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HEDGING COTTON TO PROTECT PRICE LEVEL AND MARKETING LOAN PAYMENTS

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Overview

Cotton futures and options markets provide producers the opportunity for "locking in" prices year-round. Further, July call options may be employed as synthetic "storage" against the possibility of price increase. Finally, marketing loan provisions under the Federal Farm Program may provide price enhancement. This analysis determined the net price available to producers during a 19 month period, beginning on January 1 and ending on July 15 of the following year, for the five years 1987 to 1992. Net prices received from short hedges in December and March futures were compared with those for long put options for December and March futures. Additionally, using a July long call for "storage" and, alternatively, for marketing loan deficiency payment protection was examined.

Using put options rather than regular short hedges improved the price for cotton in three periods because price increased during these seasons. The puts provided the intended price insurance for the two years when price fell. The July "storage hedge" was profitable on balance and the marketing loan deficiency payment increased the net price received in two periods. Of course, cash sale at harvest is best when price rises, and the regular short hedge is best when price falls.

Introduction

The cotton futures market is frequently subject to large price changes (price volatility). Since 1987, futures prices for contracts in December and March have varied from a low of 34.37 cents per pound on July 18, 1986, for a December 1987 futures contract, to a high of 88.10 cents

per pound on March 1, 1991, for a March 1991 futures contract (Table A). The 34.37 cents per pound was exceptionally low due to government program changes that included the marketing loan. The variability in prices was due to a number of factors such as unusual weather conditions, economic factors causing changes in supply and demand, domestic government and trade policy, and foreign cotton policies.

Producers need to be aware of the opportunities that these price fluctuations provide. The producer may be able to "lock-in" a favorable price ahead of harvest, rather than accepting the harvest price, which is often the lowest, or he/she may hold for sale later. Pricing can be accomplished by forward contracting, or through the use of futures and/or commodity options. Opportunities to increase profitability, however, may not be fully realized without knowledge of Farm Program provisions. In particular, the marketing loan offers periodic profit potential that is unrealized by many producers--especially when world prices drop to low levels. This study explores the additional pricing opportunities which may be available to producers who utilize the provisions of the marketing loan.

In This Issue . . .

The authors discuss strategies to manage cotton price risks and the use of call options to "hedge" marketing loan deficiency payments and to enhance income from possible seasonal price increases.

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Table A. High and Low December and March Futures Prices, New York Cotton.

Crop Year	Low	Date	High	Date
----- cents/lb. -----				
December Futures:				
1987	34.37	7/18/86	79.82	8/27/87
1988	48.84	8/23/88	69.98	8/26/87
1989	50.85	8/25/88	77.04	8/24/89
1990	62.85	12/20/89	76.49	12/6/90
1991	56.20	11/22/91	76.05	5/21/91
March Futures:				
1988	45.40	9/16/86	80.77	8/27/87
1989	49.22	8/23/88	68.50	*9/16/87
1990	52.00	9/27/88	77.82	8/22/89
1991	63.52	12/20/89	88.10	3/1/91
1992	52.85	3/6/92	76.86	5/21/91

*On June 20, 1988, March 89 futures also reached a high of 68.50. Source: USDA Agricultural Marketing Service Daily Spot Quotations, 1987-1992.

Futures Contracts

Futures contracts are used in this analysis to "lock in" a price level at a given time during the crop year. Using a short hedge, the producer, on a date with an acceptable price, sells a futures contract with a delivery date after harvest. This protects the producer against a drop in cotton prices subject to risk due to basis variation. Thus, producers trade price risk for basis risk. Although the cash price may drop before harvest, the producer could expect a similar drop in the futures price since cash market prices and futures market prices usually move together. When the producer is ready to sell the cotton in the cash market, the short (sell) futures contract is simultaneously offset by purchasing a long (buy) futures contract. Thus, if the price dropped, the producer sold the futures contract for a price greater than the purchase price and a gain was realized. Of course, if price increases, the gain in the cash price is generally offset by the loss in the futures market. Futures contracts require margin deposits to offset losses.

