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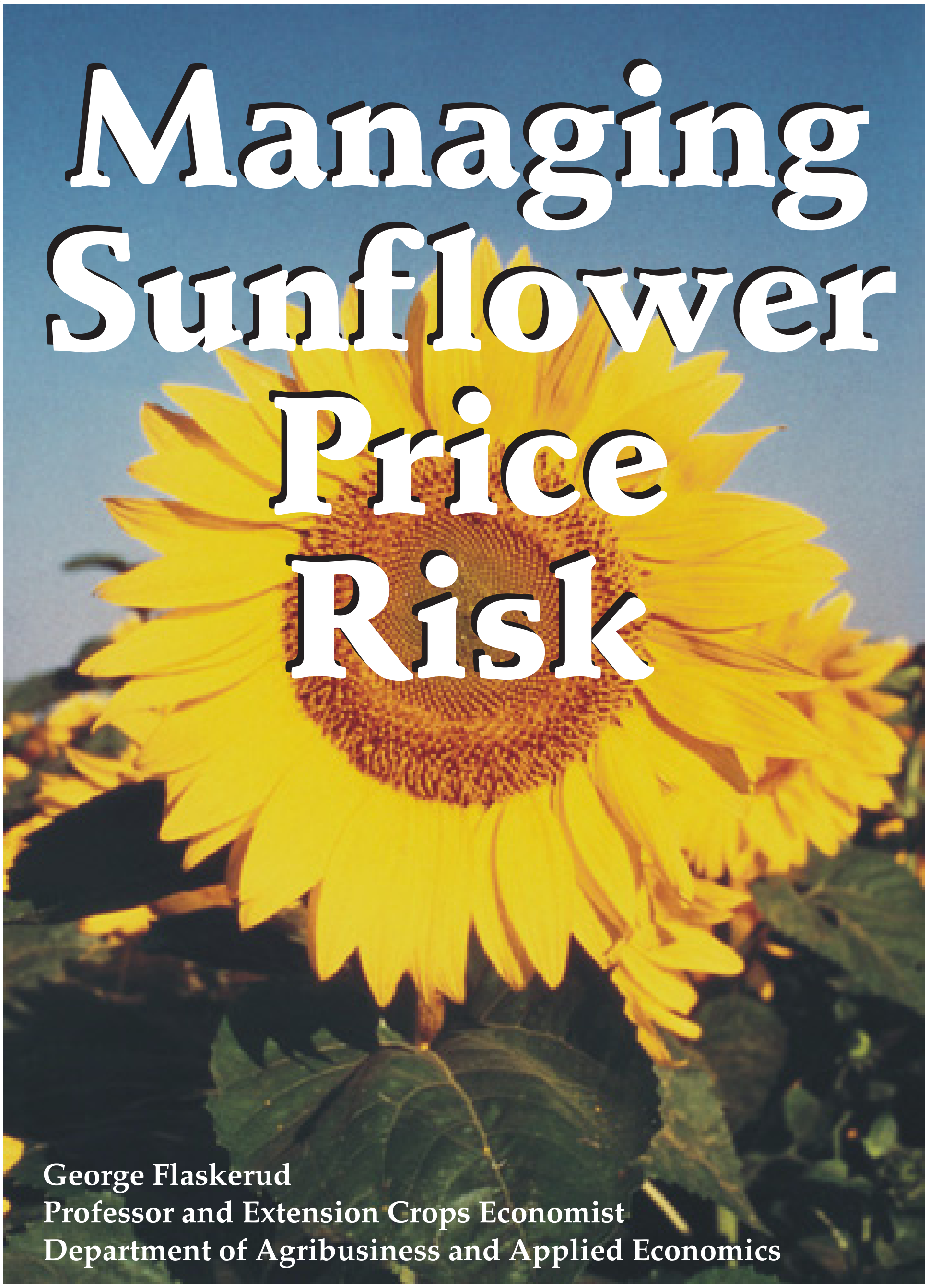

Managing Sunflower Price Risk

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Contents

Cover photo courtesy of the National Sunflower Association

Highlights

The Midwest is a major producer of sunflowers, comprising most of U.S. production which ranked seventh in the world during 2003. Oil sunflower production dominates and occurs primarily in North Dakota. NuSun has become the predominant type of oil sunflower and was the type analyzed in this study.

The seasonal pattern for Enderlin NuSun prices, on average, was for lows to occur at the beginning of the marketing year and peak in June before declining into the next marketing year. The tendency for the NuSun cross-basis relative to nearby canola futures was to weaken to a low in September and strengthen to a high in February-April before generally weakening into the end of the marketing year. Relative to nearby soybean oil futures, the average cross-basis showed a pattern of marketing year lows in November, April and September and highs in February and July. Variability, as measured by the standard deviation, was less for the cross-basis relative to nearby canola futures than for the cross-basis relative to nearby soybean oil futures.

Correlations indicate that changes in NuSun prices are the most closely correlated with canola futures. Soybean oil futures were a distant, second-best correlation.

A cross-hedge ratio of .99 cwt of November canola futures was derived for October. When cross-hedging with December soybean oil futures, the cross-hedge ratio was .33 cwt of futures to a cwt of production.

An evaluation of marketing strategies indicated that no one strategy dominated; neither did the use of canola futures or soybean oil futures. Seven strategies ranked better than harvest sales only. Soybean oil futures performed somewhat better across all strategies, although they also had somewhat higher variability, on average.

The study suggests that canola cross-hedges have the most risk reduction, whereas soybean oil cross-hedges may be preferred when looking at profitability of strategies. Also, soybean oil futures are not subject to exchange rate variability. Current fundamental and technical features in both markets need to be evaluated when considering a futures position in a marketing strategy.

Introduction[1]

U.S. sunflower production ranked seventh in the world during 2003 (Figure 1) although during the last 10 years, it has ranked as high as fourth (1998) according to USDA-FAS. In 2003, U.S. production was only 25 percent of production in Russia which has consistently ranked as one of the top three world producers during the last 10 years. Argentina, which ranked number one in production during 1994-99, has dropped to number four. Production in both China and India surpassed U.S. production during 2002-03.

U.S. sunflower production (Figure 2) dropped from a 10-year peak of 52.7 million hundredweight (cwt) in 1998 to a low of 24.5 million cwt in 2002 to 26.6 million cwt in 2003 (National Agricultural Statistics Service). Oil sunflower production has dominated, comprising 80 to 87 percent of total sunflower production during the period (85 percent in 2003).

Oil sunflower production in the U.S. occurs primarily in North Dakota (Figure 3). During recent years, production levels in South Dakota and Kansas have ranked a distant second and third, respectively. During 2003, North Dakota production was 13.3 million cwt or 59 percent of U.S. production.

