24th Congress of the International Farm Management Association

RESILIENCE THROUGH INNOVATION

SASKATOON, SASKATCHEWAN

JULY 7-12, 2024

CONFERENCE PROCEEDINGS – ACADEMIC

Sub-Theme: Marketing Farm Production

CORN AND SOYBEAN MARKETING STRATEGY EVALUATION FOR SOUTHWEST INDIANA FARMS

Grant M. Allyn[1], James R. Mintert[2] and Michael R. Langemeier[3]

[1]Undergraduate student in the Departments of Agricultural Economics and Agricultural Engineering; [2]Director of the Center for Commercial Agriculture and Professor of Agricultural Economics; [3]Associate Director of the Center for Commercial Agriculture and Professor of Agricultural Economics; Purdue University, West Lafayette, Indiana, USA.

Corresponding Author: James R. Mintert, jmintert@purdue.edu; 765-494-0468; 403 Mitch Daniels Blvd, Department of Agricultural Economics, Purdue University, West Lafayette, IN, USA 47907

Acknowledgments: The cooperation of the Allyn Farming Company and Dr. Nathanael Thompson for supplying data used in this study is appreciated. The financial support provided by the Purdue Center for Commercial Agriculture is gratefully acknowledged.

Article Length: 3,476

Academic Paper

Work reported in this manuscript is original research carried out by the authors.

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Abstract

Various corn and soybean marketing strategies' historical performance were examined from the 2004/2005 to 2022/2023 crop years. Strategies included combinations of pre-harvest sales, harvest sales, and sales from on-farm storage later in the marketing year. Strategy evaluation explicitly included on-farm storage costs based upon financial records from a commercial scale southwest Indiana farm in addition to the opportunity costs of storing corn and soybeans post-harvest. Cash prices from southwest Indiana markets near the Ohio River were used to generate historical returns. Results indicate that storing corn and soybeans after harvest generated, on average, higher corn and soybean returns compared to grain sold at harvest. Strategies that included pre-harvest sales made in May using hedges placed in December CBT corn futures for corn and November CBT soybean futures for soybeans also provided higher average net returns than strategies that relied solely upon harvest and post-harvest sales. Combining pre-harvest sales of corn and soybeans made using futures market hedges with unhedged storage following harvest generated the highest net returns, on average, for both corn and soybeans. Results provide evidence that producers should include pre-harvest spring sales and sales from on-farm storage following harvest as part of their crop marketing strategies.

Key Words: grain storage strategies, hedging, pre-harvest sales

Introduction

Corn and soybean production and sales dominate agriculture in the United States of America (U.S.). According to the U.S. Department of Agriculture (USDA) in 2023 the combined harvested area of corn, soybeans, wheat, hay, cotton, sorghum, and rice totaled nearly 111.3 million hectares with 32 and 30 percent, respectively, of land area devoted to corn and soybean production. Related calculations by USDA indicate that 35 and 23 percent, respectively, of the value added to the U.S. economy by crop production was attributable to feed grains and oil crops. Given the importance of the corn and soybean sectors to U.S. agriculture, it is important to research how U.S. farmers might reduce their risk exposure and improve their farms' income by examining strategies used to price and market corn and soybean production.

Corn and soybean prices in the United States respond to shifting world supply and demand both across crop years and within a single crop marketing year. Corn and soybean futures contracts useful for price risk management are traded on the Chicago Board of Trade (CBT) futures exchange. Harvest of corn and soybeans in the U.S. primarily takes place in the fall and the first CBT futures contract expirations following harvest are November and December for soybeans and corn, respectively. Although both the December corn and November soybean contracts begin trading four years prior to their respective expiration dates, trading volume and open interest remain very low until about one year prior to expiration and increase as contract expiration approaches. For example, on January 2, 2024, daily volume in the December 2024 corn futures contract was equivalent to about 1 percent, and open interest about 6 percent, of USDA's estimated 2024 crop size. By May 1, 2024, both daily volume and open interest doubled suggesting that use of the contracts to manage price risk increased as the spring planting season approached, and that contract liquidity also improved. Research by Edwards *et al* (2020) indicated that CBT corn and soybean futures prices rise seasonally in the spring, making it potentially advantageous to do some pricing of both crops in spring. For that reason, along with the improvement in contract liquidity that takes place in the late winter and early spring, this study examines pricing strategies that commence in May. Since many U.S. corn and soybean farms have on-farm storage facilities this study also examines marketing strategies that store corn and soybeans until June of the year following harvest which is near the end of the storage season making it possible to capture seasonal price strength.