Options Contracts

Options on futures contracts give the producer the right, but not the obligation, to buy (call option) or sell (put option) a futures contract at a specific predetermined price (strike price) at any time prior to the expiration of the option. The right to sell a futures contract at the strike price results in protection from a price decline, while providing unlimited upside price potential. Put options are an alternative to the regular short futures hedge for price protection. In order to trade options, a premium must be paid. Call options give the producer the right to buy a

futures contract at a predetermined strike price and are used by the producer who wishes to gain from an increase in the futures market price. Call options were used in this analysis in two ways: first, as an alternative to holding the cash crop in anticipation that the market will rise; i.e., "storage"; and second, as a means of increasing gains from the marketing loan provision.

The strike price chosen by the producer will determine the amount of premium required for the option. The higher the put strike price relative to the current futures price, the higher the premium. In contrast, the lower the call strike price relative to the current futures price, the higher the premium. Factors which determine an option premium include volatility of the underlying futures contract, time to maturity, short term interest rate and strike price. The producer has three choices for closing an option position:

1. Allow the option to expire
2. Exercise the option
3. Offset the option

If a put option is allowed to expire, the producer sells the crop on the cash market and loses the option premium paid. Exercising a put option places the producer with a short futures at the predetermined strike price; i.e., he/she is in a regular short futures position. Offsetting involves an opposite transaction in the options market; i.e., the producer would sell an identical option at the current market premium. As usual, the crop is sold in the cash market.

In the case of call options, any profit would be the result of a change in premium price, including time and intrinsic value. In all periods, the July "storage" return was simply the gain on the premium if the settlement price on the closing day was in-the-money, or a loss otherwise.

Marketing Loan

The marketing loan was introduced in the 1985 Farm Bill to improve the U.S. cotton industry's ability to compete in international markets. Provisions in the marketing loan provide for the adjustment of U.S. prices to levels below loan that will compete in world markets. The Commodity Credit Corporation (CCC) loan rates are calculated mainly by a formula based on prices quoted over the previous five years with some discretionary authority for the Secretary of Agriculture to adjust loan rates to maintain competitiveness in world markets. Loan rates and producer eligibility for the loan become effective at the start of each season on August 1. The initial CCC loan period is for ten months after cotton is placed under loan. If the Adjusted World Price (AWP) of cotton is less than the base loan rate, the storage costs are absorbed by the loan program. The loan period can be extended another eight months, but storage costs must be paid regardless of price level. If the AWP falls below the base loan rate, the CCC must offer to redeem the cotton at the AWP. In this situation, provided

that the crop has been harvested and is available for sale, a producer has two choices:

1. Place his/her crop under the CCC loan.
2. Have the cotton declared ineligible for the CCC loan.

If the producer places his crop in the loan, his price will be the base loan rate, adjusted for quality. The cotton can be redeemed from loan at the AWP and sold for the market price. If the producer decides to have cotton declared ineligible for the loan, the cotton must be sold outside of the loan program. In the latter case, the producer receives a payment termed the "marketing loan gain" (also known as producer optional payment (POP) or marketing loan deficiency payment (MLDP)), which is the difference between the AWP and the loan rate when the cotton was declared ineligible.

Producers may not be taking full advantage of the MLDP opportunity. For example, if a producer sells cotton on the cash market and buys a July call when AWP is below the loan rate, additional earnings would be realized if the July futures price increases substantially. If the cash sale price is equal to or greater than the variable cost of production, the producer risks losing only the options premium with this strategy. Alternatively, leaving cotton in the CCC loan when AWP goes up reduces the marketing loan gain. This analysis reviews the opportunities, which were available during 1987-1992, for enhancing the MLDP. The regular deficiency payment between the target price and average price received or base loan, whichever is higher, is excluded.

Method of Analysis

Period Definition

The data for this analysis from January 1, 1987, through March 1992 were gathered from the USDA publication "Daily Spot Cotton Quotations and Cotton Price Statistics". The data were divided into five separate periods--January 1 through July of the following year. Each 19 month period was associated with the season beginning with planting in May and extending until harvest in December or January. The cash prices used for each period were Lubbock area spot price quotes for 41-34 grade (Strict Low Middling 1/16" staple). Yield was assumed constant; however, the producer must recognize the yield risk of his/her individual crop. Brokerage fees and margin calls were omitted. The short term interest rate used for determination of option premiums was 7%. This rate was an average of historical T-bill premiums from 1983-1988. Volatility was used at a constant rate of 18%, which was assumed to be representative for the five-year period. All strike prices were in even cents above the settlement price on the date of purchase.

