A Comparison of Selected Cotton Hedges For Arizona Cotton Producers

S. J. Torok, Assistant Professor of
Agricultural Economics, The University of Wyoming,
W. E. Beach, Graduate Research Assistant, Arizona State University

Abstract

Cotton options on futures began trading in the fall of 1984 offering Arizona cotton producers an alternative risk management tool. Advantages of hedging with cotton options include: limiting risk, preserving unlimited profit potential, providing increased marketing flexibility and greater liquidity. This study compared selected cotton option hedges utilizing mean net revenues and standard deviations. Also, computed premiums were calculated with a modified Black-Scholes option pricing model to identify a historical price volatility that consistently signaled favorable cotton option trades.

******

Cotton options on futures contracts, which began trading in the fall of 1984, differ from other forward contracting methods by offering producers the right -- but not the obligation -- to buy or sell a futures contract at a specified price until the option expires (Kenyon, 1984). The right to sell (buy) a futures contract at a specific price is a put (call) option.

The hedging advantages that the purchasing of a put option provides an Arizona cotton producer includes: the limitation of losses to the cost of the premium, the establishment of a minimum selling price and the unlimited profit potential should cash prices rise. Producers can use options as a mechanism for risk management with greater flexibility and liquidity than both cash forward contracting and futures trading which lock the producer into one price (Belongia, 1983).

Trading cotton options is not without disadvantages. The cost of the option premium and the basis risk associated with futures contracts still exist. Also, lack of producer exposure to cotton options may hinder the liquidity and efficiency of options trading (Kenyon, 1984).

This study investigates selected cotton option hedges to provide producers of Arizona upland cotton an evaluation of cotton option hedges. The cotton option hedges are evaluated in terms of mean

net revenues and standard deviations of the mean net revenues for the three month period of April to June, 1985. Daily theoretical premiums were also calculated using a modified Black-Scholes pricing model for different historical volatilities at each strike price for the same time period to compare the relationship of actual and calculated premiums.

Methodology

Cotton option hedges were determined by classifying daily strike prices at one cent intervals into corresponding out of the money (OTM), at the money (ATM), and in the money (ITM) classes. For example, if the daily futures price was 65 cents/lb., the corresponding ATM strike price would also equal to 65 cents/lb. (0), and a strike price of 64 cents/lb. would be 1 cent out of the money (-1).

The classification break down provided 13 different cotton option hedges for the period of April to June, 1985, ranging from 5 cents out of the money (-5) to 7 cents deep in the money (+7). At the money (ATM) was always designated as (0).

Data for the December, 1985, futures price of New York #2, grade 4, staple cotton are from the Wall Street Journal. Strike prices and premiums for December put options were provided by E. F. Hutton and Videcom Service by ADP Comptrend. Phoenix cash prices for SLM 1-1/16 inch cotton are from the USDA Agricultural Market Service. The data collected for the December, 1985, put option was from the period of April to June, 1985. The April to June period was chosen because of data availability.

A net price for each cotton option hedge was calculated based on one cotton futures contract of 50,000 pounds. Net price is defined as:

NP = CPc + (SP - FPc) - P - HC

Where:

NP = Net price

CPc = Cash price for November 1, 1985 (option expiration date)

SP = Strike price or exercise price

FPc = Closing futures price on November 1, 1985 (option expiration date)

P = Premium or price of the option

HC = Hedging costs

Hedging costs included the cost of buying the cotton option, a minimum of $15 or 5% of the option contract value (option premium multiplied by 50,000 lbs.), plus a $90 commission fee for exercising the option of the day of expiration. All cotton

option hedges were purchased puts and held until the day of expiration. It is assumed that the option was exercised and the short futures position was immediately offset in the futures market on the November 1, 1985 closing futures price.

To develop a basis for evaluation of each cotton option hedge, the mean net revenues and standard deviations of the mean net revenues were calculated. Mean net revenues were calculated by multiplying the sum of the net price for a selected 1 cent interval by one contract (50,000 lbs.) then divided by the number of observations for the selected one cent interval. The standard deviation measures the variability of the mean net revenues. The most preferred cotton option hedge produces the greatest mean net revenue with the smallest standard deviation.

A second objective of this study was to identify a historical price volatility that consistently signaled favorable cotton option trades. A modified Black-Scholes option pricing model was employed to calculate theoretical put premiums for each strike price using different historical volatilities. The Black-Scholes pricing model calculates the premium (P) as a function of U, S, T, R, V (Labuszewski, 1983).

Where: U = Underlying futures price
S = Strike price
T = Term until expiration
R = Short term interest rates, (26 week T-bill)
V = Market place volatility.

Thirty to ten day historical price volatilities were calculated using a basic computer program developed by Labuszewski (1983). Daily theoretical put premiums were calculated for each strike price using 21 different historical volatilities (30 day to 10 day) totaling 7014 observations, in the study period of April to June, 1985.