Corn and soybean prices can vary substantially from May of one year through June of the following year. For example, reviewing the 19 years (2004-2023) of Chicago Board of Trade (CBT) corn futures prices used in this study indicates that December corn futures contract prices varied as much as $4.00/cwt from May to October and the July corn futures contract prices varied as much as $5.50/cwt from October to June of the following year. Over the same period, CBT November soybean contract futures prices varied as much as $6.00/cwt from May to October and the July soybean futures contract prices varied as much as $8.00/cwt from October to June of the following year. Variations in corn and soybean prices are a large source of risk for U.S. corn and soybean farm operations. As a result, U.S. farms would benefit from the identification of marketing strategies for both corn and soybeans that would help reduce their risk exposure without unduly limiting net returns.

This research builds upon research conducted by Edwards *et al.* (2020) who evaluated the use of grain storage and hedging strategies for Indiana farm operations using 30 years of historical data. Edwards' study included three grain storage marketing strategies: unhedged grain storage; a basic storage hedge where grain is placed in storage and simultaneously hedged in a deferred futures contract; and a hedge and roll strategy where the futures hedge is initially placed in a nearby futures contract and then subsequently rolled to a deferred contract combined with physical storage of the corn or soybeans. Results indicated that, on average, the hedge and roll strategy provided the highest net returns to storage for corn and the second highest for soybeans. However, in 2 of the 30 years studied, the hedge and roll strategy provided significant negative returns to storage due to an inverted futures market. The unhedged storage strategy on average provided the highest net returns to storage for soybeans and the second highest returns for corn. While the unhedged strategy on average provided high returns to storage, it was heavily influenced by the presence of just a few years of exceptionally high returns to storage during the 30 years studied. Finally, Edwards concluded that a basic storage hedge, where corn or soybeans are placed in storage at harvest and simultaneously hedged in the deferred futures contract, provided the lowest average net returns for both corn and soybeans.

Farmers who choose to store corn or soybeans instead of selling at harvest incur costs referred to as a carrying charge. Edwards' study included a carrying charge of approximately $0.02/cwt/month for storing grain which was comprised of the opportunity cost on money invested in the grain inventory combined with an estimate of variable on-farm storage costs. To estimate the opportunity cost of money invested in the grain inventory, Edwards used a flat 6% APR interest rate even though interest rates varied substantially throughout the 30 years examined. Additionally, Edwards used average Indiana state-level cash price data reported by USDA which might not be representative of cash prices (and basis levels) available in different regions of the state.

This study improves upon and extends Edwards research in several ways. First, a pre-harvest marketing strategy that has the potential to capture seasonal strength in corn and soybean futures prices is included with results from a total of six possible corn and soybean marketing strategies examined in the study. Second, farm records from a southwestern Indiana commercial scale farm operation are used to estimate actual on-farm storage costs. Third, cash prices for the southwest Indiana region are used instead of state level averages to ensure that strategy selection is applicable to farms in that region of Indiana. Fourth, instead of using a single interest rate for the life of the study to estimate the opportunity cost of storage, historical interest rates for corn and soybean storage loans from the USDA's Farm Service Agency (FSA) are used. U.S. producers who participate in USDA farm programs are eligible to obtain loans from FSA using corn and soybeans as collateral. Interest rates available for this program are below commercial loan rates with the resulting calculations providing a lower bound for the opportunity cost of storage.

Methods

Historical data used in this study begin with price data for the corn and soybean crops harvested in the fall of 2004 and conclude with the crops harvested in the fall of 2022. To better understand the impact of regional crop prices and the cost of storing grain on an Indiana farm, this study uses data specific to a commercial scale corn and soybean farm located in Posey County, Indiana, near Mount Vernon along the Ohio river (figure 1). Outlets for corn and

soybeans in southwest Indiana include export-oriented elevators on the Ohio River, a soybean processing facility, and two nearby ethanol plants.

Figure 1. County Map of State of Indiana.