Utilization of Futures and Options

Futures contracts in cotton are available for 18 months prior to and including the maturity month. Contracts are

available for the months of March, May, July, October and December. This analysis used the months of December, March and July. December contracts were used to accommodate the sale of a crop on the cash market by December. The use of March contracts allowed for longer production schedules. The number of days the producer could have received at least the variable cost of production was determined for each period. The variable cost of production was estimated at 50.00 cents per pound, representative of some dryland cotton production in the Lubbock area. Each producer should calculate the average variable cost of production for his/her area as well as the fixed costs so that total cost of production is estimated.

Long July call options were used as "storage" after the actual crop was sold. Depending upon the time of year, options on other futures months could be used. The analysis determined what percentage of the time a producer would have benefited from the long call. It was assumed that the producer would automatically purchase a July call at the time of cash sale in either December or March. The purchase time and futures month may vary from area-to-area and year-to-year, depending on market movements. In this analysis, July call options were held until just before the last trading day of the option; i.e., the first Friday in the month preceding the maturity date of the underlying futures contract.

The July call may also be important in conjunction with the marketing loan deficiency payment (MLDP). If the AWP of cotton is below the base loan rate after harvest, the producer may choose to receive the loan deficiency payment by having the crop declared not eligible for CCC loan and selling in the cash market. At that time, he/she would receive a marketing loan deficiency payment based on the difference between AWP and base loan. The producer could use the MLDP to purchase as many July calls as needed to cover the bales produced. It is important to note that if the AWP is below the loan rate prior to harvest, the producer may buy July calls in anticipation of the AWP going up and the MLDP decreasing. If the position were entered early in the crop year when AWP was low but subsequently increased above the loan rate at harvest, the producer would have "protected" the potential MLDP.

Timeline for Futures and Options Trades

For comparison, each period examined followed an identical schedule. An opportunity to sell a December or March futures contract at or above the cost of production was sought beginning in January of each period. Although the variable cost of production was set at 50.00 cents per pound, each producer must adjust for the expected basis. The average basis for Lubbock High Plains 41-34 Strict Low Middling cotton for the past twelve years has been -7.19 cents per pound with the range from -11.28 to -3.88 cents for a December sale. A basis of -7.00 cents per pound was used here.

Beginning on the date that the short futures position was entered, a second analysis determined the profitability of a long put purchased at-the-money as an alternative to the short futures. The premium was determined using the Black-Scholes model. The analysis considered the December and March contracts separately to provide for early or late harvest.

The December and March futures and put options positions were closed and the cash crop sold on the first Wednesday of November and February, respectively. These dates were chosen to insure that the positions were closed before the last trading day of the applicable option. The cash price was determined using the actual basis for the date of sale. The trade occurred the first time the futures price was at or above 57.00 cents per pound; the price needed to cover the variable cost of production with a basis of -7.00 cents per pound. At the time of the cash sale, a July call was purchased at-the-money to establish the "storage" position. The July call was sold (offset) during the first week of June if the premium was worthwhile and the gain or loss determined.

Timeline for MLDP

When the AWP fell below the base loan rate after August 1 of each period, a July call was purchased at-the-money. The July call was sold the first week of June concurrent with the call purchased for the "storage" position. In periods when the AWP fell below the base loan rate, the producer would hold two separate long call positions.

Results

There were numerous opportunities to short futures at 57.00 cents or higher during each of the five years or seasons as shown in Tables B through F. Each table shows the number of days during each period that the producer could have received at least the variable cost of production. Cost of production was attainable from 49% to 100% of the contract days using a December futures contract, and from 69% to 100% using a March contract (Tables B through F). Profitability could have been increased by trading at a later date, but the time window of opportunity decreased as price increased.

Unfortunately, of course, one cannot obtain the highest price of the season other than by luck. Thus, a conservative approach to hedging was used herein. For hedging, the short futures positions and, alternatively, long put positions were entered the first date that the appropriate futures price equaled or exceeded 57.00 cents per pound objective. Higher prices subsequent to the entry date would have provided higher returns.

All trades placed in the futures and options markets at 57.00 cents or higher on the first date available resulted in a net price at or above the variable cost of production of 50.00 cents per pound except for the December 1989/90

short hedge (SHF) (Table G). Simply selling in the cash market at harvest was best for the three years 1987, 1989 and 1990 when prices were higher at harvest than at the initial hedge date. Put option short hedges not exercised (PNX) provided the next highest price levels because the put options allow the user to benefit as prices increase. At the other extreme, the regular short hedge provided the highest minimum price when price at harvest was below the initial hedge date for the 1988 and 1991 seasons. The short hedges with put options exercised (PX) were equivalent to or better than cash prices when prices fell. The five season average price was highest for cash sales at harvest and second highest for put option short hedges.

