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An Evaluation of Hedging Strategies for Backgrounding Feeder Cattle in Tennessee

University of Tennessee Agricultural Experiment Station

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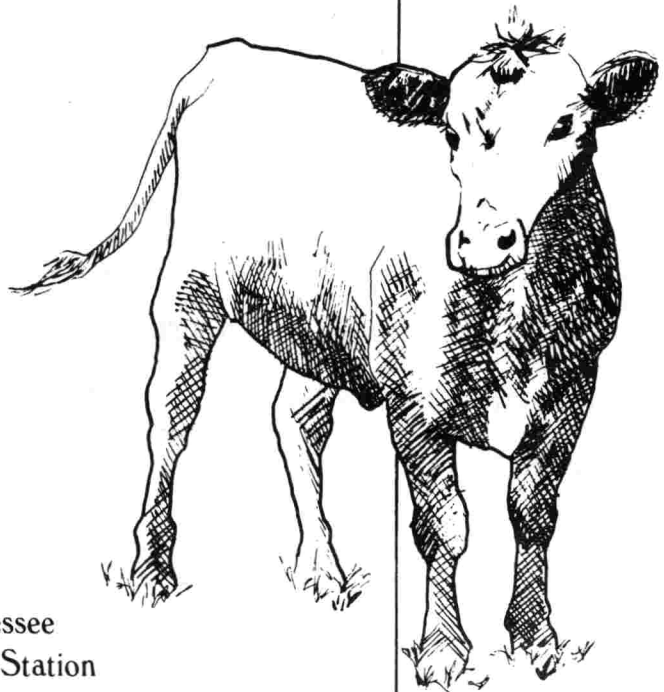
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An Evaluation of Hedging Strategies for Backgrounding Feeder Cattle in Tennessee

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An Evaluation of Hedging Strategies for Backgrounding Feeder Cattle in Tennessee

C. D. Miyat and D. L. McLemore*

INTRODUCTION

During the past decade feeder cattle producers have experienced increased production costs and highly variable livestock prices. This situation creates the need for management techniques which can help protect producers from adverse price fluctuations.

Futures market hedging is a risk management technique which, when properly used, may offer producers protection from adverse price movements, helping them to maintain a profitable operation. In addition, hedging may improve the producer's ability to obtain production credit. Many loan officers consider a producer's ability to minimize risk, as well as his ability to maximize profits, as an important factor in evaluation of farm loans.

A substantial number of studies have collectively analyzed numerous variations and combinations of proposed hedging strategies to determine their potential as risk management tools [2,5,6,4,10,7, 8,9,12]. Results from these studies and others indicate that while hedging appears to offer potential for increasing a producer's net returns and decreasing the risk he bears, there are no assurances of this. In fact, the opposite may occur. Therefore, the ability to increase net returns or minimize losses through hedging depends to a large extent on the producer's ability to determine when to hedge and when to remain unhedged.

Unfortunately, little research has specifically addressed questions pertaining to the profitability and reliability of alternative hedging strategies applied to Tennessee operations and markets. Such information could be of substantial benefit to the State's cattle industry. The general objective of this study, therefore, was to determine

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whether futures market hedging was a viable management tool to help Tennessee feeder cattle backgrounding operations increase net returns and/or reduce price risk. More specifically, the objective was to determine the optimal pricing strategies for Tennessee feeder cattle backgrounding operators over the recent past using the level and variability of net returns as criteria for evaluation. Alternative hedging strategies were evaluated by simulating the actual use of the strategies over the 1972-79 period for typical feeder cattle backgrounding operations in Tennessee. The analysis was based upon the assumption that a study of past performance of the various strategies tested will give a strong indication of their future performance.

HEDGING PROCEDURE

This study selected and analyzed those hedging strategies which appeared to offer the producer the greatest potential to maximize returns and minimize risk based upon similar studies conducted for other geographic areas, time periods, or production systems [5,6,7]. Some new variations of the selected hedging strategies were also tested to determine their effect on the level and variability of net returns.

Feeder Cattle Futures Trading

Live feeder cattle futures contracts are offered for January, March, April, May, August, September, October, and November by the Chicago Mercantile Exchange. These contracts are usually offered for trading about a year in advance of their maturity date, with all trading terminated on the twentieth day of the respective contract month.¹ Each contract is for 42,000 pounds of feeder steers averaging between 550 and 650 pounds which is approximately 76 to 65 head, respectively.² The contract specifies that the feeder steers must grade not less than 80% USDA Choice and not more than 20% USDA Good quality grade.

In this study, the May, August, September, October, and November futures contracts were used, beginning with the 1973 contract year and ending with the 1979 contract year. A computer simulated summer backgrounding operation which began on March 15, April 15, and May 15, and ended on September 1, October 1, and November 1, respectively, utilized the September, October, and November

¹If the 20th is not a business day, trading is terminated on the business day immediately preceding the 20th.

²Beginning with the January 1982 feeder cattle contracts, the Chicago Mercantile Exchange will implement new trading specifications. The contract will be 44,000 pounds of feeder steers averaging between 575 and 700 pounds. The steers will be of medium frame and the lower two-thirds of the large frame size and USDA No. 1 muscle thickness with not more than 13 head of the top one-third of the USDA No. 2 muscle thickness.

contracts, respectively, for hedging purposes. A computer simulated winter backgrounding operation which began September 1, and ended May 1, used the May contract, while the operations which began on October 1 and November 1, and ended on June 1 and July 1, respectively, used the August contract for hedging purposes.

All positions taken in the futures market were mechanically dictated by the particular hedging strategy being followed which eliminated all subjectivity from marketing decisions. Certain trading rules were imposed to make the trading simulation realistic:

- 1) The producer was not allowed to take a position in the futures market until the day he actually began backgrounding the steers.
- 2) The producer was not allowed to place a hedge after the 23rd day of the month immediately preceding the month in which the feeder steers were to be sold.
- 3) If the producer was holding an open position in the futures market on the day he sold the feeder steers in the cash market, he was also required to close out his futures position the same day.
- 4) No futures trading was allowed on days when the closing price moved the daily limit.

Trades which could not be made on the appropriate day because of limit moves were deferred until the next trading day.

Cash Market Strategy

The traditional cash market sale of feeder cattle served as the benchmark strategy against which the other strategies were compared. This "no-hedge" strategy made no use of the futures market. Net returns for this strategy were computed simply by subtracting the calculated break-even price³ per hundredweight (cwt.) from the cash price per cwt. received for the feeder steers at the completion of each backgrounding operation.

Elementary Hedging Strategies

Cash prices on local markets typically are not identical to price quotations on futures markets even during delivery periods. This difference between the futures price and the local cash price is known as the **basis**. Basis is defined as the number of cents per cwt. that, on a given day, the local cash price for feeder steers is above or below the current price for the next maturing futures contract. Therefore, a producer with perfect knowledge of the basis for his local market could translate a given futures price into a price he could expect to

³The break-even price reflects the price required for a marketed feeder steer which would allow the producer to exactly cover all variable costs.

receive from his local market. This process is known as "localizing" the futures price.

The elementary hedging strategies require that the producer have some estimate of his local basis so that he can translate a given futures quotation into a localized futures price. Although these strategies are selective, they do not allow the producer to be "in and out" of the futures market. Once a hedge has been placed the producer does not lift the hedge until the end of the production period (hedge and hold approach). Some exceptions are noted later. A hedge was placed when specific criteria were met. If the criteria were never met, no hedge occurred.

Localized Futures Exceeds Break-even Price. This strategy triggered hedging only if the calculated localized futures price was greater than the computed break-even price. The results of this hedging strategy rely on the ability of the producer to accurately predict the basis. If the basis is accurately predicted this strategy will insure the producer that at least all of the variable costs will be covered, provided the difference between the localized futures and break-even is sufficient to cover the cost of trading futures. If the basis is underestimated, however, this strategy could result in a net price which is too low to pay variable costs.

Variations on the elementary Localized Futures Exceeds Break-even strategy included the addition of specific dollar increments to the break-even price criterion. The increments consisted of \$.50, \$1, \$2, \$3, and \$5 per cwt. This made the hedging criterion more selective and, if the basis is correctly estimated, would insure some return above variable cost. Adjustments were made in the size of the increment to account for inflation over the simulation period (1972-1979) as explained later.

Localized Futures Exceeds Cash Price. This strategy allowed a hedge to be placed only when the localized futures was above the current local cash price. This strategy might permit a producer to take advantage of cyclical and seasonal cash price patterns by locking in higher current futures prices when subsequent futures or cash prices are low. As in the previous strategies involving the computation of the localized futures price, the results of this strategy also rely on the ability of the producer to accurately predict the basis.

Variations on the Localized Futures Exceeds Cash strategy included the addition of \$1 and \$2 per cwt. increments to the cash price criterion. These strategies would be more selective resulting in fewer hedges.

Inflation Adjustments. In order to maintain a constant real value for the dollar increments used in the strategies discussed above, it was necessary to account for the loss in value of the dollar caused by inflation over the 1972-79 time period. This was accomplished by

adjusting the increments by the index of prices paid by farmers for commodities, interest, taxes and wage rates converted to a 1972 dollar base [16]. The resulting dollar increments used in the elementary hedging strategies are shown in Table 1. For example, a \$5 increment in 1972 was equivalent to a \$7.20 increment in 1975 and a \$10 increment in 1979. This procedure was necessary to simulate equivalent comparisons of the strategies over time.

Table 1. Index of Prices Paid by Farmers (1972=100) and Inflated Dollar Increments used in the Elementary Hedging Strategies for the Simulation Period, 1972-1979

Year	Index	Increments in Current Dollars				
		----- Dollars/cwt. -----				
1972	1.000	0.500	1.000	2.000	3.000	5.000
1973	1.152	0.576	1.152	2.304	3.456	5.760
1974	1.312	0.656	1.312	2.624	3.936	6.560
1975	1.440	0.720	1.440	2.880	4.320	7.200
1976	1.536	0.768	1.536	3.072	4.608	7.680
1977	1.616	0.808	1.616	3.232	4.848	8.080
1978	1.752	0.876	1.752	3.504	5.256	8.760
1979	2.000	1.000	2.000	4.000	6.000	10.000

Source: Calculations on data from U. S. Department of Agriculture, **Agricultural Statistics**, U. S. Government Printing Office, Washington, D. C., 1979, p 454.

Variations in Lifting the Hedge. Three variations in lifting each hedge were evaluated with the elementary hedging strategies. The first variation required that once a hedge had been placed, it was not lifted until the feeder steers were marketed, regardless of what happened to price levels in the meantime. Some economists refer to this type as a "pure" hedge.

The second and third variations in lifting the hedge involved margin requirements for futures trading. When a hedger or speculator initiates a futures contract, he is required to post a predetermined amount of cash, commonly referred to as the initial margin deposit, which serves as a guarantee of fulfillment of the contract. Once the initial margin has been deposited and a trade executed, the trader must maintain a certain margin equity or his position in the futures market will be closed out automatically by the brokerage firm. This required maintenance level is set below the initial margin level. If the futures market moves against the individual's position to the extent that the individual's margin equity is below the maintenance level required, the individual will receive a "margin call" from the brokerage firm for additional funds to bring the account back up to the initial level. On the other hand, if the futures market moves in a

favorable direction to the individual's position, the trader can withdraw the excess above the required margin level. Margin calls are usually cause for concern on the part of the hedger because they can exhaust the producer's cash reserves and available credit and may cause cash flow shortages. However, margin calls should not cause the hedger to overreact by lifting his hedge at an inopportune time.

The second variation lifted the hedge when the producer received his first margin call. Instead of meeting the margin call, the producer liquidated his position in the futures market. Once the hedge had been lifted, the producer did no further futures trading for the duration of the production period. The dollar difference between the initial and maintenance margin requirements for the particular futures contract (Table A-1, Appendix) determined the amount of adverse price movement needed before the market triggered the margin call.

The third variation lifted the hedge when the producer received a second margin call. This meant the producer met the first margin call but liquidated his position upon receiving the next margin call. Again, once the hedge had been lifted, the producer did not reenter the futures market.

Moving Average Hedging Strategies

Moving average hedging strategies are trend-following methods of technical price analysis based on the principle of "selling weakness and buying strength" [5]. They utilize the concept of progressive averages by adding the current price to the end of the averaged series daily, while simultaneously dropping the oldest price from the beginning of the series. Shorter length moving averages are more sensitive to price changes than are longer length moving averages. Thus, the shorter length moving average will indicate a directional change in the price trend sooner than will a longer length moving average. The moving average hedging strategy uses different length moving averages, and sell and buy signals are generated by the "crossing action" of the moving averages. The success of this concept is based on the notion that, since progressive moving averages consist of a number of daily price observations, they are better indicators of the "true" direction of price trends than the daily price fluctuations.

The objective of a trend-following method is to prevent the producer from placing a hedge on an upward trending market, yet allow him to place a hedge on a downward trending market. A strategy consisting of two different length moving averages generates a sell signal when the shorter length moving average crosses the longer length moving average from above. This indicates a downward turn in price movement. An upward turn in price movement or a buy signal is indicated when the shorter length moving average crosses the longer length moving average from below. The crossing action becomes more frequent and reflects a greater degree of sensitivity in revealing

price trend changes as the time length of the moving averages becomes shorter. Figure 1 illustrates the sell and buy signals generated by the crossing action of two moving averages.

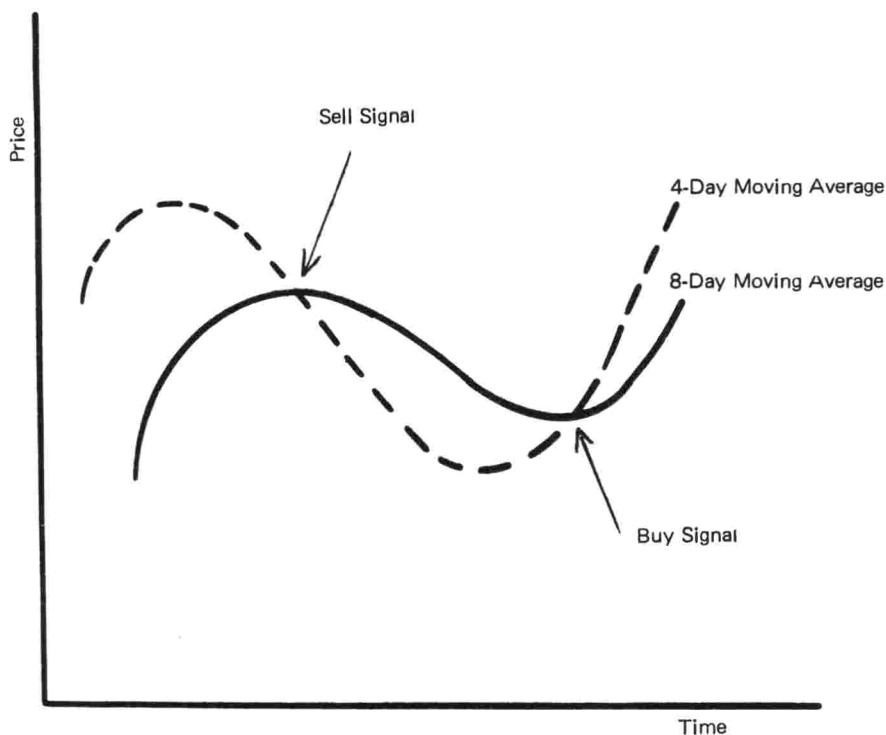


Figure 1. Illustration of Crossing Action of Two Moving Averages.