North Dakota oil sunflower yields (Figure 4) rank first or second most of the time compared to other sunflower producing states. During 1994-03, they averaged 13.7 cwt per harvested acre and ranged from 11.5 to 15.4 cwt.

[1] Appreciation is expressed for comments by reviewers Bruce Dahl, Tim Petry and Andrew Swenson in the Department of Agribusiness and Applied Economics, and John Sandbakken of the National Sunflower Association.

Major World Sunflower Producers

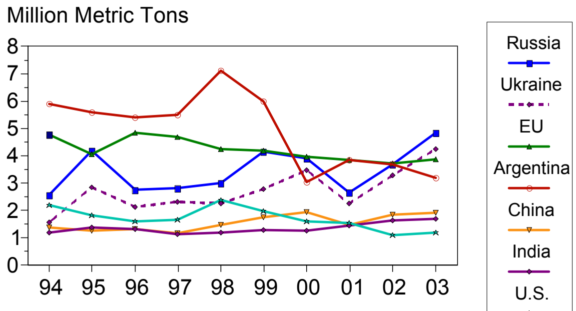


Figure 1.

Major U.S. Oil Sunflower Producers

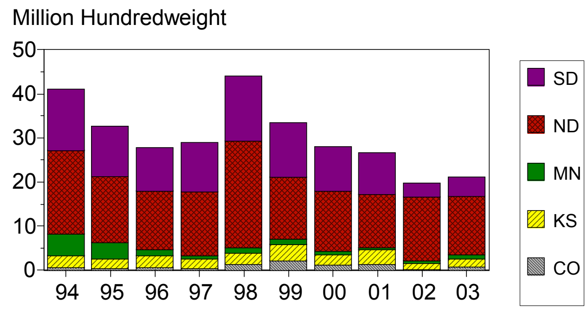


Figure 3.

U.S. Sunflower Production

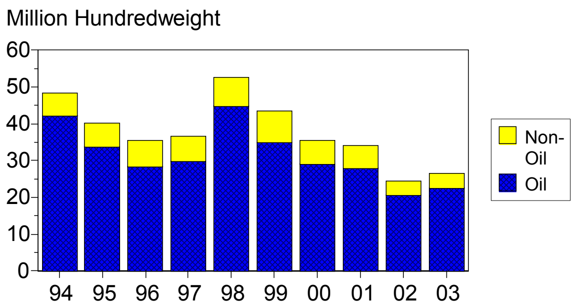


Figure 2.

Oil Sunflower Yield Per Harvested Acre

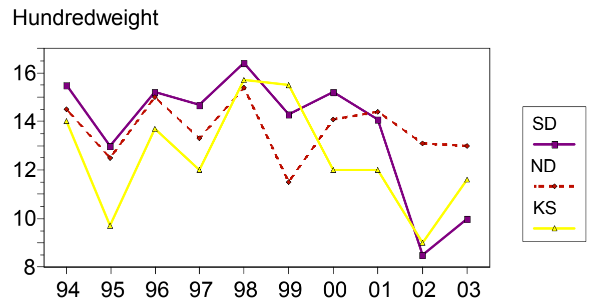


Figure 4.

NuSun™ has become the predominant type of oil sunflower (55 percent of total oilseed acres planted in 2003), according to the National Sunflower Association (NSA). It states that "NuSun is a mid range oleic (monounsaturated) sunflower oil. It needs no hydrogenation and has a 9 percent saturated fat level. NuSun is extremely functional for frying applications and has a good balance of linoleic acid, an essential fatty acid that enhances the taste of products."

Sunflower crushing plants are located at Enderlin and West Fargo, N.D., Red Wing, Minn., Goodland, Kan., and Lamar, Colo. (NSA). The Enderlin plant discontinued crushing regular oil sunflowers in August 2003 in favor of NuSun. Additional sunflower statistics can be found on the NSA Web site and in Sunflower Production (Berglund).

Sunflowers compete well economically with other crops (Swenson). In the 2004 budgets for south central North Dakota, for example, oil sunflowers ranked fifth out of 18 crop budgets with a projected net cash flow of $36.16 per acre.

The profitability of producing sunflowers is dependent to a large extent on how well price risk is managed, which requires the development of marketing strategies. The development of strategies entails, first of all, an understanding of seasonal price patterns. While seasonal price patterns are tied to the crop cycle, they can vary from year-to-year depending on supply and demand fundamentals. The pattern anticipated will prescribe the appropriate tool to use in the marketing strategy.

A number of tools are available for marketing oil sunflowers. They can be sold by taking the cash price offered by elevators and crushing plants. They can be sold prior to harvest by using the cash forward contract. For a discounted price, the cash forward contract may include an "Act of God" clause to protect growers from production failures beyond their control. The cash forward contract can also be used to sell sunflowers for delivery after harvest at a time when they are needed by the processor, generally at a premium price.

Sunflower marketing strategies usually use the cash forward contract to fix a price for later delivery. Use of this contract may be appropriate on a portion of the sunflower crop but so may the use of other marketing tools such as futures or options (puts or calls).

Since a sunflower futures market does not exist, relationships between the sunflower cash price and other closely related futures market need to be considered. Using the futures market of a different commodity for hedging is cross-hedging while the cash and futures price relationship is the cross-basis.

This publication analyzes price risk management strategies for U.S. sunflower growers. Various time series of prices are analyzed to identify patterns and relationships useful for developing marketing strategies, and preharvest and harvest/postharvest marketing strategies are evaluated. A comprehensive analysis of marketing is presented that builds on previous studies by Flaskerud and Shane; O'Brien, Stockton and Belshe; and Boland, Domine, Korber, O'Brien and Theriault.

Data and Methods

Data were gathered from several sources during 1997 - April 2004. Cash prices were obtained for NuSun and regular oil sunflowers (40 percent oil) from Northern Sun - ADM, Enderlin, N.D. The NuSun sunflower price history began October 1997 while the regular oil sunflower price history ended August 2003. Canola futures were obtained from the Winnipeg Commodity Exchange (WCE) Web site. Soybean oil futures on the Chicago Board of Trade (CBT) were obtained from the Great Pacific Trading Company Web site. Exchange rates were obtained from the Federal Reserve Bank of St. Louis Web site.

Data were compiled as monthly averages. Prices were standardized in U.S. dollars per hundredweight (US$/cwt). The sunflower marketing year used was October through September as defined by the NSA.

The data were analyzed using methods to identify patterns and relationships useful for developing marketing strategies (Flaskerud, Dahl and Wilson). Methods included seasonal distributions, correlations, cross-hedge ratios and regression.

The analysis of seasonal distributions of prices (Flaskerud and Johnson) and basis (Flaskerud 2003) was limited to the most recent five marketing years, beginning October 1998 and ending September 2003, to reflect the impact of rapidly expanding Brazil soybean production. The seasonal distributions were reviewed by marketing year and summarized using the average excluding the low and high. The standard deviation is used as an indicator of variability.