In summary, for the 1987 through 1991 period, selling in the cash market without hedging yielded the highest average return because price increased subsequent to the initial hedging date for three of the five years. Use of the put option for a short hedge was "second best" and subject to the least variability. Considerably higher prices were available later in each season but securing them would have required a higher target than the 57.00 cents used herein.

Considering price risk, the put option strategy gave the best alternative in a rising market. The use of a put option reduces risk by providing a price floor and unlimited profit potential from upward price movement. Because of this favorable risk/return relationship, the put option strategy should be considered by producers with expectations for a rising market. In a stable or declining market the put option strategy provides a net price that is lower than the net price received from a regular short hedge due to the premium paid for the option.

July Call "Storage"

Buying a July call for "storage" when the crop was sold at harvest provided additional revenue for only two years for the December contract and four years with the March contract (Table G). In both the December and March contract cases, the total net return was positive for the July call "storage" over the five years, in spite of the three losses for the December case.

MLDP

The MLDP payment was available in 1988 and 1991 when the AWP fell below the loan rate. Numerous opportunities existed in 1988 for the producer to protect the MLDP using a July call. The MLDP was available the first day of eligibility in period two, August 1, 1988. On this date, the AWP was 50.32, which was 1.18 cents below the base loan rate. On that date, the closing price for a July 1989 contract was 56.80 cents per pound. A 57 cent July call at-the-money traded for 3.43 cents premium. On the closing date of May 31, 1989, the July 1989 futures settlement price was 67.86 cents per pound and the value for a 57 cent July call was 10.86, or 7.43 cents per pound above the premium paid (Table G).

Table B. Futures Prices Above Cost of Production and Basis, January 1, 1987 through July 15, 1988.

December 1987 Futures		March 1988 Futures	
Min. Price	51.05	Min. Price	51.60
Max. Price	79.82	Max. Price	80.77
Futures Price	Percent of Time	Futures Price	Percent of Time
57.00	48.66	57.00	69.44
63.00	41.71	63.00	52.55
69.00	29.41	69.00	33.78
75.00	10.43	75.00	13.94
79.00	2.14	79.00	4.02

Source: USDA Agricultural Marketing Service Daily Spot Quotations, 1987-1992.

Table C. Futures Prices Above Cost of Production and Basis, January 1, 1988, through July 15, 1989.

December 1988 Futures		March 1989 Futures	
Min. Price	48.84	Min. Price	49.22
Max. Price	67.83	Max. Price	68.50
Futures Price	Percent of Time	Futures Price	Percent of Time
57.00	68.09	57.00	70.59
61.00	50.27	61.00	35.29
65.00	24.73	65.00	15.24
67.00	11.97	67.00	4.81
69.00	3.46		

Source: USDA Agricultural Marketing Service Daily Spot Quotations, 1987 - 1992.

Table D. Futures Prices Above Cost of Production and Basis January 1, 1989 through July 15, 1990.

December 1989 Futures		March 1990 Futures	
Min. Price	55.60	Min. Price	55.25
Max. Price	77.04	Max. Price	77.82
Futures Price	Percent of Time	Futures Price	Percent of Time
57.00	75.60	57.00	83.60
63.00	52.82	63.00	67.74
69.00	31.64	69.00	39.52
75.00	7.51	75.00	16.94
77.00	0.54	77.00	2.42

Source: USDA Agricultural Marketing Service Daily Spot Quotations, 1987 - 1992.

Table E. Futures Prices Above Cost of Production and Basis, January 1, 1990 through July 15, 1991.

December 1990 Futures		March 1991 Futures	
Min. Price	62.90	Min. Price	63.75
Max. Price	76.49	Max. Price	88.10
Futures Price	Percent of Time	Futures Price	Percent of Time
61.00	100.00	61.00	100.00
65.00	83.11	65.00	91.03
69.00	35.12	69.00	54.62
73.00	18.23	73.00	41.03
75.00	4.02	77.00	8.97
		81.00	5.71
		85.00	3.26
		87.00	0.82

Source: USDA Agricultural Marketing Service Daily Spot Quotations, 1987 - 1992.