All historical cash price and futures price data are obtained from DTN's ProphetX (2023) database which limited the study to 19 years of recent price data since cash prices prior to 2004

are not available. Cash prices from grain elevators in the Mount Vernon, Indiana area are used to simulate sales from a southwest Indiana farm. Futures prices are for Chicago Board of Trade corn and soybean futures contracts. To take advantage of available on-farm storage it is assumed that if corn and soybeans are placed in storage, they are stored until June of the year following harvest. Daily price data are used to compute monthly averages by year for both cash price and futures price data. October cash price averages are used to simulate sales made at harvest and to calculate opportunity costs of storage until June. Pre-harvest corn and soybeans sales are simulated using an average of daily May futures settlement prices for December CBT corn futures and November CBT soybean futures prices, respectively, and then offset using October averages for the same futures contracts. Hedges for corn and soybeans stored from October to June are placed each year using October monthly averages for July CBT corn and soybean futures contracts, respectively, and then offset using June averages for the same contracts. June monthly average cash prices are used to simulate cash market sales for corn and soybeans in storage.

The study assumes an existing on-farm storage facility is used to store corn and soybeans and that grain quality is maintained throughout the storage season. Utility and repair costs from 2022 and 2023 for a southwest Indiana farm's grain storage facilities are used to estimate variable costs per cwt. stored. The cost of repairs and utilities for the entire eight-month storage season averaged $0.09/cwt for both corn and soybeans. The opportunity cost of having capital invested in corn and soybean inventories is calculated using the USDA's FSA Commodity Credit Corporation's borrowing rate for each year. Since U.S. farmers can obtain low-cost financing of inventories from USDA, it represents a lower bound for the opportunity cost of having dollars invested in inventories. The storage season evaluated is limited to an eight-month season from harvest in October to delivery in June for all the storage strategies. The Commodity Credit Corporation's average interest rates for each year are divided by 12 to obtain a monthly interest rate and then multiplied by eight to cover the eight-month storage period, October to June. The total carrying charge is computed by adding the opportunity cost of capital to the repairs and utilities cost. The total carrying charge is subtracted from the four corn and soybeans storage strategies sales prices to obtain net sales prices.

Six possible marketing strategies are evaluated for both corn and soybeans. Strategies 1 and 2 assume corn and soybeans will be sold in October while Strategies 3-6 assume an eight-month storage season with cash sales made in June. October is a key harvest month for both corn and soybeans in southwest Indiana and June crop sales take advantage of a seasonal tendency for prices to rise in the spring and are also near the end of the storage season for many farms in the region. Strategies 2-5 utilize futures market hedges where the sale of CBT futures is used as a temporary substitute for a cash market sale that will take place at a later date. At the time of delivery, the hedge is offset in the corresponding futures market. The study assumes unlimited futures margins 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 average cash price. In strategy #2, *Spring Hedge, No Storage*, a short hedge is placed in May in December CBT futures for corn and November CBT futures for soybeans then offset in October. In October, the grain is sold at the October 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 and 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 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, *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 at the June average cash price. Strategy #4 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.

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 average cash price and the July CBT futures hedges are offset at the same time. In this strategy, corn and soybean sales are not hedged during the growing season but are hedged during the 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.

Strategy #6, *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 June cash price, less the total carrying charge.

Data

Tables 1 and 2 provide the average October and June corn and soybean cash prices from 2004-2022. Futures contract prices for each month are calculated by averaging all the daily settlement prices for that entire month. Cash prices for each month are also calculated by averaging daily cash prices posted in the DTN database following that day's futures market close. The two tables also include the average price change, along with their respective standard deviations, from October through the following June. Although the average price change during the October-June storage period is positive for both commodities, there is considerable variation around the average suggesting that storing unpriced corn and soybeans carries some downside risk.

Table 1. Average Corn Cash Prices in October and June in Southwest Indiana, 2004-2022.

Corn			
	Average ($/cwt)	Minimum ($/cwt)	Maximum ($/cwt)
October Cash Price	7.46 (2.66)*	3.15	13.40
June Cash Price	8.84 (3.07)*	3.06	14.31
Range (June – October)	1.39 (1.92)*	-0.91	5.48

* standard deviation.

Table 2. Average Soybean Cash Prices in October and June in Southwest Indiana, 2004-2022.

Soybeans			
	Average ($/cwt)	Minimum ($/cwt)	Maximum ($/cwt)
October Cash Price	16.46 (4.34)*	8.80	25.73
June Cash Price	19.37 (5.42)*	9.73	28.95
Range (June – October)	2.91 (2.83)*	-0.83	8.55

* standard deviation.