Basis is the difference between a cash and futures price. The basis with respect to a nearby futures is derived by subtracting the nearby futures contract price from the corresponding local cash price. Prices from the nearby futures contract month are used until the last day in the month before the futures contract month. After that day, prices from the following futures contract month are used.

Hedging of commodities relies on the relationship or correlation between futures and cash prices. Correlations were calculated since they indicate the degree that prices tend to move in the same direction. Higher correlations, between cash and futures prices, would indicate that prices move similarly, thus risk in cash prices can be offset by hedging with futures.

A cross-hedge ratio is the proportion of the futures position required to minimize the risk associated with a cash position. Note that the emphasis is on minimizing risk, not maximizing returns. Hedging price risk for a commodity with both cash and futures markets is generally accomplished by taking equal and opposite positions in the cash and futures markets, i.e., selling a futures contract and then buying it back when an equal amount of the commodity is sold on the cash market. This implies a hedge ratio of one. For cross-hedging the NuSun cash price with a closely related futures market, the cross-hedge ratio needs to be determined.

Regression analysis was used to estimate optimal cross-hedge ratios for each of the different futures contracts (Blank, Carter, and Schmiesing). Cash and futures prices were converted to similar units and then cash prices were regressed as a function of futures contract prices. Separate equations were estimated for various canola and soybean oil futures. Ordinary least squares estimates were derived adjusting for auto-correlation when present.

NuSun Prices as a Percent of Nearby Futures for Canola and Soybean Oil

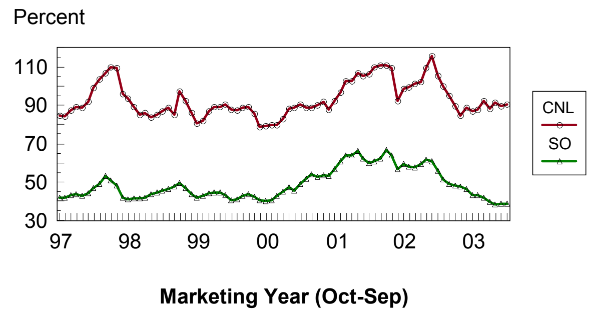


Figure 7.

Seasonal Price Patterns

NuSun sunflower prices are presented in Figure 5 along with regular oil sunflower prices; the prices for both represent 40 percent oil content. The premium for NuSun over regular oil sunflowers (Figure 6) averaged $.59. The premium peaked during March in 2002 at $1.45 (monthly average).

NuSun prices are presented in Figure 7 as a percent of nearby futures prices for canola and for soybean oil. NuSun prices averaged 93 percent of the canola price and 49 percent of the soybean oil price. The NuSun price ranged 79-115 percent of the canola price and 38-67 percent of the soybean oil price.

Patterns were examined by marketing year for Enderlin NuSun, nearby canola futures and nearby soybean oil futures. They were also examined for specific futures contracts that may be useful for preharvest and postharvest marketing strategies.

NuSun prices

Seasonal patterns for NuSun prices were examined for the marketing year (Figure 8). A broad range of price behavior occurred during individual years. Highs occurred during August 2000 and 2001, April 1999, October 1998 and November 2002. When prices were significantly above the average at the beginning of the marketing year and tended to decrease, such as in 1998 and 2002, prices generally declined into harvest. The price was also above the average early in the marketing year during 2001 but

Prices for Enderlin NuSun and Regular Oil Sunflowers (40% Oil)

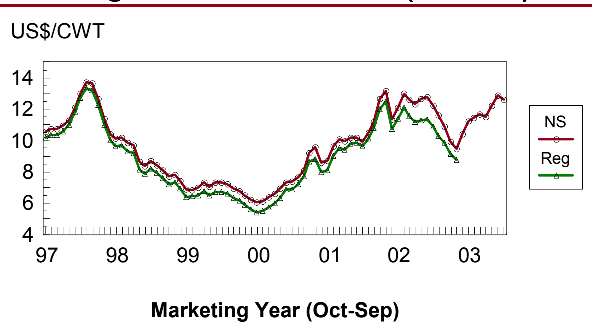
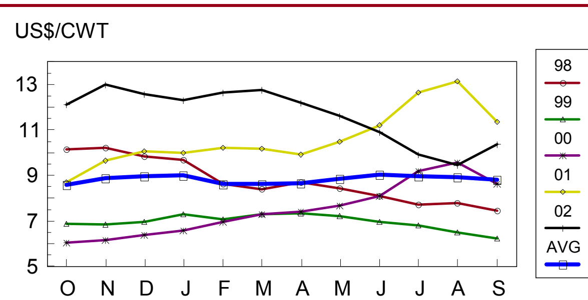


Figure 5.

Premium for Enderlin NuSun Over Regular Oil Sunflowers

Figure 6.

Seasonal Behavior of Enderlin NuSun Prices



AVG is an average of 1998-02 excluding the low and high.

Figure 8.

tended to increase. The distribution of prices reveals that the pattern, on average, was for lows to occur at the beginning of the marketing year and peak in June before declining into the next marketing year.

The range in the average from low to high was only $.53. The annual variations were considerably greater. The average marketing year range each year was $3.07. During the 2000 and 2001 marketing years when prices trended up, the range each year was $3.98, on average. During the other years, the range each year was $2.47, on average.

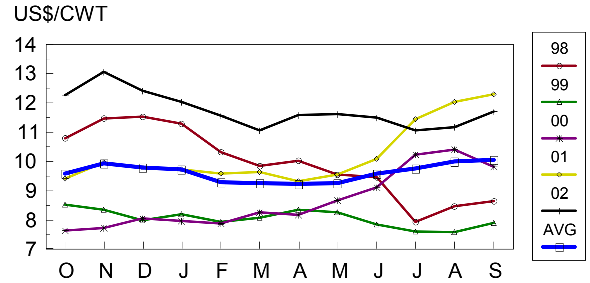
Canola futures

Seasonal patterns for canola nearby futures revealed wide price behavior similar to the behavior for NuSun prices (Figure 9). Highs for nearby futures occurred during October 1999, November 2002, December 1998, August 2000 and September 2001. On average, nearby futures reached lows in February-May and highs in August-September with a range in the average limited to $.75. The average marketing year range each year was $2.45. During the 2000 and 2001 marketing years when prices trended up, the range each year was $2.87, on average. During the other years, the range each year was $2.17 on average.

Annual patterns for the November canola futures contract (Figure 10) indicates highs occurring in a variety of months: November, April, June, August and September. For those years when prices generally declined into harvest, 1999 and 2000, the highs occurred in November and April, respectively. Of the two contracts, 1999 and 2003, that were well above the average early in the marketing year, the 1999 contract declined into harvest while the 2003 contract traded sideways.

