June-October)	$0.65	-$0.88	$3.29

Table 2. Average Northeast Indiana Cash Soybean Prices, 2004-2023 Crop Years			
Time Frame	**Average ($/bu.)**	**Minimum ($/bu.)**	**Maximum ($/bu.)**
October Cash Price	$9.89	$4.98	$15.28
June Cash Price	$11.53	$5.81	$17.04
Range (June-October)	$1.63	-$0.76	$5.28

Table 3. Average Change in December CBT Corn Futures Prices from May to October, 2004-2023 Crop Years			
Time Frame	**Average ($/bu.)**	**Minimum ($/bu.)**	**Maximum ($/bu.)**
December Futures Price in May	$4.49	$2.29	$7.34
December Futures Price in October	$4.26	$2.03	$7.50
Range (May-October)	-$0.22	-$2.05	$2.26

Table 4. Average Change in November CBT Soybean Futures Prices from May to October, 2004-2023 Crop Years			
Time Frame	**Average ($/bu.)**	**Minimum ($/bu.)**	**Maximum ($/bu.)**
November Futures Price in May	$10.47	$6.18	$14.93
November Futures Price in October	$10.15	$5.25	$15.36
Range (May-October)	-$0.32	-$3.88	$2.41

Table 5. Net Sale Prices for Six Corn Marketing Strategies, Northeast Indiana, 2004-2023	
Strategy	**Average Net Sale Price ($/bu.)**
#1 Fall Cash Sale	$4.18
#2 Spring Hedge, No Storage	$4.41
#3 Spring Hedge & Roll, Storage	$4.63
#4 Unhedged & Storage	$4.67
#5 Fall Hedge & Storage	$4.40
#6 Spring Hedge, Store Unhedged	$4.90

Table 6. Net Sale Prices for Six Soybean Marketing Strategies, Northeast Indiana, 2004-2023	
Strategy	**Average Net Sale Price ($/bu.)**
#1 Fall Cash Sale	$9.89
#2 Spring Hedge, No Storage	$10.21
#3 Spring Hedge & Roll, Storage	$10.46
#4 Unhedged & Storage	$11.28
#5 Fall Hedge & Storage	$10.14
#6 Spring Hedge, Store Unhedged	$11.60