Tables 3 and 4 examine the average change in CBT futures contract prices from May to October. Once again, the average futures contract price change is positive for both commodities, but there is a lot of variability around the average.

Table 3. Average Change in December CBT Corn Futures Prices from May to October, 2004-2022.

Corn			
	Average ($/cwt)	Minimum ($/cwt)	Maximum ($/cwt)
Dec Futures Price in May	7.94 (2.33)*	4.11	13.11
Dec Futures Price in Oct.	7.55 (2.55)*	3.61	13.39
Range (May – October)	0.39 (1.69)*	-4.04	3.75

* standard deviation.

Table 4. Average Change in November CBT Soybean Futures Prices from May to October, 2004-2022.

Soybeans			
	Average ($/cwt)	Minimum ($/cwt)	Maximum ($/cwt)
Nov Futures Price in May	17.27 (4.26)*	10.30	25.00
Nov Futures Price in Oct.	16.68 (4.30)*	8.77	25.65
Range (May – October)	0.59 (2.70)*	-3.95	6.17

* standard deviation.

Results

The four corn storage strategies generated higher net sale prices than the two strategies without storage. Strategy #4 produced the highest net sale price among the storage strategies at $9.08/cwt while strategy #1 provided the lowest net sale price at $7.46/cwt.

Table 5. Corn Marketing Strategies Average Net Sale Prices, 2004-2022 Crop Years.

Corn	
Strategy	Average Price Received ($/cwt)
#1 Fall Cash Sale	7.46
#2 Spring Hedge, No Storage	7.85
#3 Spring Hedge & Roll, Storage	8.51
#4 Spring Hedge, Store Unhedged	9.08
#5 Fall Hedge & Storage	8.12
#6 Unhedged & Storage	8.69

#2 *Spring Hedge, No Storage* corn strategy generated an average price of $7.85/cwt. while #1 *Fall Cash Sale* strategy's average net sale price was $7.46/cwt. Looking more closely at the strategies without storage, #2 provided the highest net sale price in 14 out of 19 marketing years and, on average, provided a net sale price that was $0.39/cwt. higher than unhedged fall delivery.