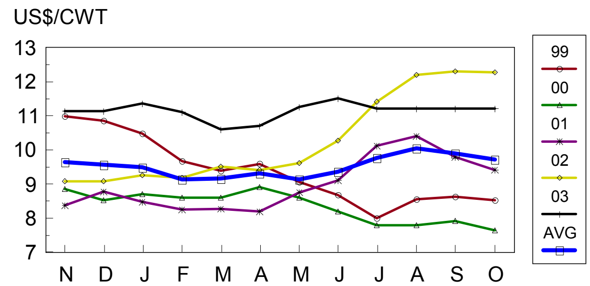
The May canola futures contract (Figure 11) peaked close to harvest except during 2004 when the peak occurred in March. On average, the contract peaked in November.

Seasonal Behavior of Nearby WCE Canola Futures



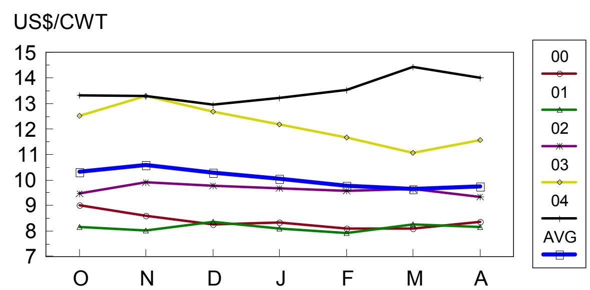
AVG is an average of 1998-02 excluding the low and high.
Figure 9.

Seasonal Behavior of November WCE Canola Futures



AVG is an average of 1999-03 excluding the low and high.
Figure 10.

Seasonal Behavior of May WCE Canola Futures



AVG is an average of 2000-04 excluding the low and high.
Figure 11.

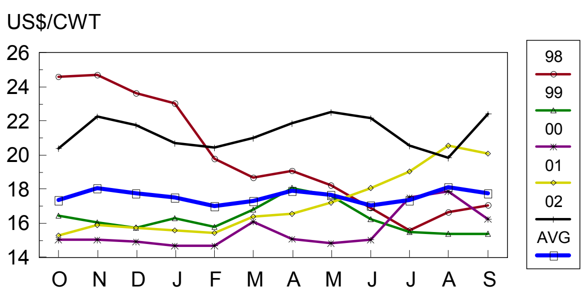
Soybean oil futures

Seasonal patterns for soybean oil nearby futures varied widely (Figure 12). Prices generally decreased during the 1998 marketing year and generally increased during the 2000 and 2001 marketing years. When they decreased, prices peaked early, and when they increased, prices peaked late. On average, the price pattern was fairly flat; prices were the highest during November, April and August and the lowest during October, February and June. Price increases from the October low were $.70 to November, $.51 to April and $.98 to August. The average marketing year range each year was $4.49.

For the December soybean oil futures contract (Figure 13), annual highs occurred in November, April, May and August. On average, the price peaked in April. Of the two contracts, 1999 and 2003, that were significantly above the average early in the marketing year, the 1999 contract declined into harvest while the 2003 contract increased sharply.

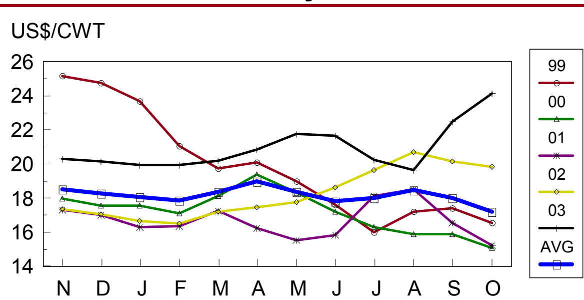
The 2004 May soybean oil futures contract (Figure 14) was the only contract to make significant gains. The others traded sideways.

Seasonal Behavior of Nearby CBT Soybean Oil Futures



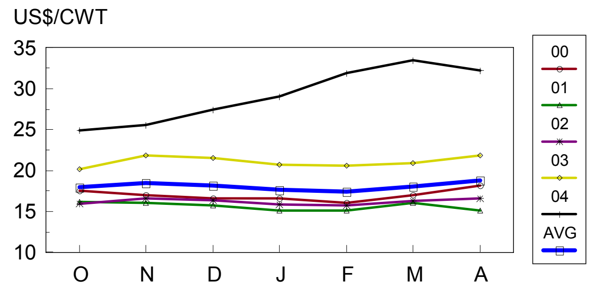
AVG is an average of 1998-02 excluding the low and high.
Figure 12.

Seasonal Behavior of December CBT Soybean Oil Futures



AVG is an average of 1999-03 excluding the low and high.
Figure 13.

Seasonal Behavior of May CBT Soybean Oil Futures



AVG is an average of 2000-04 excluding the low and high.
Figure 14.

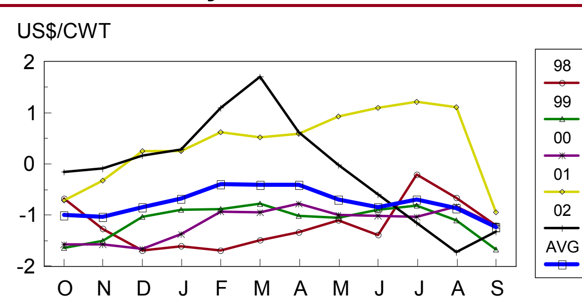
NuSun Cross-Basis

Relative to nearby canola futures

The tendency for the Enderlin NuSun cross-basis relative to nearby canola futures (Figure 15) was to decline to a low in September and to remain nearly as low during October and November, and then to increase to a high in February-April before generally declining into the end of the marketing year. During three of the five years, the cross-basis was near its low in October. The range of the cross-basis was the narrowest during September and the widest during May. During October, the average cross-basis ranged from $-1.64 to $-.16 and averaged $-.99.

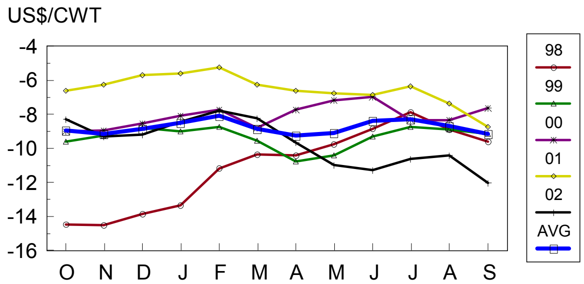
Variability, as measured by the standard deviation, was less for the cross-basis relative to nearby canola futures than for the cross-basis relative to nearby soybean oil futures. This suggests lower basis risk when cross-hedging with canola futures rather than with soybean oil futures.

Enderlin NuSun Cross-Basis Relative to Nearby WCE Canola Futures



AVG is an average of 1998-02 excluding the low and high.
Figure 15.