Table F. Futures Prices Above Cost of Production and Basis, January 1, 1991, through July 15, 1992.

December 1991 Futures		March 1992 Futures	
Min. Price	56.20	Min. Price	52.85
Max. Price	76.05	Max. Price	76.86
Futures Price	Percent of Time	Futures Price	Percent of Time
57.00	98.92	57.00	89.22
63.00	90.84	63.00	75.74
67.00	57.41	67.00	50.67
71.00	14.02	71.00	19.14
75.00	2.16	75.00	4.58

Source: USDA Agricultural Marketing Service Daily Spot Quotations, 1987 - 1992.

Table G. Net Price Received for Cash, Short Hedges with Futures and Options, and "Storage" and MLDP Returns.

Crop Year	NP _{Cash}	NP _{SHF}	NP _{PNX}	NP _{PX}	"Storage"	MLDP
----- cents/lb. -----						
December Contracts:						
1987	60.00	51.10	56.26		(3.33)	
1988	51.25	59.11		55.15	8.05	7.43
1989	66.75	48.41	62.94		(1.01)	
1990	70.00	58.52	65.85		6.65	
1991	<u>58.75</u>	<u>62.17</u>		58.44	(3.32)	(3.20)
Average	61.35	55.86	59.72		1.41	
March Contracts:						
1987	54.50	50.57	50.28		0.88	
1988	55.00	60.00		55.82	4.74	7.43
1989	61.50	51.25	57.17		9.45	
1990	67.75	52.52	62.90		5.35	
1991	<u>50.75</u>	<u>61.84</u>		57.58	(1.35)	(3.20)
Average	57.90	55.23	56.75		3.81	

USDA Agricultural Marketing Service Daily Spot Quotations, 1987-1992.

Note: Average prices for the five year period are shown below each column(s).

Table H. Cash Price and Combined Net Prices for Futures and Options With "Storage" and MLDP Effects.

Crop Year	NP _{Cash}	NP _{SHF}	NP _{PNX}	NP _{PX}
----- cents/lb. -----				
December Contracts:				
1987	60.00	47.77	52.93	
1988	51.25	74.59		70.63
1989	66.75	47.40	61.93	
1990	70.00	65.17	72.50	51.92
1991	<u>58.75</u>	<u>55.65</u>		
Average	61.35	58.11	61.98	
March Contracts:				
1987	54.50	51.45	51.16	
1988	55.00	72.17		67.99
1989	61.50	60.70	66.62	
1990	67.75	57.87	68.25	
1991	<u>50.75</u>	<u>57.29</u>		53.03
Average	57.90	59.89	61.41	

Source: USDA Agricultural Marketing Service Daily Spot Quotations, 1987-1992.

Note: Average prices for the five year period are shown below each column(s).

The AWP eventually fell to a low of 41.00 cents per pound, or 10.50 cents below the base loan rate, for the 5 days between August 26 and September 1, 1988 (Figure 1).

The July 1989 contract settlement was 50.75 on August 26 with an at-the-money call premium of 2.91 cents. The call value on the closing date was 16.86. This would have resulted in a return of 13.95 cents per pound on the initial trade, plus the 10.50 cents MLDP for a total price enhancement of 24.45 cents.

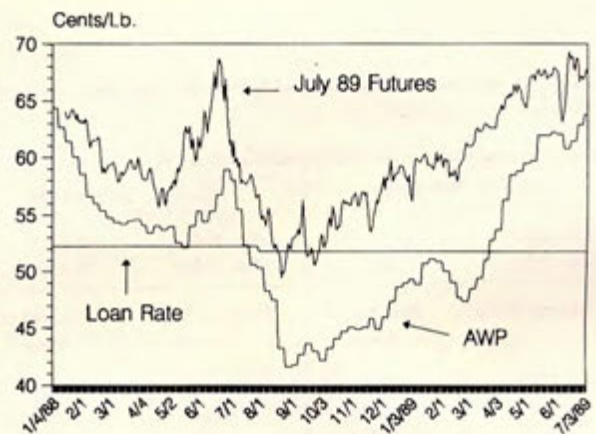


Figure 1. AWP vs. Loan Rate, 1988, Crop

The AWP was below the marketing loan rate from August 8, 1988, to March 22, 1989, 163 trading days. Therefore, the producer could have "hedged" or protected some of the MLDP for approximately two-thirds of the trading days from August 1, 1988 to July 31, 1989.