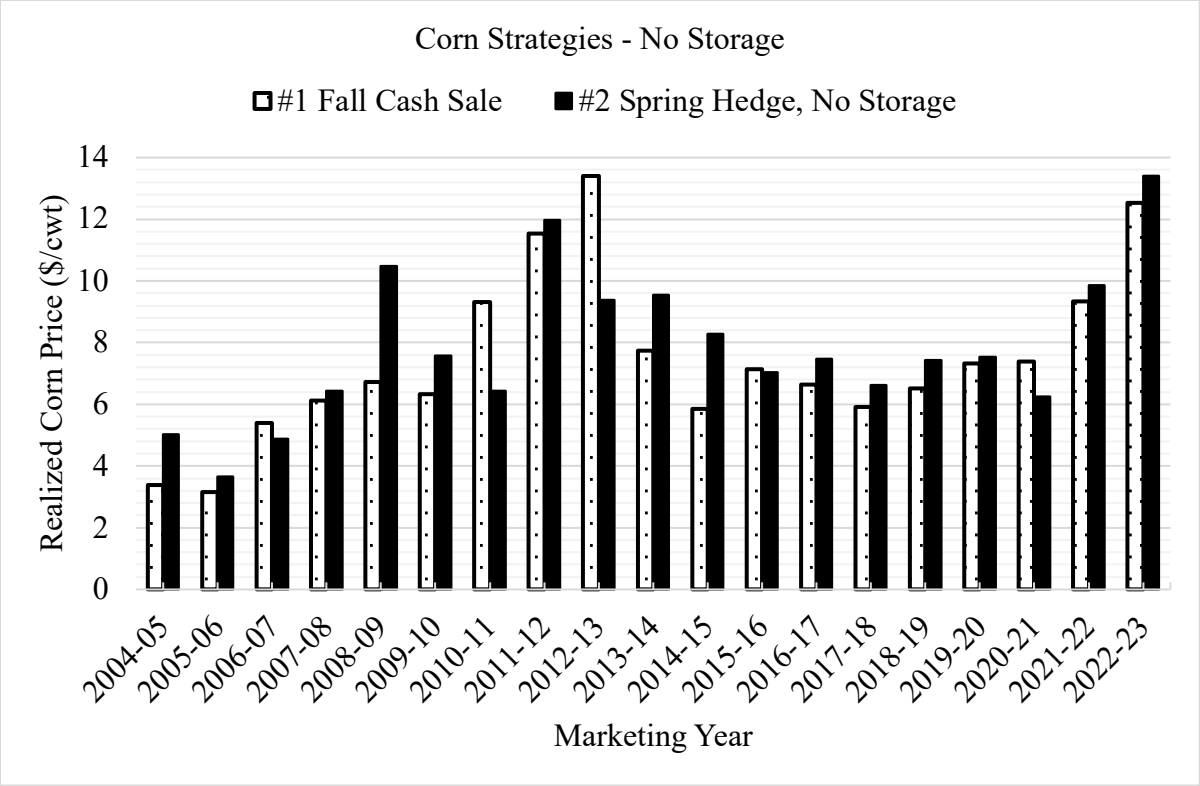

Figure 1. Net Sales Prices for Corn Marketing Strategies Without Storage, Southwest Indiana, 2004-2022.

The three corn storage strategies that produced the highest average net sale price from 2004 through 2022 are compared in Figure 2. Strategy #4 *Spring Hedge, Store Unhedged* provided the highest net sale price at $9.08/cwt but was only the top strategy in 4 out of 19 years. Strategy #3 *Spring Hedge & Roll, Storage* generated the lowest average net sale price among these three strategies but produced the highest net sale price in 9 out of 19 years and tied for the top net sale price with strategy #4 once. Strategy #6 provided an average net sale price of $8.69/cwt. and had the highest net sale price in 5 of 19 years.