Enderlin NuSun Cross-Basis Relative to Nearby CBT Soybean Oil Futures



AVG is an average of 1998-02 excluding the low and high.
Figure 16.

Relative to nearby soybean oil futures

Relative to nearby soybean oil futures (Figure 16), the Enderlin average cross-basis showed a pattern of marketing year lows in November ($-9.15), April ($-9.25) and September ($-9.16) and highs in February ($-8.08) and July ($-8.30). During October, the average cross-basis ranged from $-14.47 to $-6.59 and averaged $-8.95.

Correlations

Correlations were estimated among NuSun prices, canola futures prices and soybean oil futures prices (Table 1). Relative to nearby futures, these correlations indicate that changes in NuSun prices are the most closely correlated with canola futures (correlation = .91). Soybean oil futures were a distant, second-best correlation (.75). When specific periods were examined, canola futures continued to provide the strongest relationship with NuSun prices. These correlations suggest that canola futures should provide the most risk reduction for cross-hedging NuSun prices.

Table 1. Correlation of Enderlin NuSun sunflower prices with various futures contracts during specific calendar months and data periods.

Futures Contract	Calendar Month	Data Period	Correlation with NuSun Prices
Nearby canola	Monthly	10/97-4/04	.913
Nearby soybean oil	Monthly	10/97-4/04	.754
Nov canola	October	1997-2003	.986
Dec soybean oil	October	1997-2003	.744
May canola	February	1998-2004	.937
May soybean oil	February	1998-2004	.703
May canola	April	1998-2004	.963
May soybean oil	April	1998-2004	.835

Cross-Hedge Ratios

Cross-hedge ratios (Table 2) were derived for cross-hedging NuSun sunflowers with canola futures and with soybean oil futures using regression analysis. These were estimated for cross-hedging during specific time periods. Again, the emphasis with cross-hedge ratios is on minimizing risk, not maximizing returns.

A cross-hedge ratio of .99 cwt of November canola futures was derived for October. In effect, .99 cwt of canola November futures should be used to cross-hedge each cwt of NuSun sunflower production when the cross-hedge is offset in October. Using this ratio, about 95 percent of the variability in prices could be eliminated.

When cross-hedging production with December soybean oil futures, the cross-hedge ratio should be .33 cwt of futures to a cwt of production. This strategy would provide less risk reduction (controlling 87 percent of price variability) than the canola futures strategy.

Cross-hedge ratios were also derived for time periods farmers would traditionally use futures for storage cross-hedge strategies or as an alternative to storage. These are provided to give an indication of how much price risk could be controlled, and to indicate how cross-hedge ratios can change depending on the specific time period of the cross-hedge. Two periods were examined.

Table 2. Estimated cross-hedge ratios and cross-hedge effectiveness for Enderlin NuSun sunflower cross-hedge alternatives.

Cross-Hedge in Futures Contract Month	Cross-Hedge Offset Month	Cross-Hedge Ratio	Cross-Hedge Effectiveness
Canola futures			
Nov (1997-2003)	October	.99	.95
May (1998-2004)	February	.85	.91
May (1998-2004)	April	.97	.92
Soybean oil futures			
Dec (1997-2003)	October	.33	.87
May (1998-2004)	February	.16	.84
May (1998-2004)	April	.30	.88

Cross-hedges in May futures were examined that were offset in February. For canola futures, a cross-hedge ratio of .85 was estimated (91 percent effective), and for soybean oil futures, a cross-hedge ratio of .16 was estimated (84 percent effective).

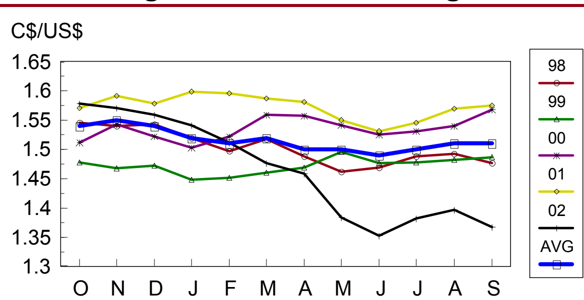
Ratios were also derived for cross-hedges in May that were offset in April. In this cross-hedge, a cross hedge ratio of .97 was calculated for canola (92 percent effective) and .30 for soybean oil (88 percent effective).

Exchange Rates

Price quotations for canola are in Canadian dollars per metric ton. Converting price quotations to dollars per hundredweight requires knowing the exchange rate and the relationship between a metric ton and hundredweight. A metric ton is equal to 2204.6 pounds or 22.046 hundredweight. The price quotation for November canola was C$352 on Aug. 25, 2003, and the exchange rate was 1.41 C$/US$. In U.S. dollars per hundredweight, this quotation would be US$11.32 (C$352 divided by 1.41 divided by 22.046 = US$11.32).

Using the canola futures market to establish a hedge in a distant futures contract means that the sunflower cross-hedge in that market is subject to uncertainty about changes in the exchange rate. The patterns of exchange rates throughout the sunflower marketing years are presented in Figure 17. Changes from month to month were generally small for large periods of most marketing years

Canada Vs U.S. Exchange Rate During Sunflower Marketing Year



AVG is an average of 1998-02 excluding the low and high.
Figure 17.

although a significant decline did occur from January through June in 2003. The more typical pattern of minimal changes, however, suggests that variability in exchange rates may be of lesser importance for sunflower growers, especially for shorter term cross-hedges.

The exchange rate could be hedged just as the sunflower price is cross-hedged. But, including an exchange rate hedge would increase the transaction cost. Since variability is usually minimal, hedging the exchange rate would likely provide little risk reduction, on average, for the increase in transaction costs.

Marketing Strategies

Preharvest and harvest/postharvest marketing strategies are evaluated. The illustrations provide a systematic framework for analyzing and planning marketing strategies. Caution must be exercised in generalizing about what might happen in the future based on the illustrations since relatively few years were analyzed. Illustrations matching future expectations can be examined for possible strategy outcomes.

Cross-hedge ratios were applied to the gain or loss from futures transactions and the net amount was added to the cash price to arrive at a net price less transaction fees. A fee of $.07/cwt ($31 per contract) was specified for each transaction (purchase and sale) of canola futures and $.103/cwt ($62 per contract) for soybean oil futures.

Preharvest sales

The seasonal price patterns suggest that preharvest sales should be considered when prices are above the five-year average (where the average is calculated excluding the low and high) and prices appear to be in a decreasing pattern. November canola futures and December soybean oil futures fit this description in 1999. However, those futures contracts decreased during other years too, making fundamental and technical analysis imperative whenever a sale is being considered.

Use of the cash forward contract or cross-hedge would be appropriate on that portion of the sunflower crop that can be safely produced, i.e., on 20-40 percent of the crop. The cash forward contract would be preferred if it reflects an average or better cross-basis relative to sunflower oil futures or canola futures. A greater portion of the crop could be sold on a cash forward contract if it includes an act-of-God clause.