Some of the false signals generated by the strategies consisting of two moving averages can be eliminated when a third moving average is added to the strategy. This third moving average serves to either confirm or contradict the signals being generated by the other two moving averages. A sell signal is generated only when the shortest length moving average has preceded the medium length moving average in crossing the longest length moving average from above. Conversely, a buy signal is indicated only when the shortest length moving average has preceded the medium length moving average in crossing the longest length moving average from below. Figure 2 illustrates the sell and buy signals generated by the crossing action of three moving averages.

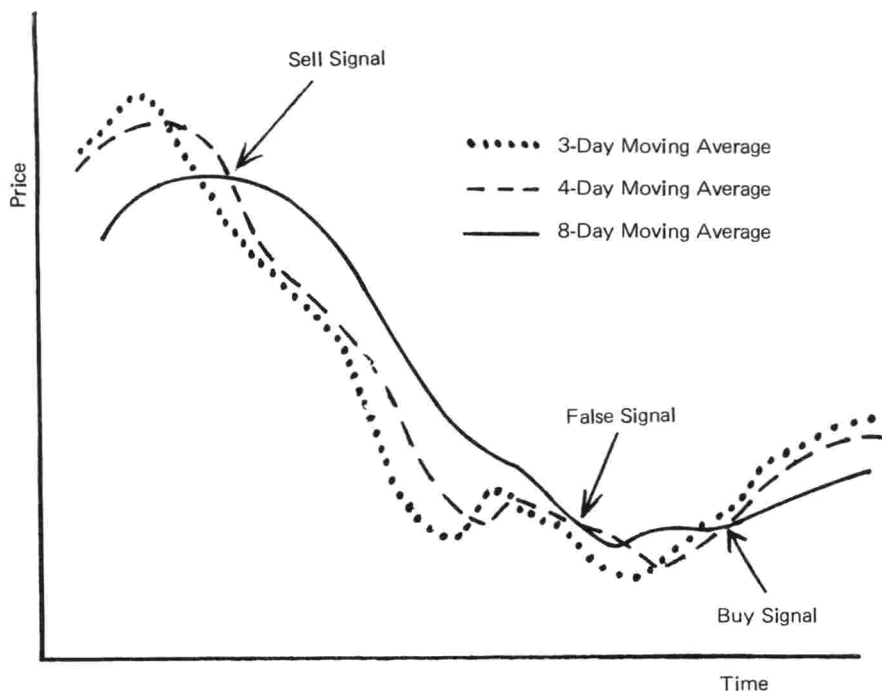


Figure 2. Illustration of Sell and Buy Signals from Three Moving Averages.

Recently a new dimension was added to the moving average technique with the application of a **weighted average scheme** [5]. This approach consists of giving the most recent price in the moving average series the largest weighted value, with the successively older prices in the series receiving successively smaller weights. This new dimension maintains the concept of moving averages, but places more emphasis on the most recent prices. The weight factor used in this study directly corresponded to the number of prices in the series being weighted. The weighted value for the next oldest price in the series was decreased by a value of one. This process continued until the oldest price in the series was weighted by one.⁴

⁴To illustrate how a 4-day linear weighted moving average is calculated, let t be the most recent day. The 4-day weighted moving average is calculated as follows:

Day	Closing Price	Weight	Product
t	\$59.25	4	237.00
$t-1$	\$58.50	3	175.50
$t-2$	\$58.00	2	116.00
$t-3$	\$57.00	1	57.00
		10	585.50

The 4-day weighted average is $585.50/10 = \$58.55$.

A **penetration rule** was also tested to determine its effect on the moving average strategies [5]. It required that the shortest length moving average in the strategies consisting of two moving averages and the short and medium length moving averages in the strategies consisting of three moving averages, cross the longest length moving average by a prescribed minimum amount before a buy or sell signal was generated. This rule attempts to eliminate some of the false signals generated when the market is in a "side-ways" trend—that is, when small day-to-day movements in prices generate buy or sell signals when there is actually no price trend.

The moving average hedging strategies allowed the producer to selectively place and lift hedges as many times as indicated throughout the production period (multiple hedges). The specific strategies evaluated in this study were based upon strategies which proved most effective in research by Franzmann and Lehenbauer [5].

Point-and-Figure Analysis Hedging Strategies

Point-and-figure analysis is a trend-following graphic tool of market analysis which is commonly used by traders in the futures market [6]. This technique also usually results in "in and out" trading (multiple hedges) in the futures market as does the moving average technique. Basically, point-and-figure analysis is concerned only with the daily high, the daily low, and the extent of the price change in the event a new high or new low fails to materialize. The system has no reference to time. The point-and-figure graph is composed of a price scale based on a predetermined **box size**⁵ along the vertical axis. The graph produced by this technique shows price movements in a series of alternating vertical columns of X's and O's which represent successive daily high and daily low prices, respectively. Sell and buy signals are generated based on the configuration of the graph which these irregular columns form.

For example, the data in Table 2 are plotted in Figure 3. The market for the May 1979 feeder cattle futures contract was in an upward trend on April 9, 1979. Therefore, starting with the high price of \$90.30/cwt. on April 10, an X was plotted up through the \$90.20/cwt. box. A new high of \$90.90 was reached the following day, April 11, and three additional X's were plotted vertically. Both April 12 and April 16 produced further highs and X's were plotted through the \$93.20 box. However, April 17 failed to produce a new high. Therefore, the low price for that day was checked. If the difference between that low and the previous high was equal to or greater than

⁵ The box size is an arbitrary dollar value, which reflects the increments of the price scale on the vertical axis of the point-and-figure graph.

Table 2. Daily High and Low Prices for the May 1979 Feeder Cattle Futures Contract, April 10-24, 1979

Date	High	Low
	-----\$/cwt.-----	
April 10	90.30	89.00
April 11	90.90	89.00
April 12	92.30	91.45
April 16	93.35	92.40
April 17	93.30	92.40
April 18	94.00	91.45
April 19	92.35	91.55
April 20	92.65	90.80
April 23	92.50	91.50
April 24	92.00	90.45

Source: Chicago Mercantile Exchange Yearbook, 1979.

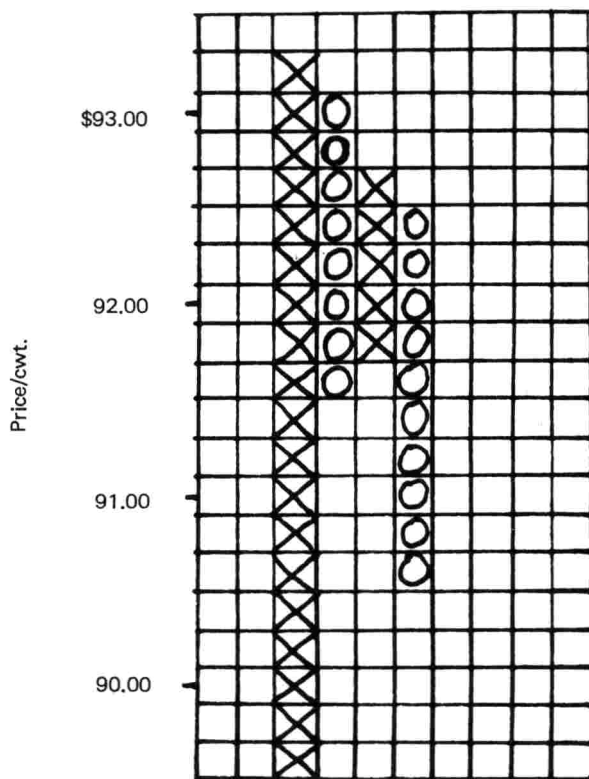


Figure 3. Point-and-Figure Chart for Feeder Cattle Futures, April 10, 1979 to April 24, 1979, (Box Size = 20¢, Reversal Number = 2).

the product of the box size and a predetermined reversal number⁶, then a reverse trend had been established. To determine whether a reversal had occurred, the low on April 17, \$92.40, was subtracted from the most recent high, \$93.35. The difference was \$.95 which was greater than the \$.40 (\$.20 box size multiplied by the 2 box reversal number) needed for a reversal to occur.

To graph the reversal, O's were plotted in the vertical column immediately to the right of the X column beginning one box below the highest X box plotted in the preceding column. The market was then in a downward trend and the new lows became the focus of attention. Consequently, O's were plotted one column to the right, down to \$92.40/cwt. April 18 produced a new low and O's were plotted down to \$91.40. However, on the following day, April 19, a new low was not produced and when the high of \$92.35 on April 19 was subtracted from the recent low of \$91.45 on April 18, the difference of \$.90 signaled a reversal. This reversal indicated an upward market again. The X's were plotted in the next vertical column immediately to the right of the O column beginning one box above the lowest O box plotted in the preceding column. Thus, X's were plotted one column over, up to \$92.20. The same procedure was followed in plotting the remaining data.

Basic sell and buy signals are generated by market actions when two reversals result in a **Double Top** or **Double Bottom** as illustrated in Figure 4. Penetration of a Double Top results in a buy signal and penetration of a Double Bottom results in a sell signal. Many more complex procedures have been defined and employed by point-and-figure analysts, but they were not utilized in this study.

In addition to the simple buy and sell signals, various sizes of **stops** and **trailing stops** were included to test their effect on profitability of the various selected parameter combinations [6]. The stop rule liquidated the hedge automatically whenever the price moved a specified amount against the entry price of the hedge. For example, if a 30¢ stop was specified and a hedge had been placed at \$70.00, the hedge would automatically be "stopped out" if the closing price ever rose to \$70.30 or higher.

The trailing stop rule disregarded the entry price of the hedge. It liquidated the hedge automatically whenever the high price moved a specified amount above the preceding low price that was plotted. An example of a \$1.40 trailing stop is illustrated in Figure 5.

The specific point-and-figure analysis strategies evaluated in this study were selected from strategies which proved most effective in research by Franzmann and Lehenbauer [6]. As in the moving average strategies, the producer was allowed to selectively place and lift hedges throughout the production period (multiple hedges).

⁶ The reversal number is an arbitrary number which is multiplied by the relevant box size to establish the price level difference required for a reversal to occur.

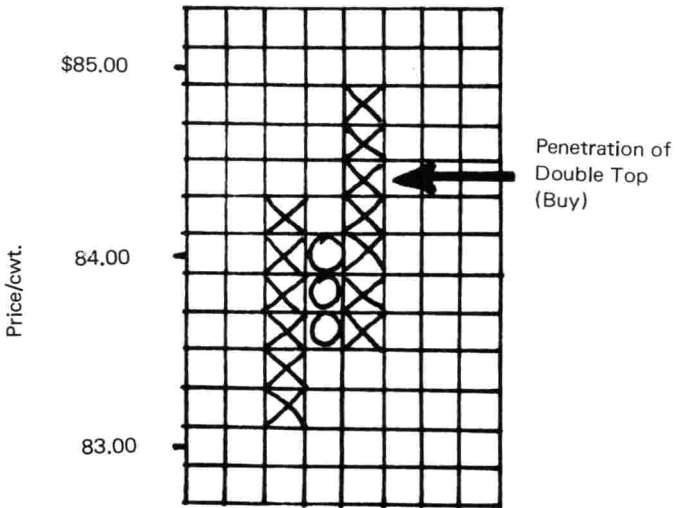
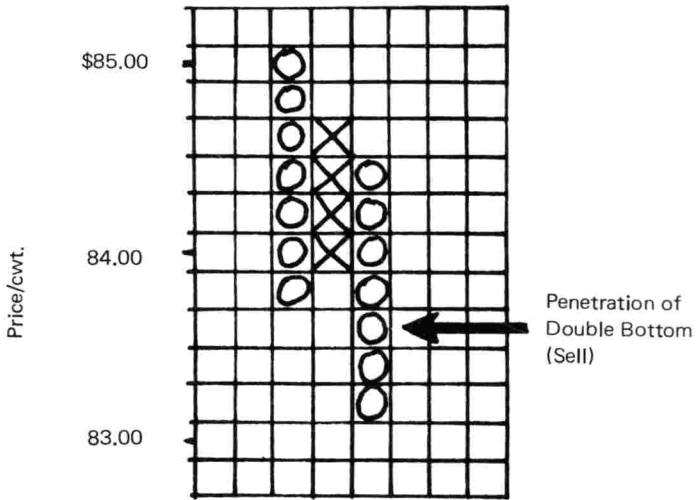
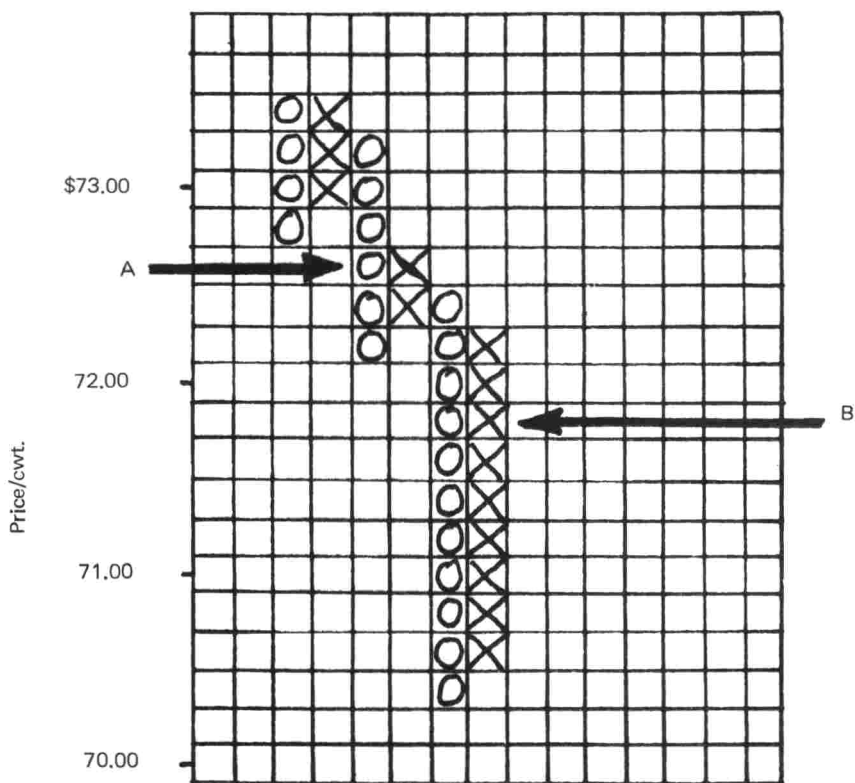


Figure 4. Simple Sell and Buy Signals on Point-and-Figure Charts (Box Size = 20¢, Reversal Number = 2).