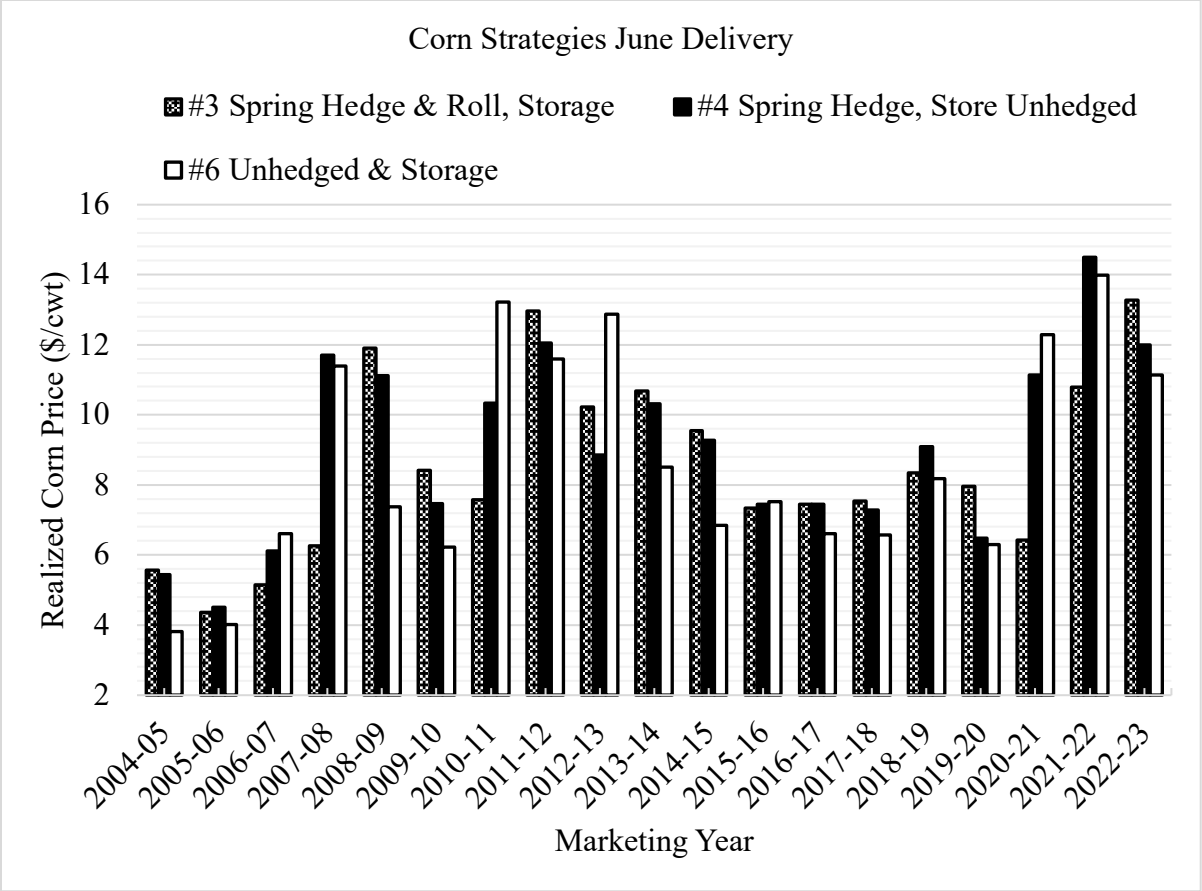

Figure 2. Net Sale Prices for Corn Marketing Strategies With Storage, Southwest Indiana, 2004-2022.

For soybeans, the four storage strategies produced higher net sale prices than the strategies without storage. Strategy #4 produced the highest average net sale price at $19.73/cwt while strategy #1 provided the lowest average net sale price of $16.46/cwt.

Table 6. Soybean Marketing Strategy Average Net Sale Prices, Southwest Indiana, 2004-2022.

Soybeans	
Strategy	Average Net Sale Price ($/cwt)
#1 Fall Cash Sale	16.46
#2 Spring Hedge, No Storage	17.06
#3 Spring Hedge & Roll, Storage	17.59
#4 Spring Hedge, Store Unhedged	19.73
#5 Fall Hedge & Storage	17.00
#6 Unhedged & Storage	19.14

Examining the two soybean strategies without storage reveals that Strategy #2 *Spring Hedge, No Storage* averaged a net sale price of $17.06/cwt while Strategy #1 *Fall Cash Sale* averaged a net sale price of $16.46/cwt. Among the two soybean sales strategies without storage, #2 provided the highest net sale price in 12 out of 19 marketing years in addition to generating an average net sale price that was, on average, $0.60/cwt higher than the *Fall Cash Sale* strategy.