In this analysis, preharvest marketing strategies were initiated during January and April (Tables 3-6). Those months were used since November canola futures and December soybean oil futures were usually the strongest during January-April in years of declining prices. The cross-hedges established in November canola futures and December soybean oil futures were offset in October.

The cross-hedges in soybean oil were generally more profitable than in canola. During 1997-2003, on average, the soybean oil cross-hedge provided a net price that was $.18 higher than the harvest price for strategies initiated in January and $.28 for April. The returns were negative for canola cross-hedges, on average. The canola cross hedge was more profitable only once and that was when the cross-hedge was initiated in January 1998.

The net price for the cross-hedge established in January ranged from $7.05 to $10.93 for Canola and $6.85 to $11.02 for soybean oil. When established in April, returns ranged from $7.25 to $11.25 for Canola and $7.45 to $11.30 for soybean oil.

The variability of net price as measured by the standard deviation was slightly lower for the

Table 3. Net price received by cross-hedging in November canola futures from January to October, $/cwt, 1997-03.

	January	October	Gain/ Loss	Cash October	Net Price
1997	12.59	12.26	0.33	10.58	10.84
1998	11.69	10.81	0.88	10.13	10.93
1999	10.47	8.52	1.95	6.88	8.74
2000	8.71	7.64	1.07	6.06	7.05
2001	8.49	9.43	-0.94	8.71	7.71
2002	9.27	12.27	-3.00	12.11	9.07
2003	11.36	12.91	-1.55	11.21	9.61
Avg	10.37	10.55	-0.18	9.38	9.14
Std	1.47	1.90	1.60	2.09	1.36
Min	8.49	7.64	-3.00	6.06	7.05
Max	12.59	12.91	1.95	12.11	10.93

Table 4. Net price received by cross-hedging in December soybean oil futures from January to October, $/cwt, 1997-03.

	January	October	Gain/ Loss	Cash October	Net Price
1997	25.36	24.66	0.70	10.58	10.78
1998	25.11	24.60	0.51	10.13	10.26
1999	23.69	16.57	7.12	6.88	9.20
2000	17.58	15.07	2.51	6.06	6.85
2001	16.32	15.24	1.08	8.71	9.03
2002	16.64	19.83	-3.19	12.11	11.02
2003	19.95	24.16	-4.21	11.21	9.79
Avg	20.66	20.02	0.65	9.38	9.56
Std	3.70	4.12	3.46	2.09	1.30
Min	16.32	15.07	-4.21	6.06	6.85
Max	25.36	24.66	7.12	12.11	11.02

Table 5. Net price received by cross-hedging in November canola futures from April to October, $/cwt, 1997-03.

	April	October	Gain/ Loss	Cash October	Net Price
1997	12.20	12.26	-0.06	10.58	10.45
1998	12.01	10.81	1.20	10.13	11.25
1999	9.60	8.52	1.08	6.88	7.88
2000	8.91	7.64	1.27	6.06	7.25
2001	8.20	9.43	-1.23	8.71	7.42
2002	9.43	12.27	-2.84	12.11	9.23
2003	10.70	12.91	-2.21	11.21	8.95
Avg	10.15	10.55	-0.40	9.38	8.92
Std	1.42	1.90	1.58	2.09	1.41
Min	8.20	7.64	-2.84	6.06	7.25
Max	12.20	12.91	1.27	12.11	11.25

Table 6. Net price received by cross-hedging in December soybean oil futures from April to October, $/cwt, 1997-03.

	April	October	Gain/ Loss	Cash October	Net Price
1997	25.27	24.66	0.61	10.58	10.75
1998	27.29	24.60	2.69	10.13	10.98
1999	20.11	16.57	3.54	6.88	8.01
2000	19.37	15.07	4.30	6.06	7.45
2001	16.26	15.24	1.02	8.71	9.01
2002	17.47	19.83	-2.36	12.11	11.30
2003	20.87	24.16	-3.29	11.21	10.09
Avg	20.95	20.02	0.93	9.38	9.66
Std	3.71	4.12	2.67	2.09	1.41
Min	16.26	15.07	-3.29	6.06	7.45
Max	27.29	24.66	4.30	12.11	11.30

January cross-hedge in soybean oil ($1.30) than in canola ($1.36). For the April cross-hedge, the variability was higher than in January but the same for soybean oil and canola ($1.41). Variability was the highest for harvest sales ($2.09).

In addition to the cash forward contract or cross-hedge, a call option could be purchased to preserve upside potential. In the case of the cross-hedge, the call option would be purchased in the same futures contract. In the case of the cash forward contract, the call option could be purchased in either the soybean oil futures or canola futures. The put option would be an alternative to using a cash forward contract or cross-hedge in combination with a call option.

Storage

For sunflowers that are not cash forward contracted, storage is an alternative. Note that this analysis assumes that sales are made during the month of highest returns net of storage costs. The analysis was done to determine if a particular length of storage is the most profitable. Sell or store decisions (Flaskerud 1992) are difficult and require frequent evaluation of fundamentals, cash prices, futures prices, basis and storage costs.

On average, storage was profitable during the 1997-2002 marketing years when sunflowers are stored to the month that provides the highest net return (Table 7). The net returns averaged $10.68 from storage versus $9.03 from harvest sales, in effect, a return to storage of $1.61 was achieved, on average. The variability of storage net returns was $2.22 versus $2.11 for harvest sales.

Although storage was profitable, on average, it would be difficult to achieve because the most profitable period of storage varied considerably. The most profitable sell or store strategy was to store the 1997 crop until May, sell the 1998 crop at harvest, store the 1999 crop until January, store the 2000 and 2001 crops until August, and store the 2002 crop for one month.

Storage cross-hedge

Storage cross-hedges were initiated by selling the May futures in October and offsetting in February and April (Tables 8-11). Those months were chosen since the nearby cross-basis relative to nearby canola futures was the strongest during February-April, on average, and relative to nearby soybean oil futures, April had the strongest basis, on average. When the futures were offset, the sunflowers were sold in the cash market. The cash price received was net of storage costs and is compared to the harvest cash sales presented in Tables 3-6.

A cross-hedge in canola futures performed the best. Offsetting in February provided a net return that was $.27 better than harvest cash sales, on average, and for April the net return was $.40 better. Relative to harvest sales, the cross-hedge in soybean oil lost $.14 in February and $.07 in April.

Table 7. Net returns from storage, $/cwt, 1997-98 to 2002-03.