- A. Sell signal at \$72.60 triggered by penetration of the double bottom.
- B. Buy signal at \$71.80 triggered by the trailing stop.

Figure 5. Example of \$1.40 Trailing Stop, (Box Size = 20¢, Reversal Number =2).

METHOD OF ANALYSIS

In order to analyze the effectiveness of hedging strategies, models were developed which mathematically represented two types of feeder cattle backgrounding operations in Tennessee. These models were incorporated into computer simulation routines with mathematical representations of the alternative hedging strategies. The simulation routines were "operated" based on data from the 1972-1979 period. The analysis used mean and variance of net returns⁷ as

⁷ Net returns refers to returns above variable cost of production.

the measures of the level of profitability and price risk, respectively, which ultimately determined the performance of each alternative hedging strategy.⁸

240-Day Winter Backgrounding Operation

The winter backgrounding operations consisted of a producer buying 400 pound feeder steers and backgrounding them on pasture and hay in the fall and spring, with hay becoming the main source of nutriment during the winter months. Three replications of this operation were simulated each year, beginning September 1, October 1, and November 1, and ending 240 days later on May 1, June 1, and July 1. At the completion of the operation the steers were assumed to have gained a net weight of 250 pounds, which is an average daily gain of 1.04 pounds. Therefore, the feeder steer was marketed at 650 pounds.

Only variable costs were included in the budgets for the calculation of break-even prices. Fixed costs and management were assumed to receive the residual of returns above variable costs. The variables in the budget were based upon the **Tennessee Farm Planning Manual** [14] and consisted of costs of feeder steers, hay, pasture, interest on operating capital, veterinary services, medicine, trucking, tractor, marketing, labor, and a 1 1/2% allowance for death loss.

165-Day Summer Backgrounding Operation

The summer backgrounding operations consisted of a producer buying 430 pound feeder steers and backgrounding them on pasture from spring to fall. Three replications of this operation were simulated per year, beginning March 15, April 15, and May 15, and ending 165 days later on September 1, October 1, and November 1. At the completion of the operation and after accounting for shrinkage, the steers were assumed to have gained a net weight of 220 pounds, which is an average net daily gain of 1.33 pounds. As was the case with the winter budget, a 650-pound feeder steer was the final product.

Again, only variable costs were included in the budgets for the calculation of breakeven prices. Fixed costs and management were assumed to receive the residual of returns above variable costs. The variables in the budget were based upon **Tennessee Beef Systems Management and Marketing Options** [13] and consisted of costs of feeder steers, pasture, interest on operating capital, veterinary services, medicine, trucking, marketing, labor, and a 1% allowance for death loss.

⁸ Additional detail on the methods used in this study may be found in Miyat [11].

Price and Cost Data

Feeder cattle futures prices and Tennessee auction market cash prices constituted the major data collected for this study. Data were collected from the time that feeder cattle futures contracts were first available in the fall, 1971, through 1979.

Daily high, low, and closing futures contract prices were taken from the Chicago Mercantile Exchange Yearbooks [1]. The closing prices were assumed to represent the most realistic approximation of the price for each day's futures trading and, thus, were used as transaction prices in futures trading. The local Tennessee cash prices were based upon the weekly average of approximately 15 livestock auction markets throughout the State and were obtained from Federal-State Market News Service sources [3].

The Tennessee Agricultural Statistics bulletins [15] provided prices for hay and 400-500 pound feeder steers. Interest rates reflected the net cost of money from Production Credit Associations as reported in USDA's Agricultural Statistics [16]. The remaining costs were obtained from budgets in various issues of the Tennessee Farm Planning Manuals [14].

For those pricing strategies which involved futures market trades, a commission charge and interest on the initial margin requirement for the feeder cattle contract were included as costs.⁹ Initial and maintenance margin data were obtained from the Chicago Mercantile Exchange for the period of this study (Table A-1, Appendix). The same annual interest rates used in the budgets were used to calculate the interest charged on the initial margin requirement. A commission charge of 12¢/cwt. (\$50.40/contract) was added to the cost of operation each time a group of feeder cattle was hedged.

Basis Estimates

As noted earlier, basis is the price for the nearby futures contract for a given period, minus the local cash price for the same period. It was necessary for the simulated producer to estimate the basis for the anticipated sale period for the cattle in order to arrive at a localized futures price for the elementary hedging strategies. The necessary basis estimates were made by averaging the actual basis during the first ten days of a sale month. These ten-day basis estimates were incorporated into a two-year moving average of corresponding ten-day

⁹ No interest allowance was made for margin money which might be required to meet margin calls since its expected value is zero. However, it should be noted that interest charges on margin call funds may in fact be substantial in circumstances where there are sizeable price movements against a hedger's position. Also, margin calls may exert heavy demands on the producer's cash reserves or on his borrowing capacity.

periods. Thus, the estimate of the basis for the approaching ten-day period (when cattle would be sold) was the average for the corresponding ten-day period in the two preceding years. This procedure was used in estimating the basis for all the simulation periods except for the observations in 1973. The basis estimates for the simulations in 1973 were based upon only one year's data, 1972, since futures trading was initiated in fall, 1971.

RESULTS

Producers utilize hedging as a management tool to accomplish one of three goals: (1) to obtain a higher mean return compared to the cash market; (2) to obtain a lower variance of return compared to the cash market; (3) to obtain a higher mean return and lower variance compared to the cash market.

A clearly superior hedge was one which yielded a higher mean net return (greater profit) and a lower variance (less risk) when compared to the cash market. Hedging strategies which yield a lower mean return and a higher variance than the cash market are clearly inferior. However, those hedges which yield both higher means and variances than the cash market or lower means and variances fall into an indeterminate category. No certain judgment can be made about these strategies because the individual's preference for them would depend on his willingness to sacrifice profit to obtain low risk. Thus, strategies in the indeterminate category might be superior for some individual producers but not for others.

General Price Pattern

In general, the price level for feeder cattle appeared to show a reasonably consistent seasonal pattern over the 1972-79 period. Prices usually reached a low in January and then continually increased until they reached annual highs in May. June usually showed a decline in price level with the market recovering in July and peaking again in August. After August, the price level appeared to decrease continually through the fall months. In retrospect, this seasonal price pattern had a predictable effect on the performance of the hedging strategies.

Winter Operation Beginning September 1 and Ending May 1

The mean and variance of net returns for this operation are shown graphically in Figure 6. Appendix Table A-2 gives numeric results. The elementary hedging strategies performed rather poorly for the winter operation. The results show that while the variance of net returns was reduced, the mean return was higher in the cash market (number 0) than for any of the elementary hedging strategies tested (numbers 1-27). Lifting the hedge after the first margin call (numbers 2,5,8,11,14,17,20,23,26) significantly improved the mean net return of the elementary hedging strategies because it got the producer out

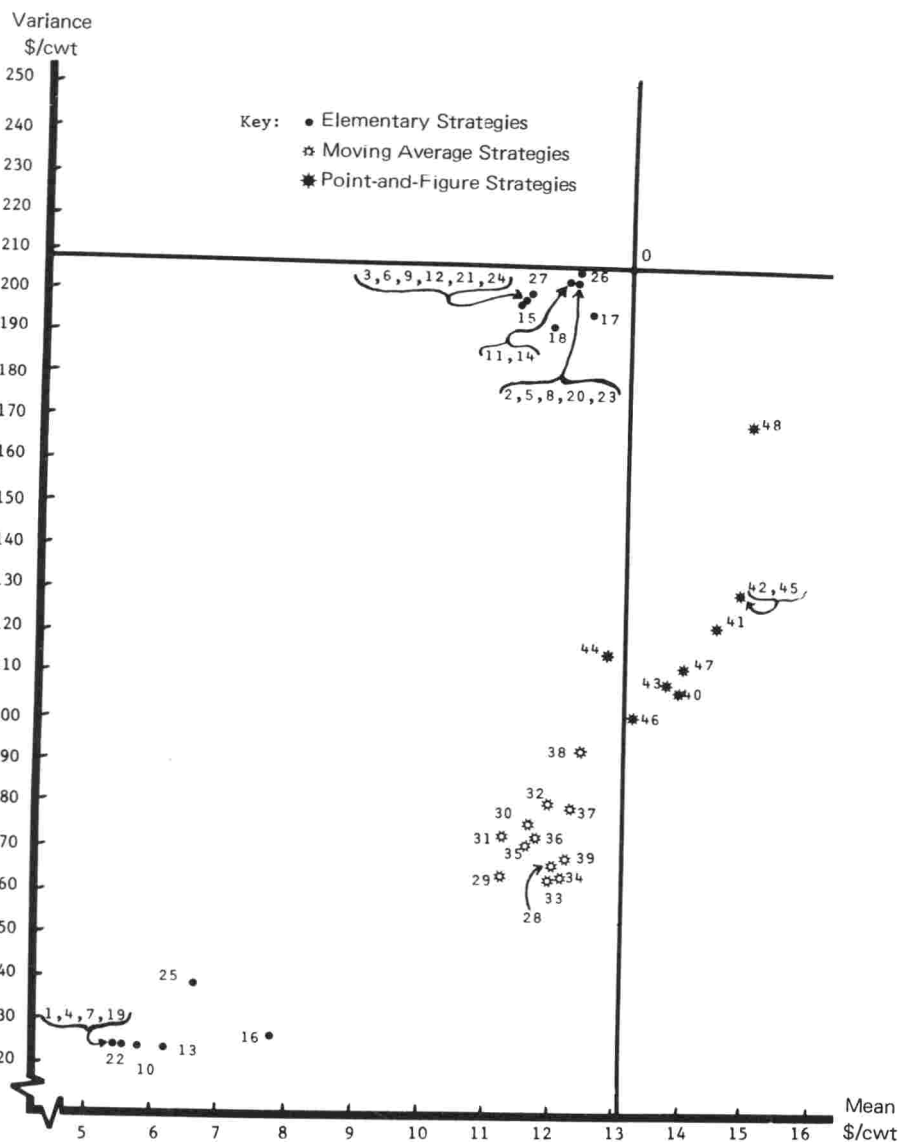


Figure 6. Mean and Variance of Net Returns for the Winter Backgrounding Operation Beginning September 1 and Ending May 1 using Specified Hedging Strategies, Tennessee, 1972-79 (Numbers refer to items in the following legend).

Legend of Strategies Illustrated in Figures 6 Through 13.^a

Number	Strategy
0)	Cash
Elementary Strategies^b	
1)	Hedge if Localized Futures $>$ Breakeven Price
2)	Same as 1, Lift at First Margin Call
3)	Same as 1, Lift at Second Margin Call
4)	Hedge if Localized Futures $>$ Breakeven Price + \$.50
5)	Same as 4, Lift at First Margin Call
6)	Same as 4, Lift at Second Margin Call
7)	Hedge if Localized Futures $>$ Breakeven Price + \$1
8)	Same as 7, Lift at First Margin Call
9)	Same as 7, Lift at Second Margin Call
10)	Hedge if Localized Futures $>$ Breakeven Price + \$2
11)	Same as 10, Lift at First Margin Call
12)	Same as 10, Lift at Second Margin Call
13)	Hedge if Localized Futures $>$ Breakeven Price + \$3
14)	Same as 13, Lift at First Margin Call
15)	Same as 13, Lift at Second Margin Call
16)	Hedge if Localized Futures $>$ Breakeven Price + \$5
17)	Same as 16, Lift at First Margin Call
18)	Same as 16, Lift at Second Margin Call
19)	Hedge if Localized Futures $>$ Cash Price
20)	Same as 19, Lift at First Margin Call
21)	Same as 19, Lift at Second Margin Call
22)	Hedge if Localized Futures $>$ Cash Price + \$1
23)	Same as 22, Lift at First Margin Call
24)	Same as 22, Lift at Second Margin Call
25)	Hedge if Localized Futures $>$ Cash Price + \$2
26)	Same as 25, Lift at First Margin Call
27)	Same as 25, Lift at Second Margin Call
Moving Average Strategies	
28)	4-day – 8-day
29)	5-day – 10-day
30)	3-day – 4-day – 8-day
31)	4-day – 8-day Weighted
32)	3-day – 4-day – 8-day Weighted
33)	4-day Weighted – 4-day – 8-day Weighted
34)	4-day – 8-day, with 5¢ Penetration Rule
35)	5-day – 10-day, with 4¢ Penetration Rule
36)	3-day – 4-day – 8-day, with 2¢ Penetration Rule
37)	4-day – 8-day Weighted, with 5¢ Penetration Rule
38)	3-day – 4-day – 8-day Weighted, with 2¢ Penetration Rule
39)	4-day Weighted – 4-day – 8-day Weighted, with 2¢ Penetration Rule
Point and Figure Strategies	
40)	5¢ Box Size, 5 Box Reversal
41)	5¢ Box Size, 5 Box Reversal, 65¢ Stop

- 42) 5¢ Box Size, 5 Box Reversal, \$1.50 Trailing Stop
 - 43) 15¢ Box Size, 1 Box Reversal
 - 44) 15¢ Box Size, 1 Box Reversal, 30¢ Stop
 - 45) 15¢ Box Size, 1 Box Reversal, \$1.35 Trailing Stop
 - 46) 20¢ Box Size, 1 Box Reversal
 - 47) 20¢ Box Size, 1 Box Reversal, 75¢ Stop
 - 48) 20¢ Box Size, 1 Box Reversal, \$1.35 Trailing Stop
-

^a All dollar values are in terms of dollars per hundredweight.

^b For all strategies utilizing dollar increments above cash or breakeven prices the increment values are in 1972 dollars. For example, inflation over the period of study caused a \$1 increment in 1972 to be equivalent to a \$2 increment in 1979 (See Table 1).

of the rising futures market in the winter and spring, thereby allowing him to benefit from the rising cash price. Lifting the hedge after the second margin call also improved the mean net return of the hedging strategies by limiting the producer's losses in futures, but it forced him to absorb slightly more loss than lifting the hedge after the first margin call. Both of these options also yielded variances significantly higher than the hedge and hold approach.

The result of adding additional dollar increments to the hedge criteria was to improve the hedging strategies mean return. By increasing the dollar increment, meeting the criterion required to initiate a hedge becomes more difficult, which meant the producer would rely more on the cash market. As the hedging strategy became more and more selective, a point would be reached at which no hedges occurred and the producer would be operating only in the cash market.

All the moving averages (numbers 28-39) yielded slightly lower means and considerably lower variances than cash. The penetration rules (numbers 34-39) were successful in increasing the overall net mean returns of all the moving averages and in decreasing the variance in the 4-8 and 3-4-8 strategies.