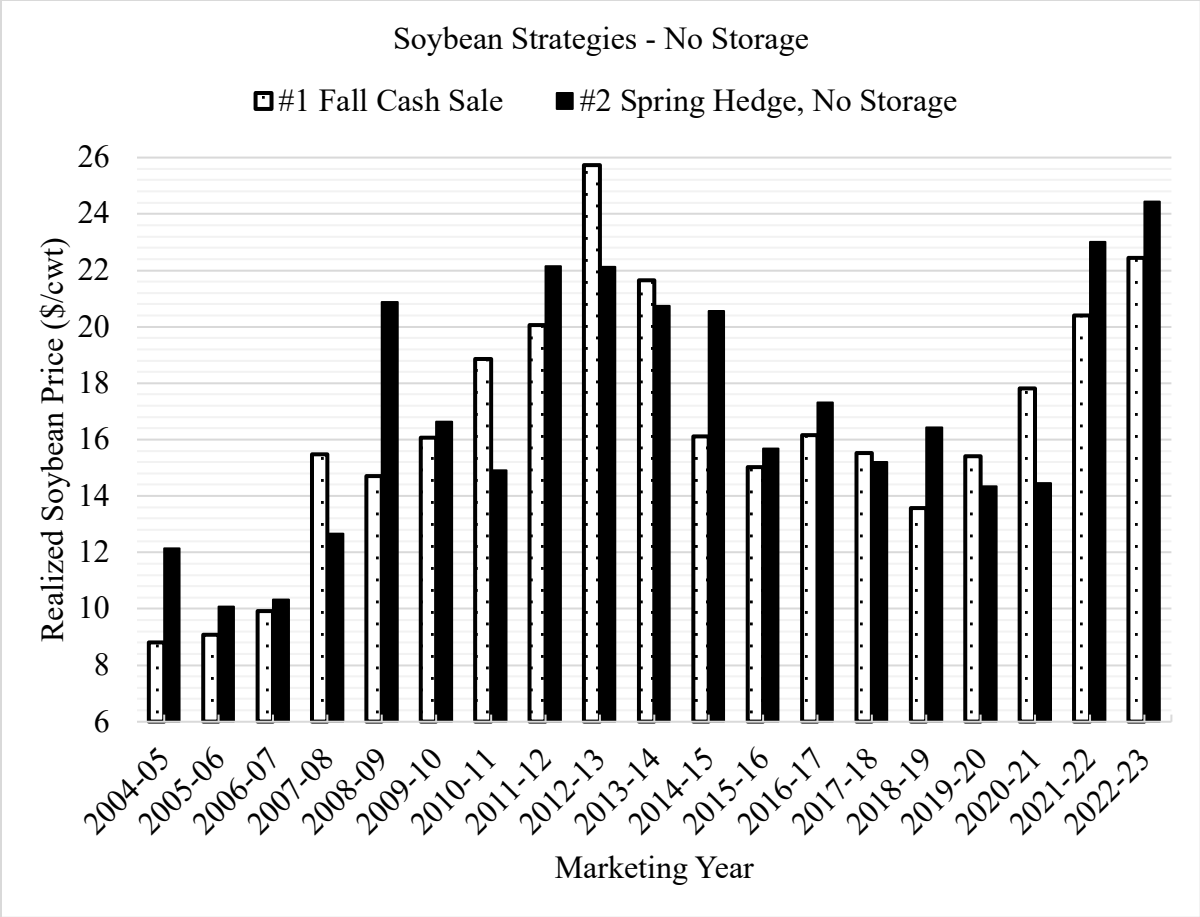

Figure 3. Net Sale Prices for Soybean Marketing Strategies Without Storage, Southwest Indiana, 2004-2022.

The three soybean storage strategies providing the highest net sale prices from 2004 through 2022 are compared in Figure 4. Strategy #4 *Spring Hedge, Store Unhedged* provided the highest average net sale price of $19.73/cwt and provided the highest net sale price in 7 out of 19 years. Strategy #6 *Unhedged & Storage* generated an average price received of $19.14/cwt, which was just $0.59/cwt lower than Strategy #4 over the 19 years examined.