While the AWP fell below the loan rate for the 1991 crop beginning November 1, 1991 (Figure 2), the MLDP protection strategy resulted in a loss in 1991 because the July futures contract price declined between November 1, 1991 and June 3, 1992. On November 1, the AWP was 50.19, or 0.58 cents below the base loan rate of 50.77. The July 1992 contract settlement price was 64.50 with an at-the-money call premium of 3.20 cents. On the closing date of June 3, 1992, the 65 cent call had no value as the futures price had decreased. This resulted in a loss of the premium paid for the option. The AWP reached a low of 40.08 for a period of 15 days between March 13 and April 2, 1992. The settlement price for a July contract on March 13 was 55.85 cents. The at-the-money call premium on this day was 1.82 cents. On June 3, 1992, the premium for a 56 cent July call was 2.88 cents. Thus the maximum MLDP profit available was only 1.06 cents per pound during 1991.

Conclusions

On average, December contracts exhibited slightly higher net prices than March contracts partly because the average basis was stronger for December contracts than for March contracts. The loss experienced from the July call "storage" for December 1987 and December 1989 caused the net price for a short hedge to fall below the variable cost of production. The use of a put option short hedge yielded a net price higher than the variable cost of production for each of the five seasons.

The highest net price would have been received using the cash market sale for four of the ten periods examined. The net prices received using the short hedge strategy and the put option strategy were adversely affected by either a weaker basis than anticipated or a loss experienced with the July "storage hedge" for these four cases. However, it is important to realize the potential for risk reduction, if not price enhancement, available through the use of short hedge or put option strategies.

This analysis suggests that the gains from protecting the MLDP and the returns from the "storage" were worthwhile versus the straight cash approach. Incidentally, since the AWP moves on a weekly basis, producers have a time advantage in deciding when to trade to protect the MLDP.

The July "storage hedge" was profitable in only two of the five periods using the December futures contract and a November cash sale date. The "storage" increased income in four of the five periods using the March futures contract and a February cash sale date. The added profitability for the 1988 crop due to the availability of the MLDP was particularly significant. Producers need to be aware of the opportunity to enhance income through the use of the MLDP and call options.

The potential for profit from the MLDP existed in 1992 and continues for the 1993 crop as it did in the period from January 1, 1988, to July 1989. Through study of the markets and knowledge of available pricing alternatives, the producer may generate substantial profits beyond those, if any, available through the normal cash sales and hedging strategies.

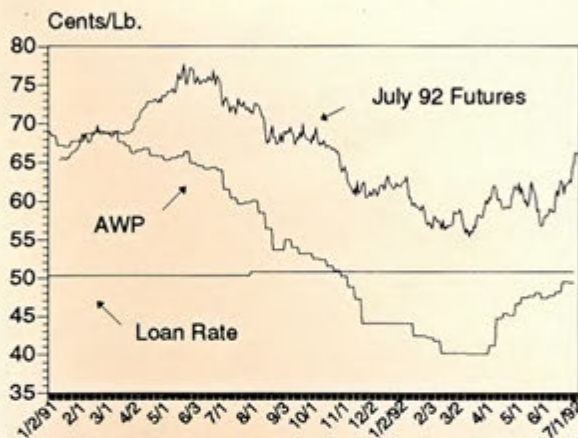


Figure 2. AWP vs Loan Rate, 1991 Crop

The AWP fell below the loan rate on November 1, 1991, and did not recover by the end of the 1991 crop (Figure 2). The MLDP was available 134 of 241 trading days, or 55.60%. The profit potential in 1991 was not as large as in 1988. The 1988 and 1991 situations are similar to the marketing loan period situation beginning August 1, 1992, when there were many opportunities to protect the MLDP.

Applying both the MLDP protection and "storage" returns (or losses) to the net prices for short hedges with futures and put options in Table G provides the combined net prices in Table H. Cash prices remain the same. The potential for the more involved pricing procedures incorporating futures and/or put and call options is apparent in that the five year average net price for the put option hedge plus long calls was higher than the cash or regular short hedge average net price. Cash price was highest in three of the years using the December contract but highest in only one of the years where the March contract (later cash sale) was used. Significant returns from the July call "storage" and MLDP procedures available in some years improved the overall returns for the five seasons, particularly where the cash sale was later in the season and the March futures contract was used.

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