All point-and-figure hedging strategies, with the exception of strategy number 44, were superior to the cash market. The addition of the stop (numbers 41,44,47) and trailing stop rules (numbers 42, 45, 48) increased the mean net return in every strategy except number 44. The trailing stop rules yielded the highest overall mean returns of all strategies. The mean returns and variances were higher and the average number of hedges executed per year were slightly lower for the point-and-figure hedging strategies than for the moving average strategies.

Winter Operation Beginning October 1 and Ending June 1

Mean and variance of net returns for the October-to-June operation are shown in Figure 7 (also see Appendix Table A-3). The results are very similar to the results obtained for the September to May operation, with the mean of returns being higher in the cash market (number 0) than for any of the elementary hedging strategies (numbers 1-27) except number 12. However, nine of the 27 elementary strategies were actually inferior to the cash market since they showed a larger variance and a smaller mean. The direction of price movement in this operation was primarily in an upward direction, as for the previous operation. This explains why hedge and hold approaches typically produced poor results.

Six of the moving average strategies (numbers 28,30,33,34,36, and 39) produced higher means and lower variances than the cash market. The other six moving average strategies fell into the indeterminate category. The penetration rules reduced the total number of hedges executed in all strategies but, they failed to materially improve the overall mean return or decrease the variance.

All the point-and-figure hedging strategies (numbers 40-48) were superior to the cash market. Unlike the previous operation, the addition of stop and trailing stop rules to the hedging strategies did not yield higher means. The stop rule not only produced lower means but also yielded higher variances, whereas the trailing stop rules yielded both lower means and lower variances. With the exception of strategies 42 and 48, all the point-and-figure hedging strategies yielded higher means and higher variances than the moving average strategies.

Winter Operation Beginning November 1 and Ending July 1

The results of the November to July operation are expressed in Figure 8 and Appendix Table A-4. Again, none of the elementary hedging strategies (numbers 1-27) were superior to the cash market. However, 14 of the 27 elementary hedging strategies tested were clearly inferior to the cash market. In general, the level of price movement was in an upward direction as in the previous two operations. This explains the similar pattern of results.

All of the moving average strategies (numbers 28-38), with the exception of strategy 31, were superior to the cash market. Strategy 31, despite producing a higher mean, also yielded a higher variance than the cash market and, thus, fell into the indeterminate category. The addition of the penetration rules produced better results (higher means and lower variances) in only the 3-4-8W and 4W-4-8W moving average strategies.

The point-and-figure hedging strategies (numbers 40-48) were all superior to the cash market. The addition of the stop and trailing stop rules failed to produce higher means. The stop rule actually reduced means and increased variances. The point-and-figure hedging

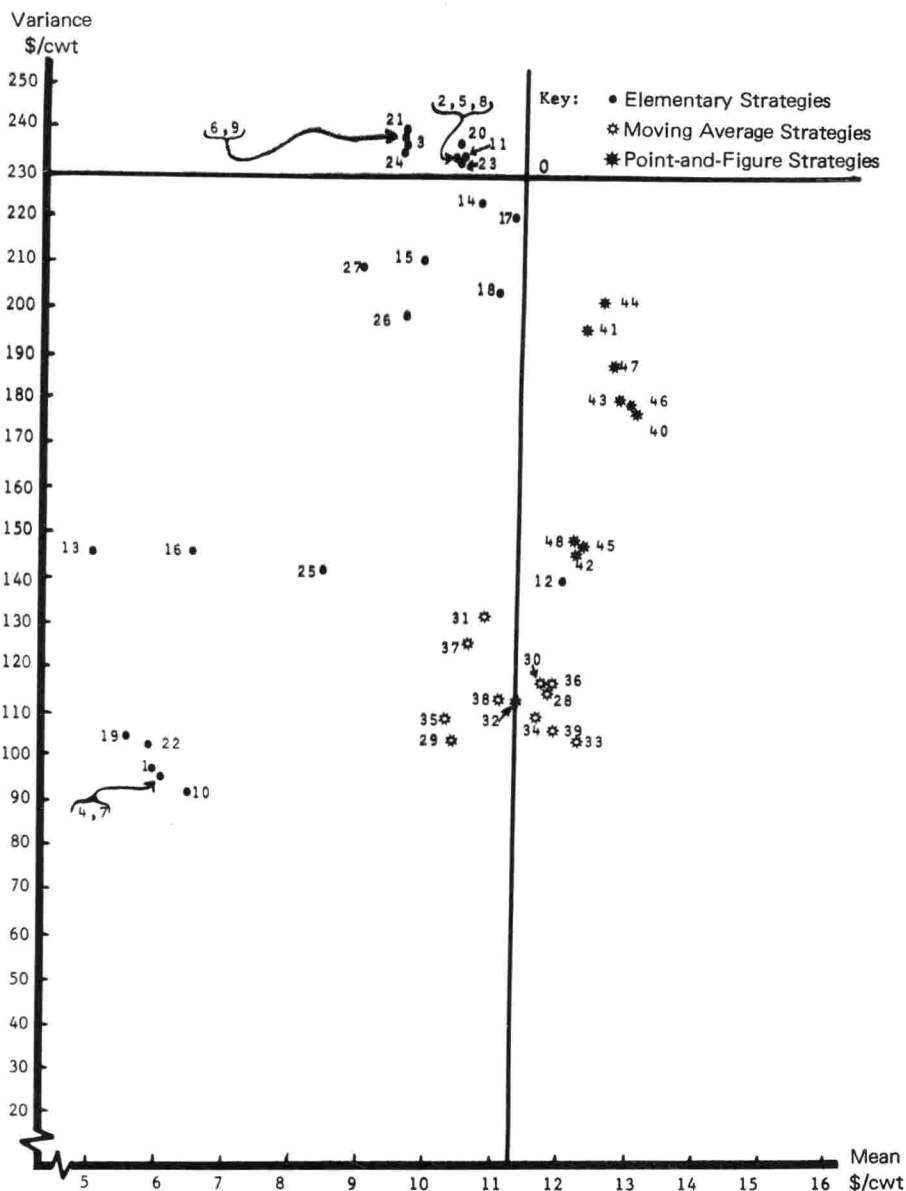


Figure 7. Mean and Variance of Net Returns for the Winter Backgrounding Operation Beginning October 1 and Ending June 1 Using Specified Hedging Strategies, Tennessee, 1972-79 (Numbers refer to items in the preceding legend).

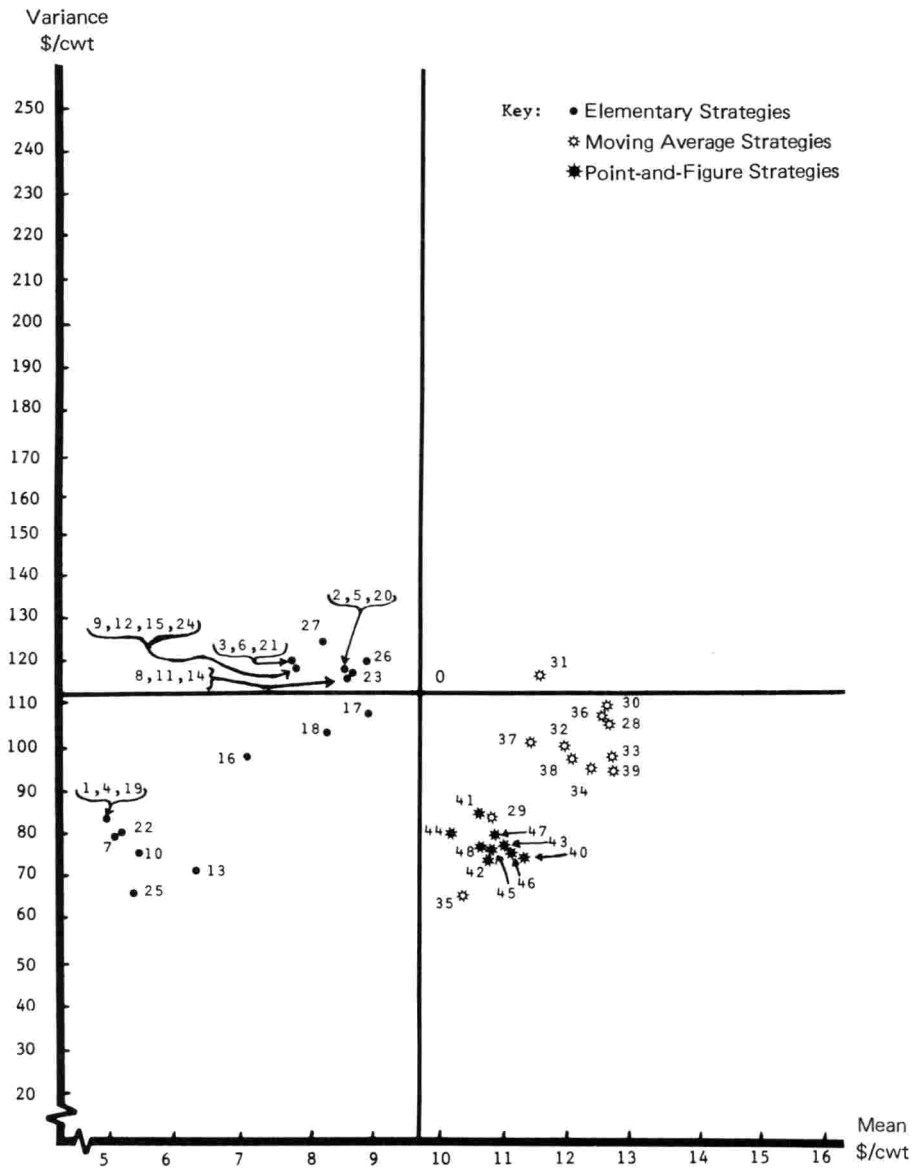


Figure 8. Mean and Variance of Net Returns for the Winter Backgrounding Operation Beginning November 1 and Ending July 1 Using Specified Strategies, Tennessee, 1972-79 (Numbers refer to items in the preceding legend).

strategies typically yielded lower means and variances than the moving average strategies (exceptions are numbers 29 and 35).

Combined Analysis of Winter Operations

Results of a combined analysis of all three winter operations are presented in Figure 9 and Appendix Table A-5. None of the elementary hedging strategies (numbers 1-27) proved to be superior to the cash market and 11 of them were inferior to the cash market. The remaining 16 elementary strategies fell into the indeterminate category. In general, the operations experienced rising levels of prices during the production period which meant the producer was executing a hedge only to buy back the contract at a higher price at the completion of the operation. The option of lifting the hedge after the first margin call improved the elementary hedging strategies, but only to the extent that it got the producer out of the rising market sooner, which limited his losses. The option of lifting the hedge after the second margin call improved the overall net mean return, but to a lesser extent than lifting the hedge after the first margin call. Both of these options yielded variances substantially higher than the option of holding the hedge once it had been placed.

All except three of the moving average strategies were superior to the cash market. The other three strategies (numbers 29,31, and 35) fell into the indeterminate category. Addition of the penetration rule improved the overall mean return and variance for the 3-4-8 and 4-8W moving average strategies, and improved the mean in the 3-4-8W strategy.

All of the point-and-figure strategies were superior to the cash market. The addition of a stop rule improved the overall mean return with the 20¢ box size strategy only, while decreasing the overall mean and increasing the variance in the 5¢ and 15¢ box size strategies. The addition of a trailing stop rule improved the mean and variance of the 15¢ box size and improved the mean for the 20¢ box size. With the exception of strategy number 44, all the point-and-figure strategies yielded higher means and variances than the moving average strategies.

Summer Operation Beginning March 15 and Ending September 1

Figure 10 and Appendix Table A-6 show the mean and variance of net returns for the March to September operation. All except eight of the 27 elementary hedging strategies were superior to the cash market. Of the eight strategies which were not superior, six were actually inferior to the cash market and two fell into the indeterminate category. Over the entire simulation period, the option of holding the hedge until the end of the production period was the best elementary strategy. However, the option of lifting the hedge

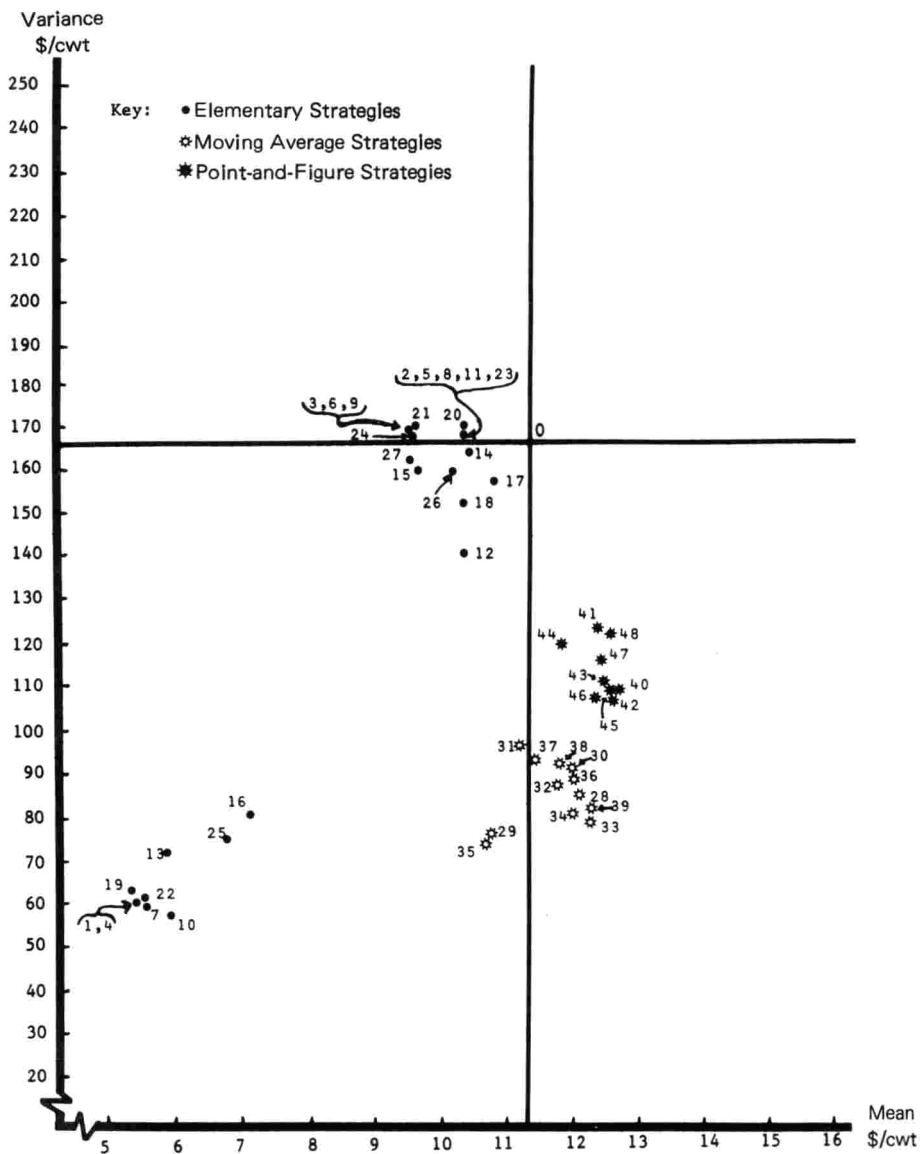


Figure 9. Mean and Variance of Net Returns for the Three Winter Back-grounding Operations Combined Using Specified Hedging Strategies, 1972-79 (Numbers refer to items in the preceding legend).