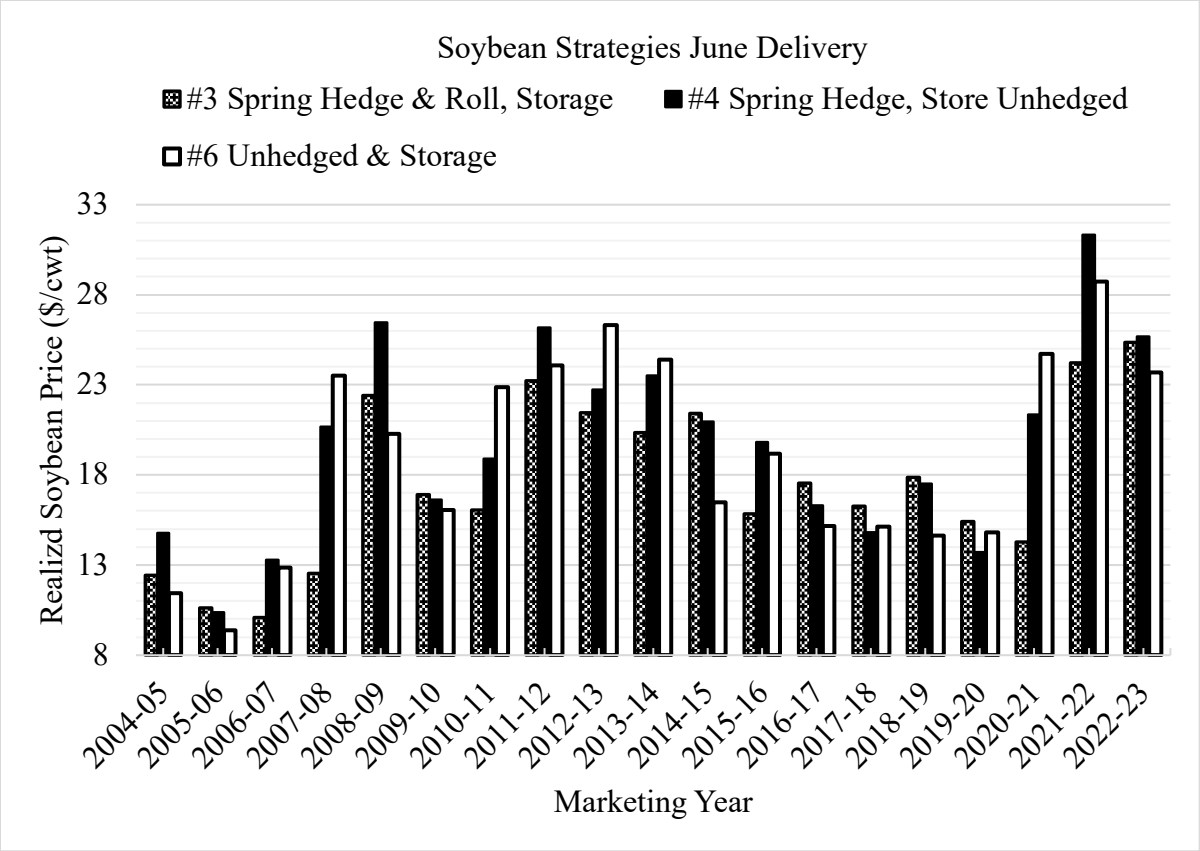

Figure 4. Net Sale Prices for Soybean Marketing Strategies With Storage, Southwest Indiana, 2004-2022.

Discussion

No single marketing strategy generated the highest net sales price for either corn or soybeans every year. Strategy #4 provided the highest average net sale prices for corn and soybeans over the 19 years of data, but it did not produce the highest net sale price strategy every year. The storage strategies all resulted in higher average net sales prices than the strategies without storage, but again this was not the case every year. Since no single strategy was a clear winner, a risk analysis technique known as stochastic dominance (SD) was used to try and identify a preferred marketing strategy. Using stochastic dominance, it's possible to compare the probability distribution of outcomes from the 6 marketing strategies and determine which strategy dominated the other strategies over the 2004-2022 time frame. Two forms of SD were used: 1) first degree; and 2) second degree. First degree SD assumes that more is preferred to less and only occurs when one distribution of outcomes lies entirely above another distribution of outcomes. For this to occur in our study, the net sales price for one strategy would need to be higher than the net sales price for another strategy for every year in the analysis. Second

degree SD, which is more discriminating than first degree SD, assumes that a farmer is risk averse. Results from the SD analysis revealed that, for both corn and soybeans, strategy #4 was dominant for all risk averse producers. In other words, strategy #4 is preferred by all producers who are concerned about variability of outcomes and/or outcomes below a specified target (i.e., downside risk).

Conclusion

Results from 6 corn and soybean sales strategies for southwest Indiana corn and soybean farms from 2004 to 2022 were examined. Strategies that took advantage of 1) seasonal price strength in the spring and 2) the seasonal tendency for cash prices to rise following harvest provided the highest net sale prices, on average, from 2004 through 2022. Strategy #4, which included pricing corn and soybeans in May using futures market hedges and then storing both commodities unhedged until June, provided the highest average net sale price over the 19 years reviewed. However, strategy #4 did not provide the highest net sale price every year. To learn more about which strategy provided the best results overall, first- and second-degree stochastic dominance analysis was performed on the results. Strategy #4 was second-degree dominant indicating that it was an optimal strategy for all risk averse producers.

There are two key points for corn and soybean producers in southwest Indiana to consider. First, pricing at least a portion of anticipated corn and soybean production in the spring when prices exhibit some seasonal price strength should be given serious consideration as part of a farm's marketing plan. Second, storing unpriced corn and soybeans following harvest to take advantage of the seasonal improvement in cash prices that occurs in southwest Indiana from fall harvest into the spring should also be considered for inclusion in a farm marketing plan.

Although this research helps identify pricing strategies to consider for southwest Indiana corn and soybean farms, it still leaves important questions unanswered. First, uncertainty about anticipated production precludes pricing all of a farm's production in the spring. Second, storing both corn and soybeans unhedged or unpriced over the winter and into the spring could entail taking on more risk than some farm operators are willing to assume. The question of what percentage of anticipated production to price in the spring and what percentage of actual

production should be stored into the following spring is not addressed in this research and should be examined in future research. Given these constraints, producers are faced with a quandary regarding how best to combine the use of strategy #4 with other strategies examined in this research. Future research should consider identifying a portfolio of marketing strategies that could be employed by farm operators to reduce risk and improve returns.

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