	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	Average	Standard Deviation
Oct	10.58	10.13	6.88	6.06	8.71	12.11	9.08	2.11
Nov	10.47	9.93	6.58	5.88	9.38	12.70	9.16	
Dec	10.38	9.49	6.67	6.10	9.74	12.22	9.10	
Jan	10.54	9.29	6.96	6.26	9.59	11.88	9.09	
Feb	10.82	8.17	6.68	6.57	9.77	12.14	9.02	
Mar	11.58	7.87	6.89	6.90	9.68	12.19	9.18	
Apr	12.40	8.14	6.87	6.95	9.35	11.55	9.21	
May	13.04	7.85	6.72	7.18	9.87	10.88	9.25	
Jun	12.86	7.44	6.40	7.57	10.52	10.11	9.15	
Jul	11.81	7.02	6.19	8.61	11.90	9.07	9.10	
Aug	10.48	7.06	5.86	8.93	12.34	8.53	8.87	
Sep	9.44	6.66	5.57	7.92	10.46	9.40	8.24	
Max	13.04	10.13	6.96	8.93	12.34	12.70	10.68	2.22

Table 8. Net price received from storage cross-hedge in May canola futures from October to February, $/cwt, 1997-98 to 2003-04.

	October	February	Gain/ Loss	Cash Feb. Net Price	Net Price
1997-98	12.66	12.91	-0.25	10.82	10.54
1998-99	11.16	10.13	1.03	8.17	8.99
1999-00	9.02	8.11	0.91	6.68	7.39
2000-01	8.16	7.94	0.22	6.57	6.70
2001-02	9.48	9.58	-0.10	9.77	9.62
2002-03	12.53	11.66	0.87	12.14	12.82
2003-04	13.33	13.52	-0.19	11.71	11.49
Avg	10.91	10.55	0.35	9.41	9.65
Std	1.88	2.05	0.52	2.13	2.02
Min	8.16	7.94	-0.25	6.57	6.70
Max	13.33	13.52	1.03	12.14	12.82

Table 9. Net price received from storage cross-hedge in May soybean oil futures from October to February, $/cwt, 1997-98 to 2003-04.

	October	February	Gain/ Loss	Cash Feb. Net Price	Net Price
1997-98	25.33	26.86	-1.53	10.82	10.63
1998-99	24.73	20.07	4.66	8.17	8.09
1999-00	17.49	16.05	1.44	6.68	6.54
2000-01	16.15	15.12	1.03	6.57	6.43
2001-02	15.97	15.72	0.25	9.77	9.61
2002-03	20.22	20.57	-0.35	12.14	11.97
2003-04	24.89	31.86	-6.97	11.71	11.44
Avg	20.68	20.89	-0.21	9.41	9.24
Std	3.94	5.86	3.29	2.13	2.10
Min	15.97	15.12	-6.97	6.57	6.43
Max	25.33	31.86	4.66	12.14	11.97

Using canola for cross-hedging, May canola that was offset in April was not only the most profitable but also had the least variable net price ($2.00), on average. The variability in February was only slightly higher. For soybean oil, the April offset had the lowest variability ($1.70) but the February offset had the highest variability ($2.10). All storage cross-hedges had lower variability than corresponding cash net prices.

Table 10. Net price received from storage cross-hedge in May canola futures from October to April, $/cwt, 1997-98 to 2003-04.

	October	April	Gain/ Loss	Cash April Net Price	Net Price
1997-98	12.66	13.09	-0.43	12.40	11.92
1998-99	11.16	10.04	1.12	8.14	9.16
1999-00	9.02	8.36	0.66	6.87	7.44
2000-01	8.16	8.17	-0.01	6.95	6.87
2001-02	9.48	9.33	0.15	9.35	9.43
2002-03	12.53	11.58	0.95	11.55	12.41
2003-04	13.33	14.00	-0.67	11.95	11.23
Avg	10.91	10.65	0.25	9.60	9.78
Std	1.88	2.12	0.63	2.20	2.00
Min	8.16	8.17	-0.67	6.87	6.87
Max	13.33	14.00	1.12	12.40	12.41

Table 11. Net price received from storage cross-hedge in May soybean oil futures from October to April, $/cwt, 1997-98 to 2003-04.

	October	April	Gain/ Loss	Cash April Net Price	Net Price
1997-98	25.33	27.84	-2.51	12.40	11.62
1998-99	24.73	19.07	5.66	8.14	9.81
1999-00	17.49	18.15	-0.66	6.87	6.64
2000-01	16.15	15.15	1.00	6.95	7.22
2001-02	15.97	16.56	-0.59	9.35	9.14
2002-03	20.22	21.84	-1.62	11.55	11.04
2003-04	24.89	32.21	-7.32	11.95	9.72
Avg	20.68	21.55	-0.86	9.60	9.31
Std	3.94	5.82	3.61	2.20	1.70
Min	15.97	15.15	-7.32	6.87	6.64
Max	25.33	32.21	5.66	12.40	11.62

Replace with futures

Strategies involved selling the cash sunflowers at harvest and replacing the sold sunflowers with a long futures position (Tables 12-15). May futures were purchased in October and offset in February and April.

In this case, holding a May soybean oil futures position until April was the most profitable, $.23 more profitable, on average, than harvest cash sales although the net price variability was the highest ($2.66), on average. Holding until February increased the average net price by only $.02 over harvest cash sales and the variability in net price was $.26 higher, on average, than for the harvest cash price. Losses were incurred for holding canola futures, on average.

Table 12. Net price received from replacing harvest sales with May canola futures from October to February, 1997-98 to 2003-04.

	October	February	Gain/ Loss	Cash October	Net Price
1997-98	12.66	12.91	0.25	10.58	10.73
1998-99	11.16	10.13	-1.03	10.13	9.20
1999-00	9.02	8.11	-0.91	6.88	6.05
2000-01	8.16	7.94	-0.22	6.06	5.81
2001-02	9.48	9.58	0.10	8.71	8.74
2002-03	12.53	11.66	-0.87	12.11	11.31
2003-04	13.33	13.52	0.19	11.21	11.31
Avg	10.91	10.55	-0.35	9.38	9.02
Std	1.88	2.05	0.52	2.09	2.16
Min	8.16	7.94	-1.03	6.06	5.81
Max	13.33	13.52	0.25	12.11	11.31

Table 13. Net price received from replacing harvest sales with May soybean oil futures from October to February, $/cwt, 1997-98 to 2003-04.

	October	February	Gain/ Loss	Cash October	Net Price
1997-98	25.33	26.86	1.53	10.58	10.81
1998-99	24.73	20.07	-4.66	10.13	9.37
1999-00	17.49	16.05	-1.44	6.88	6.63
2000-01	16.15	15.12	-1.03	6.06	5.88
2001-02	15.97	15.72	-0.25	8.71	8.65
2002-03	20.22	20.57	0.35	12.11	12.15
2003-04	24.89	31.86	6.97	11.21	12.31
Avg	20.68	20.89	0.21	9.38	9.40
Std	3.94	5.86	3.29	2.09	2.35
Min	15.97	15.12	-4.66	6.06	5.88
Max	25.33	31.86	6.97	12.11	12.31

Table 14. Net price received from replacing harvest sales with May canola futures from October to April, $/cwt, 1997-98 to 2003-04.