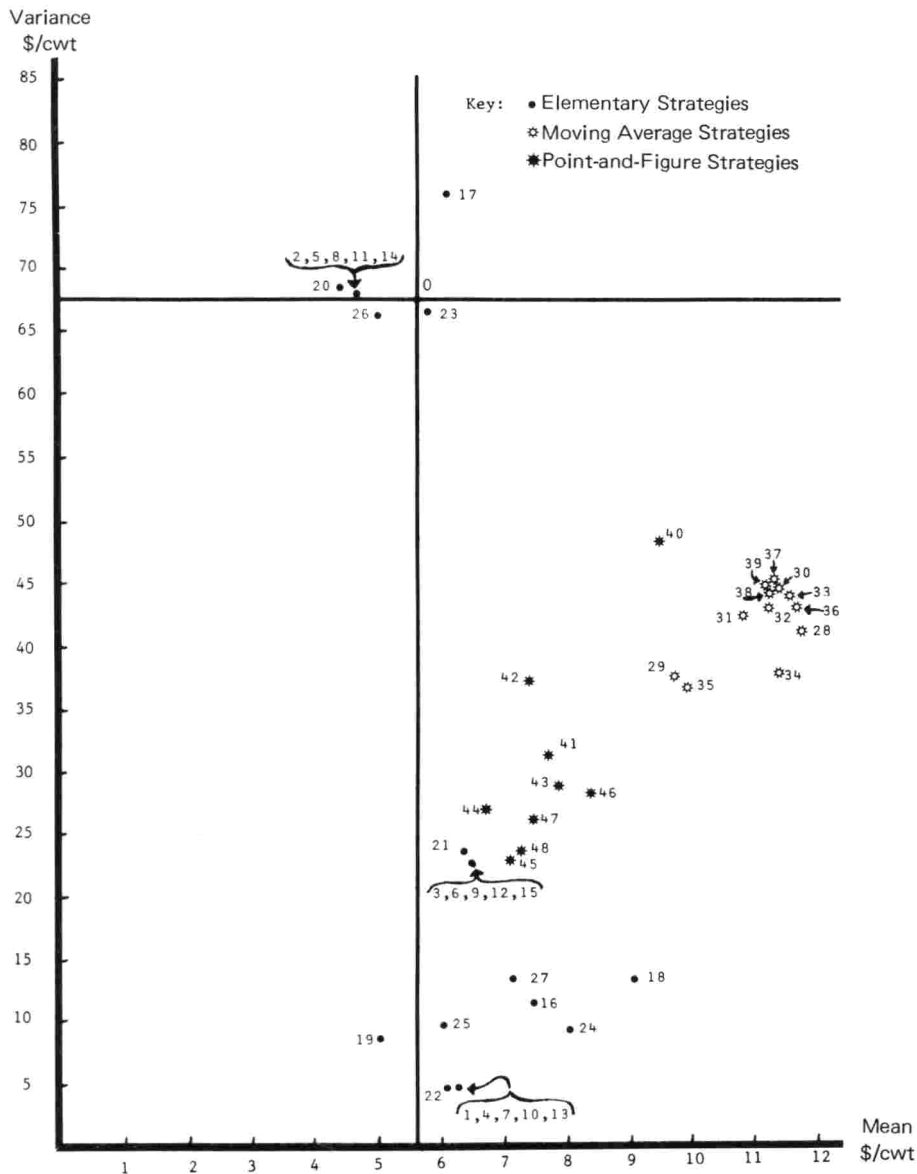


Figure 10. Mean and Variance of Net Returns for the Summer Backgrounding Operation Beginning March 15 and Ending September 1 Using Specified Hedging Strategies, Tennessee, 1973-79 (Numbers refer to items in the preceding legend).

after the second margin call yielded higher mean net returns, but did so with higher variances. The option of lifting the hedge after the first margin call produced six inferior strategies, two indeterminate and one superior strategy compared to the cash market.

In general, adding dollar increments to the strategies caused the producer to place his hedge at a higher price in a rising market before the market began to fall toward the end of the production period. Mean returns for the strategies utilizing breakeven prices were maximized with the addition of a \$5 (1972 dollars) increment, whereas strategies utilizing cash prices "topped-out" with the addition of \$1. Addition of further dollar increments beyond these two levels would make hedging less likely. Therefore, the producer would be hedging less and relying on the cash market more, which would result in returns eventually being equal to cash market returns.

The moving average hedging strategies (numbers 28-39) were all superior to the cash market and yielded higher means than the elementary and point-and-figure hedging strategies. The addition of a penetration rule improved both the mean return and variance for the 5-10 and 3-4-8 moving averages.

All of the point-and-figure hedging strategies (numbers 40-48) yielded superior results compared to the cash market. Addition of both the stop and trailing stop rules failed to increase the mean return for the point-and-figure strategies. The use of the stop rule was superior to the trailing stop in the case of the 5¢ box size, with the reverse being true with the 15¢ box size. The stop rule also yielded a higher mean in the 20¢ box size than the trailing stop. All point-and-figure hedging strategies yielded lower means and, with the exception of strategies 40 and 42, yielded lower variances than the moving averages.

Summer Operation Beginning April 15 and Ending October 1

Mean and variance of net returns for the April to October operation are shown in Figure 11 and Appendix Table A-7. All of the elementary hedging strategies were superior to the cash market for the seven-year period. The option of lifting the hedge after the second margin call yielded higher means for all the strategies utilizing breakeven prices with the exception of the strategy adding a \$5 (1972 dollars) increment (number 18). However, the strategies utilizing cash prices produced higher means when the hedge was lifted after the first margin call.

The addition of increments of more than \$1 (1972 dollars) to elementary strategies utilizing break-even prices reduced returns. Conversely, the addition of a \$1 dollar increment to the strategy utilizing cash prices increased mean returns. Additional increments beyond \$1 proved to have an adverse effect on mean returns in the strategies utilizing cash prices. These additional increments made the

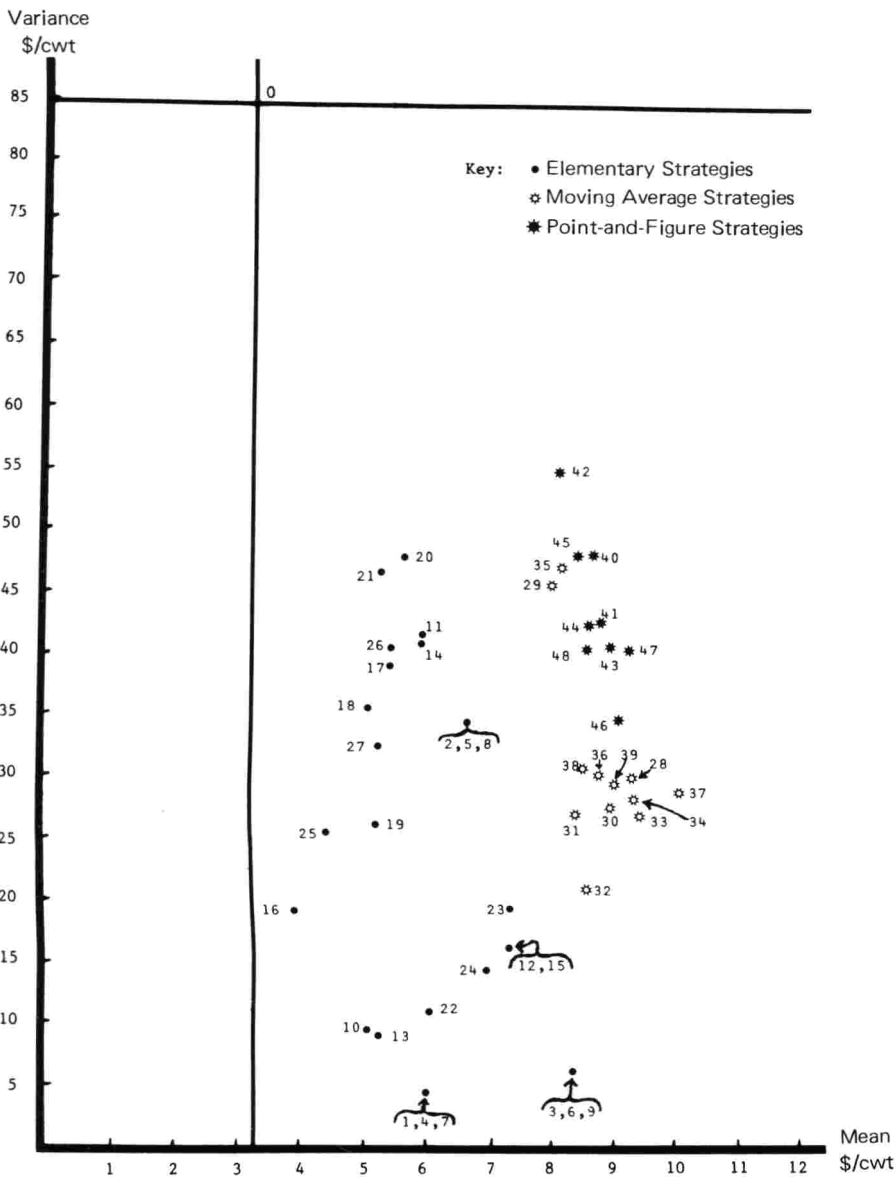


Figure 11. Mean and Variance of Net Returns for the Summer Backgrounding Operation Beginning April 15 and Ending October 1 Using Specified Hedging Strategies, Tennessee, 1973-79 (Numbers refer to items in the preceding legend).

hedging criteria more difficult to meet, thereby reducing the number of hedges executed. This made the producer rely more on the cash market. Thus, the results began to move toward the cash market results.

All of the moving average hedging strategies (numbers 28-39) were superior to the cash market. The penetration rule increased mean returns only in the 5-10 and 4-8W moving average strategies.

The point-and-figure hedging strategies were also superior to the cash market. The strategies actually yielded over twice the mean return of the cash market. The use of the stop rule increased the mean return and decreased the variance for the 5¢ box size and increased the mean return for the 20¢ box size. Use of the trailing stop rule did not improve returns. In general, the point-and-figure strategies yielded about the same mean returns as did the moving average strategies, but with higher variances.

Summer Operation Beginning May 15 and Ending November 1

The results for the May to November operation are shown in Figure 12 and Appendix Table A-8. Of the 27 elementary hedging strategies tested, four strategies were inferior, three strategies fell into the indeterminate category and 20 were superior to the cash market. The options of lifting the hedge after the first or second margin call failed to improve the mean returns for any of the strategies.

Addition of dollar increments to the elementary strategies yielded beneficial results up to a point. Strategies utilizing break-even costs were improved by adding dollar increments up to \$3 (1972 dollars). Strategies utilizing cash prices were improved by adding up to \$1. Additional increments beyond these two levels decreased mean returns for all the strategies.

All of the moving average hedging strategies fell into the indeterminate category. All the strategies yielded higher mean returns, but they also yielded higher variances than cash. The penetration rule improved the mean returns for the 4-8, 5-10, and the 3-4-8 moving average strategies.

All of the point-and-figure hedging strategies, except number 48, were superior to the cash market. Strategy 48 fell into the indeterminate category, producing a higher mean, but also producing a higher variance. The addition of both the stop and trailing stop rules failed to increase the overall mean return in any of the strategies. In general, the point-and-figure strategies again produced about the same mean returns as did the moving average strategies, but they did so with a lower variance in this case.

Combined Analysis of Summer Operations

The mean and variance of net returns for all three summer op-

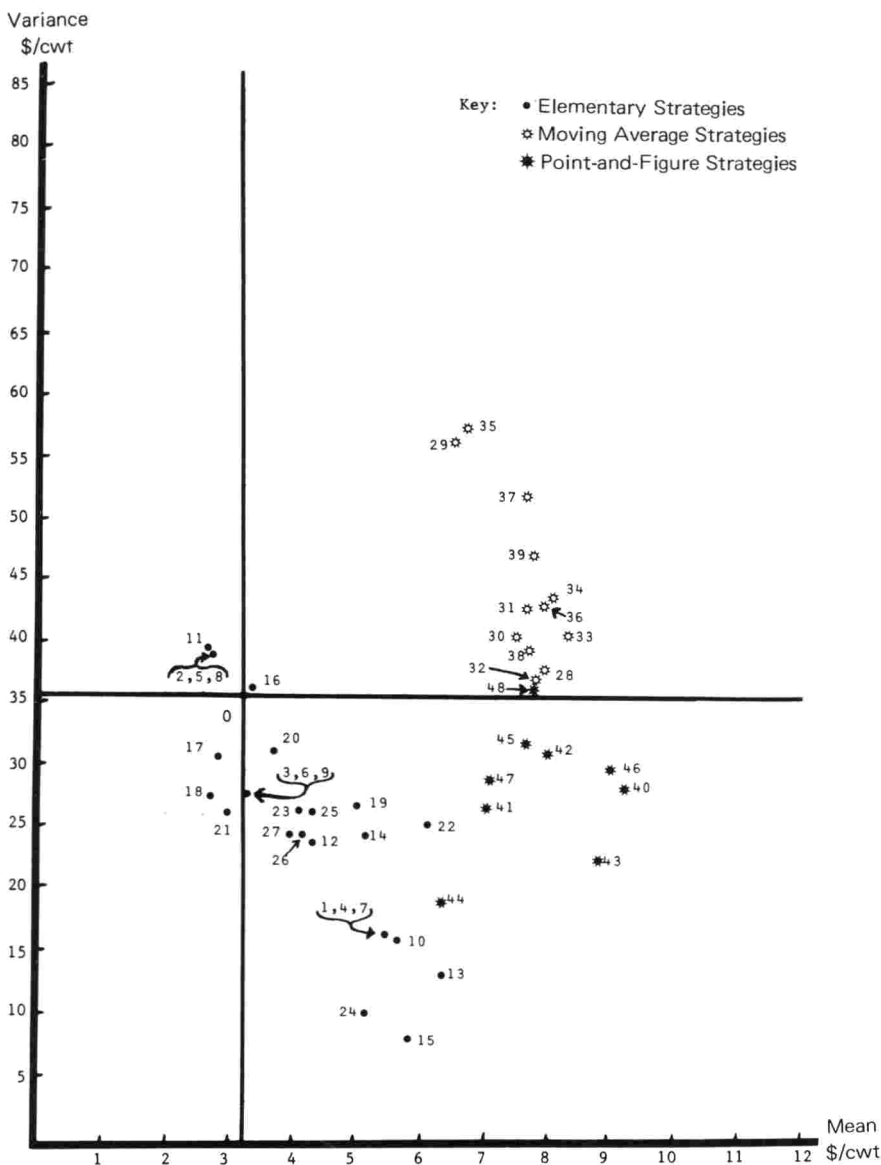


Figure 12. Mean and Variance of Net Returns for the Summer Backgrounding Operation Beginning May 15 and Ending November 1 Using Specified Hedging Strategies, Tennessee, 1973-79 (Numbers refer to items in the preceding legend).

erations combined appear in Figure 13 and Appendix Table A-9. In general, this type of operation experienced a falling level of prices during each production year. This meant the producer was able to execute a hedge at a higher price than that at which he was required to liquidate the same hedge. Thus, all of the elementary hedging strategies were superior to the cash market. The option of lifting the hedge after the first margin call failed to yield higher overall means in any of the elementary hedging strategies. However, the option of lifting the hedge after the second margin call did improve the overall mean returns in every hedging strategy except one (number 21).