Theoretical and actual premiums were compared to determine which historical price volatility (30 day to 10 day) forecasted overpriced or under priced premiums. If the calculated premium is lower than the actual premium, it may be inferred that the actual premium is overpriced. However, if the actual premium is equal to or lower than the calculated premium, it may be inferred that the actual premium is at a "fair market price."

Results and Discussion

The cotton option analysis provided thirteen different cotton option hedges ranging from -5 cents out of the money to +7 cents deep in the money. Table 1 presents the mean net revenue, stan-

dard deviation, and coefficient of variation for each of the thirteen cotton option hedges. The choice of a particular cotton option hedge will depend on the mean net revenue and the Arizona cotton producers' preference for risk (standard deviation).

The cotton option hedges that were in the money (+) yielded the highest mean net revenues except for option hedge +7 (which was "deepest" in the money) and option hedge +2. The cotton option hedges with the lowest risk, as measured by the standard deviation of the mean net revenue, were option hedges -4 and -5 (both "deep" out of the money).

In terms of group means, the "in the money" class of cotton option hedges had a higher mean net revenue ($28,477) as compared to $28,286 and $28,033 for the "at the money" and "out of the money" classes of cotton option hedges, respectively. The choice of the most preferred strategy is ambiguous; ultimately, it will depend on the Arizona cotton producers' risk preference.

The results from the modified Black-Scholes option pricing model were inconclusive. Our objective was to identify a historical price volatility that consistently signaled favorable cotton option trades. The comparison of Black-Scholes calculated premiums to actual premiums failed to identify any historical price volatility that consistently signaled that the actual premium was under-priced or overpriced. A future examination of historical price volatilities using a longer time (e.g., 12 or 24 months of data) may provide significant results.

Table 1. Means, Standard Deviations, and Coefficients of Variation for Net Revenues from Cotton Option Hedging Strategies

Options Hedges (cents/lb)	Mean Net Revenue	Standard Deviation 4/	Coefficient of Variation (Percent)
(-5) 1/	27962	30	0.11
(-4) 1/	27920	29	0.11
(-3)	28012	530	1.8
(-2)	28027	787	2.8
(-1)	28244	731	2.6
(0) 2/	28286	795	2.8
(+1) 3/	28513	817	2.9
(+2) 3/	28075	826	2.9
(+3)	28978	896	3.1
(+4)	28997	713	2.5
(+5)	28450	427	1.5
(+6)	28440	155	0.55
(+7)	27883	186	0.67

1/ (-) Out of the money
2/ (0) At the money
3/ (+) In the money
4/ Dollars per 50,000 pounds of cotton

References

Belongia, M. T. "Commodity Options: A New Risk Management Tool for Agricultural Markets." Federal Reserve Bank of St. Louis Review, June-July, 1983.

Gardner, B. L. "Commodity Options for Agriculture." American Journal of Agricultural Economics, 59, December 1977.

Kenyon, D. E. "Farmer's Guide to Trading Agricultural Commodity Options," Agriculture Information Bulletin No. 463, Economic Research Service, U.S. Department of Agriculture, April, 1984.

Labuszewski, J. "Volatility Key to Finding Fair Options Premium." Futures, Vol. 12, September, 1983.

Meisner, J. and J. Labuszewski. "Modifying the Black-Scholes Option Pricing Model for Alternative Underlying Instruments." Financial Analysts Journal, November-December, 1984.

U.S.D.A. Agricultural Marketing Service. Phoenix Cotton Division.

Wall Street Journal. Various Issues.

****
****

Put Options on Cotton Futures Contracts as Low Price Insurance

Robert S. Firch, Agricultural Economist

The value of buying put options on futures contracts on cotton has not yet been realized to any substantial extent. The futures price at the beginning of trading of the options on October 30, 1984, was only slightly above the government loan price for cotton, and it has declined since that time. This lack of downside price risk has contributed to the lack of trading in options.

For those cotton growers who are eligible for the loan program, the low price protection achieved by buying put options will have little or no value until the price of cotton moves substantially above the loan price. The latter is not likely to happen in the next 12 months as carryover stocks are currently projected to be very high next August 1.

Until the options started trading in late 1984, we could only guess at the level of the premium that would occur. Now we have at least some limited experience on which to base expectations on premiums that will occur in the future. However, the premiums that have been paid so far are probably somewhat below normal because the futures price of cotton has been so close to the government loan price.

As the futures price of cotton goes up, the premiums also rise. As the strike price rises for any given futures price, the premium rises. As the days till expiration of the option decline, the premium declines. As interest rates rise, the premiums decline, and as the volatility of the futures contract price increases, the premium increases.