	October	April	Gain/ Loss	Cash October	Net Price
1997-98	12.66	13.09	0.43	10.58	10.93
1998-99	11.16	10.04	-1.12	10.13	8.98
1999-00	9.02	8.36	-0.66	6.88	6.17
2000-01	8.16	8.17	0.01	6.06	6.00
2001-02	9.48	9.33	-0.15	8.71	8.50
2002-03	12.53	11.58	-0.95	12.11	11.12
2003-04	13.33	14.00	0.67	11.21	11.79
Avg	10.91	10.65	-0.25	9.38	9.07
Std	1.88	2.12	0.63	2.09	2.18
Min	8.16	8.17	-1.12	6.06	6.00
Max	13.33	14.00	0.67	12.11	11.79

Table 15. Net price received from replacing harvest sales with May soybean oil futures from October to April, $/cwt, 1997-98 to 2003-04.

	October	April	Gain/ Loss	Cash October	Net Price
1997-98	25.33	27.84	2.51	10.58	11.30
1998-99	24.73	19.07	-5.66	10.13	8.40
1999-00	17.49	18.15	0.66	6.88	7.05
2000-01	16.15	15.15	-1.00	6.06	5.73
2001-02	15.97	16.56	0.59	8.71	8.86
2002-03	20.22	21.84	1.62	12.11	12.57
2003-04	24.89	32.21	7.32	11.21	13.38
Avg	20.68	21.55	0.86	9.38	9.61
Std	3.94	5.82	3.61	2.09	2.66
Min	15.97	15.15	-5.66	6.06	5.73
Max	25.33	32.21	7.32	12.11	13.38

Strategies compared

The marketing strategies are summarized in Table 16 by net price received. No one strategy dominated; neither did the use of canola futures or soybean oil futures. Soybean oil futures performed somewhat better across all strategies with an overall average net price of $9.46 versus $9.26 for canola futures. On average, positions in soybean oil futures also had the highest variability (larger standard deviation) and the greatest net price range.

Seven strategies ranked better than harvest sales only. Storage provided the highest average net price, however, the most profitable storage period was unpredictable. A storage cross-hedge in canola futures from October to April ranked second. A preharvest cross-hedge in soybean oil futures from April to October ranked third followed by a storage cross-hedge in canola futures from October to February. The replacement of harvest sales with soybean oil futures from October to April ranked fifth. Sixth place was taken by a preharvest cross-hedge in soybean oil futures from January to October. The replacement of harvest sales with soybean oil futures from October to February ranked seventh.

Table 16. Comparison of net price received from alternative marketing strategies, $/cwt, 1997-04.

Marketing Strategy		Average	Standard Deviation	Minimum	Maximum
Harvest sales only, 1997-03					
October		9.38	2.09	6.06	12.11
Preharvest sales, 1997-03					
Canola	January to October	9.14	1.36	7.05	10.93
Soybean oil	January to October	9.56	1.30	6.85	11.02
Canola	April to October	8.92	1.41	7.25	11.25
Soybean oil	April to October	9.66	1.41	7.45	11.30
Storage, 1997-98 to 2002-03					
Various months		10.68	2.22	6.96	13.04
Storage cross-hedge, 1997-98 to 2003-04					
Canola	October to February	9.65	2.02	6.70	12.82
Soybean oil	October to February	9.24	2.10	6.43	11.97
Canola	October to April	9.78	2.00	6.87	12.41
Soybean oil	October to April	9.31	1.70	6.64	11.62
Replace with futures, 1997-98 to 2003-04					
Canola	October to February	9.02	2.16	5.81	11.31
Soybean oil	October to February	9.40	2.35	5.88	12.31
Canola	October to April	9.07	2.18	6.00	11.79
Soybean oil	October to April	9.61	2.66	5.73	13.38
Average of positions in:					
Canola futures		9.26	1.86	6.61	11.75
Soybean oil futures		9.46	1.92	6.50	11.93

Summary and Conclusions

The Midwest is a major producer of sunflowers comprising most of U.S. production which ranked seventh in the world during 2003. Oil sunflower production dominates and occurs primarily in North Dakota. NuSun has become the predominant type of oil sunflower and was the type analyzed in this study.

Although sunflowers compete well economically with other crops, the profitability of producing sunflowers is dependent to a large extent on how well price risk is managed which requires the development of marketing strategies. Various time series of prices were analyzed to identify patterns and relationships useful for developing marketing strategies; preharvest and harvest/postharvest marketing strategies were evaluated. Cash prices were obtained for NuSun, and futures prices were collected for canola and soybean oil during 1997 to April 2004.

The seasonal pattern for Enderlin NuSun prices, on average, was for lows to occur at the beginning of the marketing year and peak in June before declining into the next marketing year.
When prices were significantly above the average at the beginning of the marketing year and tended to decrease, prices generally declined into harvest. The average marketing year annual range was $3.07 for NuSun prices, $2.45 for nearby canola futures and $4.49 for nearby soybean oil futures.

The tendency for the NuSun cross-basis relative to nearby canola futures was to weaken to a low in September and strengthen to a high in February-April before generally weakening into the end of the marketing year. Relative to nearby soybean oil futures, the average cross-basis showed a pattern of marketing year lows in November, April and September and highs in February and July. Variability, as measured by the standard deviation, was less for the cross-basis relative to nearby canola futures than for the cross-basis relative to nearby soybean oil futures.

Correlations indicate that changes in NuSun prices are the most closely correlated with canola futures. Soybean oil futures were a distant, second-best correlation. These correlations suggest that canola futures should provide the most risk reduction for cross-hedging NuSun prices.

A cross-hedge ratio of .99 cwt of November canola futures was derived for October. When cross-hedging with December soybean oil futures, the cross-hedge ratio should be .33 cwt of futures to a cwt of production. Cross-hedges in May futures were examined that were offset in February. For canola futures, a cross-hedge ratio of .85 was estimated, and for soybean oil futures, a cross-hedge ratio of .16 was estimated. Ratios were also derived for cross-hedges in May that were offset in April. In this cross-hedge, a cross hedge ratio of .97 was calculated for canola and .30 for soybean oil.

An evaluation of marketing strategies indicated that no one strategy dominated; neither did the use of canola futures or soybean oil futures. Seven strategies ranked better than harvest sales only. Soybean oil futures performed somewhat better across all strategies, although they also had somewhat higher variability, on average.

The study suggests that canola cross-hedges have the most risk reduction, whereas soybean oil cross-hedges may be preferred when looking at profitability of strategies. Also, soybean oil futures are not subject to exchange rate variability. Current fundamental and technical features in both markets need to be evaluated when considering a futures position in a marketing strategy.

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