Adding dollar increments improved the overall mean return in all strategies up to a certain level. Strategies utilizing break-even prices appeared to yield optimal overall mean returns when a \$3 (1972 dollars) increment was added, whereas strategies utilizing cash prices yielded optimal overall mean returns when a \$1 increment was added. Additional dollar increments beyond these two levels had adverse effects on mean returns of the elementary strategies. This result occurred because the hedging criteria became more difficult to meet, thus eliminating some hedging activity and causing the producer to rely more on the cash market.

All of the moving average hedging strategies were superior to the cash market yielding mean returns which were more than twice that of the cash market. The penetration rule yielded higher mean returns in the 5-10, 3-4-8, and 4-8W moving average strategies. It yielded lower means with higher variance in the 3-4-8W and 4W-4-8W moving average strategies.

The point-and-figure hedging strategies were all superior to the cash market. Use of stop and trailing stop rules did not increase the overall mean return of any of the strategies, and in some cases it yielded higher variances. Overall results for the point-and-figure hedging strategies generally showed slightly lower means and variances compared to the overall results for the moving average strategies.

CONCLUSIONS AND IMPLICATIONS

Results of the winter and summer backgrounding simulations showed that certain selective hedging strategies can be useful management techniques in helping procedures increase net returns and reduce price risk. However, it was evident that generalizations are hazardous because the performance of the alternative strategies varied considerably depending upon the particular time period for the backgrounding operation. Results for summer operations differ from results for winter operations. The producer should focus on the results which most closely correspond to his particular operation.

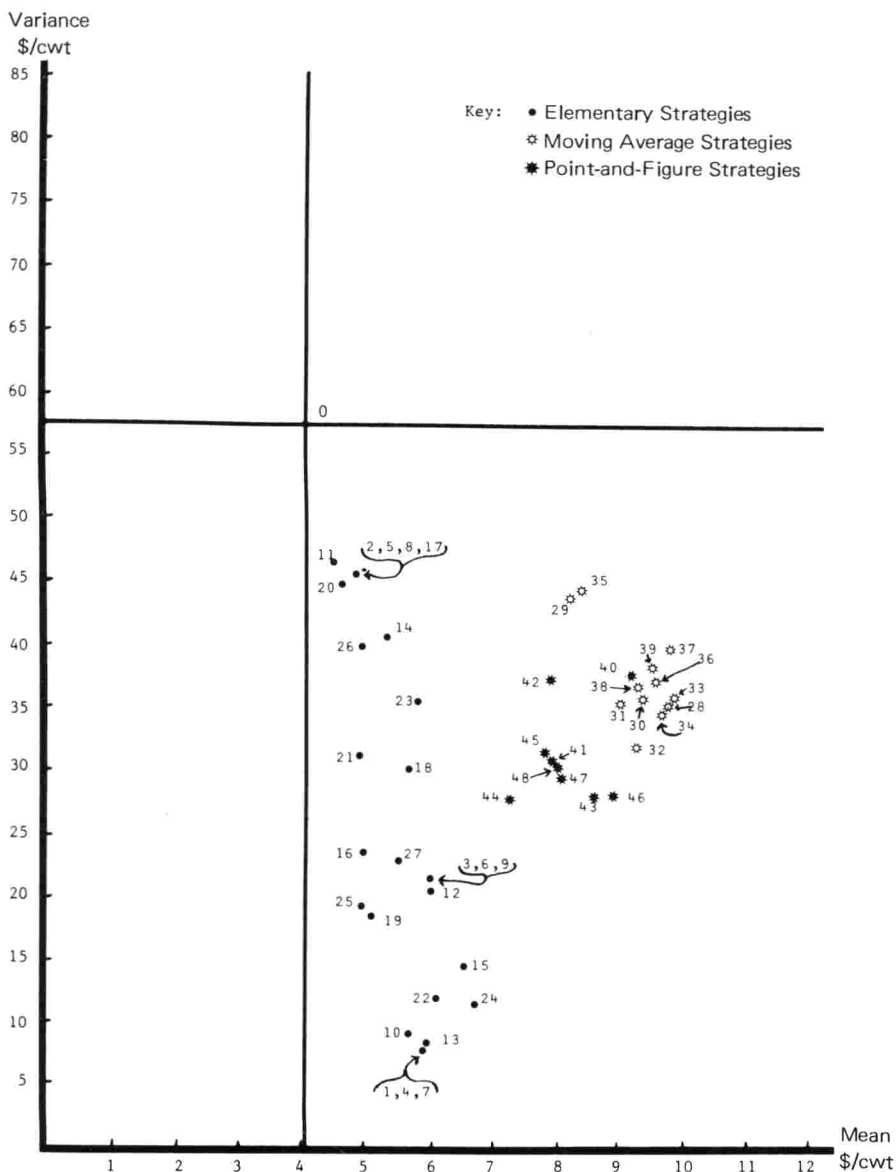


Figure 13. Mean and Variance of Net Returns for the Three Summer Back-grounding Operations Combined Using Specified Hedging Strategies, Tennessee, 1973-79 (Numbers refer to items in the preceding legend).

The elementary hedging strategies appeared to be undesirable for backgrounding feeder steers from fall to spring or summer months. However, these strategies performed well when the producer began backgrounding steers in the spring and marketed them in the fall. These conclusions reflect the influence of typical seasonal price patterns for feeder cattle. The option of holding the hedge until the end of the production period appeared to be the optimal choice where the producer was marketing in the fall months.

Moving average and point-and-figure hedging strategies were superior to the cash market in almost every observation in both the summer and winter operations, and they appeared to show the most promise for increasing net returns of all strategies tested. In general, neither the moving average nor the point-and-figure hedging strategies were clearly superior to the other. Therefore, the choice among them would ultimately be determined by the individual producer, based upon his desire for high returns and his aversion toward risk.

Assuming that the market conditions during the simulation period are representative of what will occur in the future and that the simulation procedures are sufficiently representative of actual Tennessee producers' operations, a producer following the conclusions of this study should be able to effectively increase his net returns with smaller risk compared to the cash market. However, the producer should recognize that selective hedging will not increase net returns every year, but that in the long run, average net returns should be higher with less variability.

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APPENDIX

Table A-1. Initial and Maintenance Margin Data for Feeder Cattle Futures Trading for the Period 1971-1979^a

Effective Date	Initial Margin		Maintenance Margin		Difference Between Initial and Maintenance Margin
	\$ per contract	\$ per cwt.	\$ per contract	\$ per cwt.	
November 30, 1971	400	.95	250		0.36
August 6, 1973	600	1.43	400		0.48
October 31, 1974	700	1.67	500		0.48
March 22, 1976	600	1.43	400		0.48
March 27, 1978	1000	2.30	700		0.71
March 26, 1979	1500	3.57	1200		0.71

Source: Official of the Chicago Mercantile Exchange.

^aThe margin data shown here reflect minimum levels required by the Chicago Mercantile Exchange. Many brokerage firms require larger margin deposits.

Table A-2. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Winter Operation Beginning September 1 and Ending May 1, Using Specified Hedging Strategies, Tennessee, 1972-1979

No.	Strategy	Net Returns				Number of Hedges Executed
		Mean	Variance	Maximum	Minimum	
		----- Dollars per cwt. -----				
0)	Cash	13.15	208.30	38.29	- 5.98	0
Elementary Strategies						
1) ^a	Localized Futures >					
	Break-even Price	5.47	24.94	15.35	1.05	7
2) ^a	Same as 1, First Margin Call	12.23	204.50	36.94	- 6.90	7
3) ^a	Same as 1, Second Margin Call	11.47	200.00	35.78	- 7.85	7
7)	Localized Futures >					
	Break-even Price + \$1	5.49	24.84	15.35	1.05	7
8)	Same as 7, First Margin Call	12.25	204.74	36.94	- 6.90	7
9)	Same as 7, Second Margin Call	11.50	200.50	35.78	- 7.85	7
10)	Localized Futures >					
	Break-even Price + \$2	5.84	23.94	15.35	1.05	7
11)	Same as 10, First Margin Call	12.15	204.58	36.94	- 6.90	7
12)	Same as 10, Second Margin Call	11.46	200.13	35.78	- 7.85	7
13)	Localized Futures >					
	Break-even Price + \$3	6.23	23.38	15.35	1.05	7
14)	Same as 13, First Margin Call	12.18	204.05	36.94	- 6.90	7
15)	Same as 13, Second Margin Call	11.43	199.19	35.78	- 7.85	7
16)	Localized Futures >					
	Break-even Price + \$5	7.78	26.94	16.59	1.86	7
17)	Same as 16, First Margin Call	12.50	197.08	37.02	- 6.90	7
18)	Same as 16, Second Margin Call	11.92	193.54	36.07	- 7.85	7
19)	Localized Futures >					
	Cash Price	5.49	24.84	15.35	1.05	7
20)	Same as 19, First Margin Call	12.25	204.74	36.94	- 6.90	7
21)	Same as 19, Second Margin Call	11.50	200.50	35.78	- 7.85	7
22)	Localized Futures >					
	Cash Price + \$1	5.54	24.71	15.35	1.05	7
23)	Same as 22, First Margin Call	12.23	204.44	36.94	- 6.90	7
24)	Same as 22, Second Margin Call	11.48	200.12	35.78	- 7.85	7
25)	Localized Futures >					
	Cash Price + \$2	6.61	38.26	19.49	1.05	7
26)	Same as 25, First Margin Call	12.26	207.28	37.29	- 6.90	7
27)	Same as 25, Second Margin Call	11.56	201.91	36.03	- 7.85	7
Moving Average Strategies						
28)	4-8	11.98	66.30	24.16	3.00	58
29)	5-10	11.25	64.93	21.68	1.71	47
30)	3-4-8	11.72	77.20	25.51	2.85	52
31)	4-8W	11.27	73.65	25.83	2.17	79
32)	3-4-8W	11.96	81.94	26.00	1.95	55
33)	4W-4-8W	12.00	63.40	23.74	3.52	53

Table A-2. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Winter Operation Beginning September 1 and Ending May 1, Using Specified Hedging Strategies, Tennessee, 1972-1979 (continued)

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
34) 4-8, 5¢ Penetration	12.13	64.60	22.79	3.65	49
35) 5-10, 4¢ Penetration	11.69	71.86	22.09	2.72	43
36) 3-4-8, 2¢ Penetration	11.73	73.28	24.09	3.65	48
37) 4-8W, 5¢ Penetration	12.30	80.86	26.31	2.17	57
38) 3-4-8W, 2¢ Penetration	12.45	93.59	26.63	2.77	51
39) 4W-4-8W, 2¢ Penetration	12.22	68.54	24.37	3.72	50
Point and Figure Strategies					
40) 5¢ Box, 5 Reversal	13.89	107.69	33.06	2.57	36
41) 5¢ Box, 5 Reversal, 65¢ Stop	14.46	123.04	35.46	2.62	37
42) 5¢ Box, 5 Reversal, \$1.50 Trailing Stop	14.86	130.73	37.33	2.57	43
43) 15¢ Box, 1 Reversal	13.69	109.62	33.06	2.37	37
44) 15¢ Box, 1 Reversal, 30¢ Stop	12.91	116.12	33.41	2.82	46
45) 15¢ Box, 1 Reversal, \$1.35 Trailing Stop	14.86	130.89	37.33	2.57	44
46) 20¢ Box, 1 Reversal	13.23	101.54	31.37	2.74	37
47) 20¢ Box, 1 Reversal, 75¢ Stop	13.97	113.43	33.78	2.79	37
48) 20¢ Box, 1 Reversal, \$1.35 Trailing Stop	15.04	171.72	41.13	2.74	43

^aSame results apply to Localized Futures Exceeds Break-even Price + \$.50.

Table A-3. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Winter Operation Beginning October 1 and Ending June 1, Using Specified Hedging Strategies, Tennessee, 1972-1979

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
0) Cash	11.39	230.61	32.52	- 13.18	0
Elementary Strategies					
1) Localized Futures >					
Break-even Price	5.95	97.71	27.82	- 0.78	7
2) Same as 1, First Margin Call	10.39	233.84	31.66	- 14.30	7
3) Same as 1, Second Margin Call	9.60	237.66	30.91	- 15.30	7
4) ^a Localized Futures >					
Break-even Price + \$.50	6.09	95.60	27.82	0.22	7
5) ^a Same as 4, First Margin Call	10.39	233.84	31.66	- 14.30	7
6) ^a Same as 4, Second Margin Call	9.59	238.57	30.91	- 15.41	7
10) Localized Futures >					
Break-even Price + \$2	6.46	92.41	27.82	0.52	7
11) Same as 10, First Margin Call	10.44	234.76	31.66	- 14.26	7
12) Same as 10, Second Margin Call	12.03	140.40	30.91	1.37	7
13) Localized Futures >					
Break-even Price + \$3	5.11	145.48	27.82	- 13.80	6
14) Same as 13, First Margin Call	10.68	224.40	31.66	- 13.18	6
15) Same as 13, Second Margin Call	9.91	211.75	30.91	- 13.18	6
16) Localized Futures >					
Break-even Price + \$5	6.54	146.12	27.82	- 13.18	6
17) Same as 16, First Margin Call	11.24	214.41	31.66	- 13.18	6
18) Same as 16, Second Margin Call	10.99	204.53	30.90	- 13.18	6
19) Localized Futures >					
Cash Price	5.57	103.87	27.82	- 3.03	7
20) Same as 19, First Margin Call	10.40	237.41	31.66	- 14.55	7
21) Same as 19, Second Margin Call	9.58	240.36	30.91	- 15.55	7
22) Localized Futures >					
Cash Price + \$1	5.90	102.69	28.90	- 1.78	7
23) Same as 22, First Margin Call	10.40	233.57	31.44	- 14.30	7
24) Same as 22, Second Margin Call	9.59	236.36	30.54	- 15.30	7
25) Localized Futures >					
Cash Price + \$2	8.42	142.54	28.02	- 0.78	5
26) Same as 25, First Margin Call	9.59	199.41	28.02	- 14.30	5
27) Same as 25, Second Margin Call	8.98	210.24	28.02	- 15.30	5
Moving Average Strategies					
28) 4-8	11.80	115.91	30.73	- 1.46	43
29) 5-10	10.37	104.24	25.99	- 3.63	42
30) 3-4-8	11.70	117.96	30.73	- 1.96	43
31) 4-8W	10.88	132.30	31.22	- 4.07	66
32) 3-4-8W	11.38	113.22	29.04	- 3.10	48
33) 4W-4-8W	12.22	105.69	30.27	- 0.06	44

Table A-3. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Winter Operation Beginning October 1 and Ending June 1, Using Specified Hedging Strategies, Tennessee, 1972-1979 (continued)

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
34) 4-8, 5¢ Penetration	11.60	110.25	29.43	- 1.46	41
35) 5-10, 4¢ Penetration	10.28	109.53	25.99	- 4.51	37
36) 3-4-8, 2¢ Penetration	11.80	117.56	30.73	- 1.96	41
37) 4-8W, 5¢ Penetration	10.57	126.65	28.72	- 5.15	44
38) 3-4-8W, 2¢ Penetration	11.09	114.75	28.14	- 3.83	44
39) 4W-4-8W, 2¢ Penetration	11.91	107.44	29.36	- 2.01	38
Point and Figure Strategies					
40) 5¢ Box, 5 Reversal	13.05	179.85	35.71	- 2.73	29
41) 5¢ Box, 5 Reversal, 65¢ Stop	12.29	196.99	35.63	- 4.05	35
42) 5¢ Box, 5 Reversal, \$1.50 Trailing Stop	12.20	146.09	29.15	- 2.73	35
43) 15¢ Box, 1 Reversal	12.80	181.78	35.31	- 2.73	32
44) 15¢ Box, 1 Reversal, 30¢ Stop	12.54	202.05	35.71	- 4.05	39
45) 15¢ Box, 1 Reversal \$1.35 Trailing Stop	12.25	148.84	29.15	- 2.73	38
46) 20¢ Box, 1 Reversal	12.95	180.52	35.31	- 2.73	28
47) 20¢ Box, 1 Reversal, 75¢ Stop	12.67	189.48	35.63	- 4.15	31
48) 20¢ Box, 1 Reversal, \$1.35 Trailing Stop	12.18	149.98	29.15	- 2.73	35

^aSame results apply to Localized Futures Break-even Price + \$1.00.

Table A-4. Mean and Variance of Net Returns, Maximum and minimum Net Returns, and Number of Hedges Executed for the Winter Operation Beginning November 1 and Ending July 1, Using Specified Hedging Strategies, Tennessee, 1972-1979

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
0) Cash	9.66	112.75	22.75	- 7.71	0
Elementary Strategies					
1) ^a Localized Futures >					
Break-even Price	4.92	83.01	24.61	- 3.63	7
2) ^a Same as 1, First Margin Call	8.57	117.11	21.89	- 9.08	7
3) ^a Same as 1, Second Margin Call	7.76	119.83	21.14	-10.08	7
7) Localized Futures >					
Break-even Price + \$1	5.10	79.67	24.61	- 2.37	7
8) Same as 7, First Margin Call	8.61	115.64	21.89	- 8.83	7
9) Same as 7, Second Margin Call	7.80	118.35	21.14	- 9.83	7
10) Localized Futures >					
Break-even Price + \$2	5.44	76.38	24.61	- 1.37	7
11) Same as 10, First Margin Call	8.61	115.66	21.89	- 8.83	7
12) Same as 10, Second Margin Call	7.83	118.04	21.14	- 9.83	7
13) Localized Futures >					
Break-even Price + \$3	6.26	71.43	24.61	- 0.37	7
14) Same as 13, First Margin Call	8.64	115.52	21.89	- 8.83	7
15) Same as 13, Second Margin Call	7.85	117.90	21.14	- 9.94	7
16) Localized Futures >					
Break-even Price + \$5	7.10	97.11	24.61	- 7.71	6
17) Same as 16, First Margin Call	8.91	107.27	21.89	- 7.71	6
18) Same as 16, Second Margin Call	8.32	102.57	21.13	- 7.71	6
19) Localized Futures >					
Cash Price	4.96	83.00	24.61	- 3.62	7
20) Same as 19, First Margin Call	8.57	117.11	21.89	- 9.08	7
21) Same as 19, Second Margin Call	7.80	119.59	21.14	- 10.08	7
22) Localized Futures >					
Cash Price + \$1	5.18	80.09	24.61	- 2.37	7
23) Same as 22, First Margin Call	8.69	116.22	21.89	- 8.83	7
24) Same as 22, Second Margin Call	7.81	117.57	21.14	- 9.83	7
25) Localized Futures >					
Cash Price + \$2	5.34	65.96	22.75	- 1.37	5
26) Same as 25, First Margin Call	8.88	119.42	22.75	- 8.83	5
27) Same as 25, Second Margin Call	8.24	124.74	22.75	- 9.83	5
Moving Average Strategies					
28) 4-8	12.60	105.32	31.35	3.70	48
29) 5-10	10.75	82.72	26.09	1.29	46
30) 3-4-8	12.56	108.39	31.57	3.20	47
31) 4-8W	11.55	116.50	31.84	0.52	69
32) 3-4-8W	11.95	99.12	29.87	1.49	51
33) 4W-4-8W	12.66	96.50	31.10	4.09	47

Table A-4. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Winter Operation Beginning November 1 and Ending July 1, Using Specified Hedging Strategies, Tennessee, 1972-1979 (continued)

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
34) 4-8, 5¢ Penetration	12.31	91.12	30.26	3.19	46
35) 5-10, 4¢ Penetration	10.28	65.71	22.65	1.46	44
36) 3-4-8, 2¢ Penetration	12.55	107.01	31.57	3.20	46
37) 4-8W, 5¢ Penetration	11.37	100.38	29.34	1.01	49
38) 3-4-8W, 2¢ Penetration	12.04	97.36	28.97	1.33	48
39) 4W-4-8W, 2¢ Penetration	12.67	94.42	30.20	3.15	43
Point and Figure Strategies					
40) 5¢ Box, 5 Reversal	11.24	73.88	25.45	2.43	34
41) 5¢ Box, 5 Reversal, 65¢ Stop	10.61	83.20	25.37	1.11	40
42) 5¢ Box, 5 Reversal, \$1.35 Trailing Stop	10.73	73.32	22.74	1.56	45
43) 15¢ Box, 1 Reversal	11.00	76.35	25.05	1.91	37
44) 15¢ Box, 1 Reversal, 30¢ Stop	10.18	79.88	23.58	1.11	47
45) 15¢ Box, 1 Reversal, \$1.35 Trailing Stop	10.77	76.31	22.74	1.56	48
46) 20¢ Box, 1 Reversal	11.09	74.61	25.05	1.84	33
47) 20¢ Box, 1 Reversal, 75¢ Stop	10.80	79.73	25.37	1.01	36
48) 20¢ Box, 1 Reversal, \$1.35 Trailing Stop	10.64	75.82	22.74	1.07	45

^aSame results apply to Localized Futures Exceeds Break-even Price + \$.50.

Table A-5. Summary Analysis of Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Winter Operations Combined, Using Specified Hedging Strategies, Tennessee, 1972-79

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
0) Cash	11.40	167.63	38.29	-13.18	0
Elementary Strategies					
1) Localized Futures >					
Break-even Price	5.45	61.88	27.82	- 3.62	21
2) Same as 1, First Margin Call	10.40	168.98	36.94	- 14.30	21
3) Same as 1, Second Margin Call	9.61	169.66	35.78	- 15.30	21
4) Localized Futures >					
Break-even Price + \$.50	5.49	61.31	27.82	- 3.62	21
5) Same as 4, First Margin Call	10.40	168.98	36.94	- 14.30	21
6) Same as 4, Second Margin Call	9.61	169.93	35.78	- 15.41	21
7) Localized Futures >					
Break-even Price + \$1	5.56	60.21	27.82	- 2.37	21
8) Same as 7, First Margin Call	10.42	168.58	36.94	- 14.30	21
9) Same as 7, Second Margin Call	9.63	169.63	35.78	- 15.41	21
10) Localized Futures >					
Break-even Price + \$2	5.91	58.00	27.82	- 1.37	21
11) Same as 10, First Margin Call	10.40	168.69	36.94	- 14.26	21
12) Same as 10, Second Margin Call	10.44	141.20	35.78	- 9.83	21
13) Localized Futures >					
Break-even Price + \$3	5.87	72.39	27.82	- 13.18	20
14) Same as 13, First Margin Call	10.50	165.40	36.94	- 13.18	20
15) Same as 13, Second Margin Call	9.73	160.91	35.78	- 13.18	20
16) Localized Futures >					
Break-even Price + \$5	7.14	81.32	27.82	- 13.18	19
17) Same as 16, First Margin Call	10.88	157.96	37.02	- 13.18	19
18) Same as 16, Second Margin Call	10.41	152.63	36.07	- 13.18	19
19) Localized Futures >					
Cash Price	5.34	63.59	27.82	- 3.62	21
20) Same as 19, First Margin Call	10.41	170.14	36.94	- 14.55	21
21) Same as 19, Second Margin Call	9.63	170.54	35.78	- 15.55	21
22) Localized Futures >					
Cash Price + \$1	5.54	62.34	28.20	- 2.37	21
23) Same as 22, First Margin Call	10.44	168.45	36.94	- 14.30	21
24) Same as 22, Second Margin Call	9.63	168.45	35.78	- 15.30	21
25) Localized Futures >					
Cash Price + \$2	6.97	75.70	28.02	- 1.37	17
26) Same as 25, First Margin Call	10.24	160.04	37.29	- 14.30	17
27) Same as 25, Second Margin Call	9.59	163.20	36.03	- 15.30	17
Moving Average Strategies					
28) 4-8	12.13	86.38	31.35	- 1.46	149
29) 5-10	10.79	75.70	26.09	- 3.63	135

Table A-5. Summary Analysis of Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Winter Operations Combined, Using Specified Hedging Strategies, Tennessee, 1972-79 (continued)

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
30) 3-4-8	11.99	91.24	31.57	- 1.96	142
31) 4-8W	11.23	96.81	31.84	- 4.07	214
32) 3-4-8W	11.76	88.36	29.87	- 3.10	154
33) 4W-4-8W	12.29	79.76	31.10	- 0.06	144
34) 4-8, 5¢ Penetration	12.02	80.79	30.26	- 1.46	136
35) 5-10, 4¢ Penetration	10.75	74.60	25.99	- 4.51	124
36) 3-4-8, 2¢ Penetration	12.03	89.50	31.57	- 1.96	135
37) 4-8W, 5¢ Penetration	11.41	92.89	29.34	- 5.15	150
38) 3-4-8W, 2¢ Penetration	11.86	92.05	28.97	- 3.83	143
39) 4W-4-8W, 2¢ Penetration	12.22	81.22	30.20	- 2.01	131
Point and Figure Strategies					
40) 5¢ Box, 5 Reversal	12.73	109.70	35.71	- 2.73	99
41) 5¢ Box, 5 Reversal, 65¢ Stop	12.45	123.56	35.63	- 4.05	112
42) 5¢ Box, 5 Reversal, \$1.50 Trailing Stop	12.60	108.12	37.33	- 2.73	123
43) 15¢ Box, 1 Reversal	12.50	111.64	35.31	- 2.73	106
44) 15¢ Box, 1 Reversal, 30¢ Stop	11.88	120.95	35.71	- 4.05	132
45) 15¢ Box, 1 Reversal, \$1.35 Trailing Stop	12.63	109.82	37.33	- 2.73	130
46) 20¢ Box, 1 Reversal	12.42	107.95	35.31	- 2.73	98
47) 20¢ Box, 1 Reversal, 75¢ Stop	12.48	116.57	35.63	- 4.15	104
48) 20¢ Box, 1 Reversal, \$1.35 Trailing Stop	12.62	122.74	41.13	- 2.73	122

Table A-6. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operation Beginning March 15 and Ending September 1, Using Specified Hedging Strategies, Tennessee, 1973-1979

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars Per cwt. -----				
0) Cash	5.64	67.41	16.32	-9.97	0
Elementary Strategies					
1) ^a Localized Futures > Break-even Price	6.24	4.43	8.62	2.36	7
2) ^a Same as 1, First Margin Call	4.67	67.73	15.40	-10.85	7
3) ^a Same as 1, Second Margin Call	6.43	22.76	14.94	0.62	7
16) Localized Futures > Break-even Price + \$5	7.48	11.21	13.57	3.31	6
17) Same as 16, First Margin Call	6.07	75.91	14.63	-10.85	6
18) Same as 16, Second Margin Call	9.05	13.29	13.58	5.34	6
19) Localized Futures > Cash Price	5.02	8.47	8.39	-0.09	7
20) Same as 19, First Margin Call	4.44	68.22	15.40	-10.85	7
21) Same as 19, Second Margin Call	6.34	23.48	14.94	0.62	7
22) Localized Futures > Cash Price + \$1	6.07	4.41	8.65 [†]	2.36	6
23) Same as 22, First Margin Call	5.77	66.57	15.14	-10.85	6
24) Same as 22, Second Margin Call	8.00	9.27	13.59	5.53	6
25) Localized Futures > Cash Price + \$2	6.00	9.67	11.42	2.36	5
26) Same as 25, First Margin Call	4.96	66.30	15.30	-10.85	5
27) Same as 25, Second Margin Call	7.15	13.37	13.83	2.95	5
Moving Average Strategies					
28) 4-8	11.62	41.45	22.37	5.02	45
29) 5-10	9.71	37.67	19.65	3.61	36
30) 3-4-8	11.16	44.59	22.15	5.02	39
31) 4-8W	10.82	42.61	22.05	5.05	66
32) 3-4-8W	11.17	43.33	22.96	5.62	47
33) 4W-4-8W	11.43	44.34	22.96	5.62	43
34) 4-8, 5¢ Penetration	11.31	38.07	22.15	3.99	41
35) 5-10, 4¢ Penetration	9.83	37.02	19.85	4.24	34
36) 3-4-8, 2¢ Penetration	11.56	43.40	22.15	5.02	38
37) 4-8W, 5¢ Penetration	11.14	44.65	22.19	5.10	49
38) 3-4-8W, 2¢ Penetration	11.15	43.92	22.35	5.42	42
39) 4W-4-8W, 2¢ Penetration	11.08	44.63	22.35	5.42	41
Point and Figure Strategies					
40) 5¢ Box, 5 Reversal	9.42	48.48	16.95	0.47	34
41) 5¢ Box, 5 Reversal, 65¢ Stop	7.71	31.52	14.81	0.91	39
42) 5¢ Box, 5 Reversal, \$1.50 Trailing Stop	7.33	37.23	17.22	-1.61	44

Table A-6. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operation Beginning March 15 and Ending September 1, Using Specified Hedging Strategies, Tennessee, 1973-1979 (continued)

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars Per cwt. -----				
43) 15¢ Box, 1 Reversal	7.84	28.92	16.95	0.47	35
44) 15¢ Box, 1 Reversal, 30¢ Stop	6.66	27.11	14.79	0.62	46
45) 15¢ Box, 1 Reversal, \$1.35 Trailing Stop	7.07	22.95	11.98	- 1.61	44
46) 20¢ Box, 1 Reversal	8.37	28.30	16.95	1.60	32
47) 20¢ Box, 1 Reversal, 75¢ Stop	7.44	26.27	14.79	0.91	37
48) 20¢ Box, 1 Reversal, \$1.35 Trailing Stop	7.24	23.49	12.55	- 0.48	41

^aSame results apply to Localized Futures Exceeds Break-even Price + \$.50, \$1.00, \$2.00 and \$3.00.

Table A-7. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operation Beginning April 15 and Ending October 1, Using Specified Hedging Strategies, Tennessee, 1973-1979

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
0) Cash	3.30	84.90	16.70	- 11.16	0
Elementary Strategies					
1) ^a Localized Futures >					
Break-even Price	6.07	4.31	8.20	3.04	7
2) ^a Same as 1, First Margin Call	7.03	34.48	15.23	- 4.63	7
3) ^a Same as 1, Second Margin Call	8.34	5.70	13.67	6.86	7
10) Localized Futures >					
Break-even Price + \$2	5.07	9.43	8.20	- 0.12	7
11) Same as 10, First Margin Call	6.04	41.84	15.23	- 4.63	7
12) Same as 10, Second Margin Call	7.34	16.09	13.67	- 0.12	7
13) Localized Futures >					
Break-even Price + \$3	5.27	8.77	8.20	- 0.12	6
14) Same as 13, First Margin Call	6.01	41.23	15.03	- 4.63	6
15) Same as 13, Second Margin Call	7.35	16.20	13.72	- 0.12	6
16) Localized Futures >					
Break-even Price + \$5	3.95	19.44	7.94	- 3.86	4
17) Same as 16, First Margin Call	5.52	39.22	15.58	- 3.86	4
18) Same as 16, Second Margin Call	5.16	35.76	14.82	- 3.86	4
19) Localized Futures >					
Cash Price	5.32	26.30	9.31	- 5.49	7
20) Same as 19, First Margin Call	5.73	48.18	15.58	- 4.53	7
21) Same as 19, Second Margin Call	5.36	47.07	14.83	- 5.15	7
22) Localized Futures >					
Cash Price + \$1.00	6.10	10.76	9.31	0.80	7
23) Same as 22, First Margin Call	7.42	19.19	15.23	0.80	7
24) Same as 22, Second Margin Call	6.95	14.12	13.13	0.80	7
25) Localized Futures >					
Cash Price + \$2	4.50	25.50	9.70	- 3.86	5
26) Same as 25, First Margin Call	5.53	40.70	15.78	- 3.86	5
27) Same as 25, Second Margin Call	5.35	32.76	13.68	- 3.86	5
Moving Average Strategies					
28) 4-8	9.46	30.51	19.14	4.93	41
29) 5-10	8.07	45.84	17.89	- 2.05	36
30) 3-4-8	9.10	28.30	18.01	4.16	37
31) 4-8W	8.55	27.07	17.31	4.39	61
32) 3-4-8W	8.70	20.98	16.02	4.97	40
33) 4W-4-8W	9.51	27.48	18.01	4.97	37
34) 4-8, 5¢ Penetration	9.35	28.67	18.01	4.20	36
35) 5-10, 4¢ Penetration	8.31	47.67	17.66	- 2.05	29
36) 3-4-8, 2¢ Penetration	8.90	30.59	18.01	3.74	37
37) 4-8W, 5¢ Penetration	10.15	28.98	17.70	4.10	42

Table A-7. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operation Beginning April 15 and Ending October 1, Using Specified Hedging Strategies, Tennessee, 1973-1979 (continued)

No.	Strategy	Net Returns				Number of Hedges Executed
		Mean	Variance	Maximum	Minimum	
		----- Dollars per cwt. -----				
38)	3-4-8W, 2¢ Penetration	8.67	31.02	18.53	3.41	38
39)	4W-4-8W, 2¢ Penetration	9.18	30.05	18.01	3.41	35
Point and Figure Strategies						
40)	5¢ Box, 5 Reversal	8.73	48.98	20.12	2.11	41
41)	5¢ Box, 5 Reversal, 65¢ Stop	8.87	43.22	19.25	2.30	43
42)	5¢ Box, 5 Reversal, \$1.50 Trailing Stop	8.20	55.66	23.48	2.71	48
43)	15¢ Box, 1 Reversal	9.06	41.08	19.44	2.95	40
44)	15¢ Box, 1 Reversal, 30¢ Stop	8.73	43.16	19.15	2.07	47
45)	15¢ Box, 1 Reversal, \$1.35 Trailing Stop	8.53	48.48	22.80	2.71	47
46)	20¢ Box, 1 Reversal	9.17	35.01	18.39	2.74	39
47)	20¢ Box, 1 Reversal, 75¢ Stop	9.38	40.88	19.04	2.05	39
48)	20¢ Box, 1 Reversal, \$1.35 Trailing Stop	8.69	41.13	21.75	2.50	47

^aSame results apply to Localized Futures Exceeds Break-even Price + \$.50 and \$1.00.

Table A-8. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operation Beginning May 15 and Ending November 1, Using Specified Hedging Strategies, Tennessee, 1973-1979

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
0) Cash	3.26	35.54	13.59	- 4.21	0
Elementary Strategies					
1) ^a Localized Futures >					
Break-even Price	5.47	16.21	13.73	1.87	7
2) ^a Same as 1, First Margin Call	2.74	39.03	12.47	- 5.30	7
3) ^a Same as 1, Second Margin Call	3.27	27.62	11.27	- 4.87	7
10) Localized Futures >					
Break-even Price + \$2	5.67	15.99	13.73	1.87	7
11) Same as 10, First Margin Call	2.70	39.28	12.47	- 5.30	7
12) Same as 10, Second Margin Call	4.31	23.63	11.27	- 4.87	7
13) Localized Futures >					
Break-even Price + \$3	6.36	13.22	13.73	3.13	7
14) Same as 13, First Margin Call	5.19	24.16	12.47	- 3.92	7
15) Same as 13, Second Margin Call	5.85	8.23	11.27	3.28	7
16) Localized Futures >					
Break-even Price + \$5	3.33	36.21	13.73	- 4.21	3
17) Same as 16, First Margin Call	2.83	30.64	12.47	- 4.21	3
18) Same as 16, Second Margin Call	2.74	27.51	11.27	- 4.21	3
19) Localized Futures >					
Cash Price	5.01	26.66	14.73	- 0.97	7
20) Same as 19, First Margin Call	3.69	31.07	12.27	- 5.33	7
21) Same as 19, Second Margin Call	2.99	26.22	9.56	- 6.13	7
22) Localized Futures >					
Cash Price + \$1	6.18	25.10	16.43	1.43	7
23) Same as 22, First Margin Call	4.10	26.22	11.26	- 5.33	7
24) Same as 22, Second Margin Call	5.16	10.03	11.26	1.34	7
25) Localized Futures >					
Cash Price + \$2	4.31	26.11	13.59	- 2.95	3
26) Same as 25, First Margin Call	4.07	24.39	13.59	- 2.95	3
27) Same as 25, Second Margin Call	3.96	24.35	13.59	- 2.95	3
Moving Average Strategies					
28) 4-8	8.01	37.62	16.85	1.26	49
29) 5-10	6.65	56.74	17.73	- 4.04	41
30) 3-4-8	7.63	40.50	16.52	1.26	42
31) 4-8W	7.78	43.18	17.47	0.80	63
32) 3-4-8W	7.91	36.36	16.03	0.89	46
33) 4W-4-8W	8.37	41.16	17.92	0.82	43
34) 4-8, 5¢ Penetration	8.15	43.87	18.22	0.19	41
35) 5-10, 4¢ Penetration	6.78	57.62	17.73	- 4.04	35
36) 3-4-8, 2¢ Penetration	8.06	43.51	18.22	1.26	40
37) 4-8W, 5¢ Penetration	7.78	51.91	18.56	0.87	49
38) 3-4-8W, 2¢ Penetration	7.79	39.62	15.70	0.12	44

Table A-8. Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operation Beginning May 15 and Ending November 1, Using Specified Hedging Strategies, Tennessee, 1973-1979 (continued)

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
39) 4W-4-8W, 2¢ Penetration	7.95	47.54	17.92	0.12	43
Point and Figure Strategies					
40) 5¢ Box, 5 Reversal	9.29	28.00	15.27	4.18	33
41) 5¢ Box, 5 Reversal, 65¢ Stop	7.13	26.43	15.27	2.16	39
42) 5¢ Box, 5 Reversal, \$1.50 Trailing Stop	8.08	31.17	19.06	3.85	46
43) 15¢ Box, 1 Reversal	8.88	22.42	15.27	4.18	33
44) 15¢ Box, 1 Reversal, 30¢ Stop	6.37	18.93	15.27	2.26	42
45) 15¢ Box, 1 Reversal, \$1.35 Trailing Stop	7.73	31.90	18.18	3.31	47
46) 20¢ Box, 1 Reversal	9.07	29.75	15.27	3.68	33
47) 20¢ Box, 1 Reversal, 75¢ Stop	7.14	28.88	15.27	2.09	38
48) 20¢ Box, 1 Reversal, \$1.35 Trailing Stop	7.89	35.69	19.06	3.31	48

^aSame results apply to Localized Futures Exceeds Break-even Price + \$.50 and \$1.00.

Table A-9. Summary Analysis of Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operations Combined, Using Specified Hedging Strategies, Tennessee, 1973-1979

No. Strategy	Net Returns				Number of Hedges Executed
	Mean	Variance	Maximum	Minimum	
	----- Dollars per cwt. -----				
0) Cash	4.07	57.65	16.70	- 11.16	0
Elementary Strategies					
1) ^a Localized Futures >					
Break-even Price	5.93	7.60	13.73	1.87	21
2) ^a Same as 1, First Margin Call	4.81	45.61	15.40	- 10.85	21
3) ^a Same as 1, Second Margin Call	6.01	21.40	14.94	- 4.87	21
10) Localized Futures >					
Break-even Price + \$2	5.66	9.19	13.73	- 0.12	21
11) Same as 10, First Margin Call	4.47	46.62	15.40	- 10.85	21
12) Same as 10, Second Margin Call	6.03	20.44	14.94	- 4.87	21
13) Localized Futures >					
Break-even Price + \$3	5.95	8.18	13.73	- 0.12	20
14) Same as 13, First Margin Call	5.29	40.25	15.40	- 10.85	20
15) Same as 13, Second Margin Call	6.54	14.56	14.94	- 0.12	20
16) Localized Futures >					
Break-even Price + \$5	4.92	23.47	13.73	- 4.21	13
17) Same as 16, First Margin Call	4.81	45.84	15.58	- 10.85	13
18) Same as 16, Second Margin Call	5.65	30.07	14.82	- 4.21	13
19) Localized Futures >					
Cash Price	5.11	18.45	14.73	- 5.49	21
20) Same as 19, First Margin Call	4.62	44.98	15.58	- 10.85	21
21) Same as 19, Second Margin Call	4.90	31.10	14.94	- 6.13	21
22) Localized Futures >					
Cash Price + \$1	6.12	12.08	16.43	0.80	20
23) Same as 22, First Margin Call	5.76	35.53	14.23	- 10.85	20
24) Same as 22, Second Margin Call	6.70	11.47	13.59	0.80	20
25) Localized Futures >					
Cash Price + \$2	4.93	18.99	13.59	- 3.86	13
26) Same as 25, First Margin Call	4.89	39.74	15.78	- 10.85	13
27) Same as 25, Second Margin Call	5.49	22.94	13.83	- 3.86	13
Moving Average Strategies					
28) 4-8	9.70	35.18	22.37	1.26	135
29) 5-10	8.15	43.72	19.65	- 4.04	113
30) 3-4-8	9.30	36.22	22.15	1.26	118
31) 4-8W	9.05	35.61	22.05	0.80	190
32) 3-4-8W	9.26	32.23	22.96	0.89	133
33) 4W-4-8W	9.77	35.57	22.96	0.82	123
34) 4-8, 5¢ Penetration	9.60	34.97	22.15	0.19	118
35) 5-10, 4¢ Penetration	8.31	44.32	19.85	- 4.04	98
36) 3-4-8, 2¢ Penetration	9.50	37.58	22.15	1.26	115
37) 4-8W, 5¢ Penetration	9.69	39.76	22.19	0.87	140

Table A-9. Summary Analysis of Mean and Variance of Net Returns, Maximum and Minimum Net Returns, and Number of Hedges Executed for the Summer Operations Combined, Using Specified Hedging Strategies Tennessee, 1973-1979 (continued)

No.	Strategy	Net Returns			Number of Hedges Executed	
		Mean	Variance	Maximum Minimum		
----- Dollars per cwt. -----						
38)	3-4-8W, 2¢ Penetration	9.20	36.49	22.35	0.12	124
39)	4W-4-8W, 2¢ Penetration	9.40	38.40	22.35	0.12	119
Point and Figure Strategies						
40)	5¢ Box, 5 Reversal	9.15	37.73	20.12	0.47	108
41)	5¢ Box, 5 Reversal, 65¢ Stop	7.90	30.89	19.25	0.91	121
42)	5¢ Box, 5 Reversal \$1.50 Trailing Stop	7.87	37.38	23.48	- 1.61	138
43)	15¢ Box, 1 Reversal	8.59	28.03	19.44	0.47	108
44)	15¢ Box, 1 Reversal, 30¢ Stop	7.25	27.92	19.15	0.62	135
45)	15¢ Box, 1 Reversal, \$1.35 Trailing Stop	7.78	31.38	22.80	- 1.61	138
46)	20¢ Box, 1 Reversal	8.87	28.05	18.39	1.60	104
47)	20¢ Box, 1 Reversal, 75¢ Stop	7.98	29.85	19.04	0.91	114
48)	20¢ Box, 1 Reversal, \$1.35 Trailing Stop	7.94	30.46	19.06	- 0.48	136

^aSame results apply to Localized Futures Exceeds Break-even Price + \$.50 and \$1.00.