

Price Risk Management in December Corn Futures

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Table of Contents

| | |
|---|----|
| Background | 1 |
| Timing of Action Is the Key | 2 |
| Trend Line Sell Signals | 3 |
| Selling Rallies to the Highs | 4 |
| Moving Average Guides to Price Risk Management | 6 |
| Research on Optimal Moving Average Systems | 8 |
| The Research Results | 10 |
| 1990 Review | 11 |
| 1991 Review | 14 |
| 1992 Review | 16 |
| 1993 Review | 18 |
| 1994 Review | 20 |
| 1995 Review | 22 |
| 1996 Review | 24 |
| 1997 Review | 26 |
| 1998 Review | 28 |
| 1999 Review | 30 |
| 2000 Review | 32 |
| Summary on Performance | 34 |
| Testing Out of Sample | 36 |

Background

The risk of low and unprofitable corn prices may be greater than ever. The 1996 farm legislation eliminated production controls in the form of set-aside requirements, and in the presence of generally favorable weather, corn production in the U.S. has surged. The 1996 crop was 9.293 billion bushels and that harvest started the process of a supply-side recovery from the small 1995 crop that brought record high prices during 1996. The next four years produced crops of 9.761, 9.759, 9.431, and 9.915 billion bushels for calendar years 1997 through 2000 respectively, and the 2001 crop is 9.507 billion bushels. Ending stocks that were 0.883 billion bushels at the end of the 1996/97 crop year grew to a very large 1.899 billion bushels in 2000/01 and are estimated at 1.596 billion for the 2001/02 crop year. The average farm price was \$1.82 and \$1.85 in the 1999/2000 and 2000/01 crop years, respectively, and is projected in a range of \$1.85-1.95 for the 2001/02 crop year (April 10, 2002, *World Agricultural Supply-Demand Estimates* at <http://usda.mannlib.cornell.edu/>).

The 2002 farm bill has no supply control provisions, retaining the freedom of farmers to plant as much corn as they like. The March 28, 2002 *Prospective Plantings* report indicated that corn growers will plant 79.0 million acres in 2002, up 4 percent from 2001 (<http://usda.mannlib.cornell.edu/>). If weather is even close to normal over the next several years, the corn crops will continue to be large, and farm-level price expectations of \$2.00, perhaps significantly lower, will be likely.

Corn, a commodity product, is increasingly produced and sold in a global market. New varieties of corn in the future that will offer specific and identifiable product attributes will start to move part of corn production out of the “commodity” status. But much of the corn in the next few years will continue to be a commodity with no differentiated attributes, and corn producers will continue to be price takers with no capacity to influence harvest-period price. The quantity demanded for ethanol will likely increase, but we are uncertain as to how much. Under these circumstances, it is important that corn growers take advantage of the one factor they can control—when price is established. That element of control in a global marketplace requires that growers be comfortable with forward pricing.

Corn can be forward priced in at least three basic ways:

1. *Cash forward contracts.* A buyer extends an offer to a grower at a specific cash price for delivery at a future harvest or post-harvest date. The cash offer is tied to futures prices by the cash-futures basis. Delivery must be made by the producer, so there is little flexibility. When a cash forward delivery contract is signed, the buyer will immediately sell corn futures to cover the risk that prices will go down. The cash contract offer will, therefore, tend to go up or down with increases and decreases in the underlying futures contract.
2. *Hedging by selling futures.* The producer goes directly to the futures market and, by selling futures, establishes a specific price subject to basis performance.

$$FP = \text{FUTURES} + \text{BASIS}$$

Where

FP = the forward pricing opportunity in the futures,

FUTURES = the trading level of the appropriate corn futures contract (usually December), and

BASIS = cash minus futures that localizes the futures market-discovered price for corn.

Once the basis estimate is determined from local cash and national-level futures prices from past years, it is essentially set for the new production year unless unusual supply or demand circumstances suggest an

adjustment is needed. The forward price, therefore, tends to go up and down directly with the discovered prices in the futures market. The producer is exposed to basis risk in that the final net price depends on the actual, not expected, level of the basis when the cash product is sold and the short (selling futures is “going short”) futures positions are closed out by buying back the contracts. If the corn market declines, the futures are bought back at lower prices, and the funds to cover cash price declines accumulate in the futures account. But if the market goes up, the producer can receive “margin calls” and be asked to send funds to the broker; the margin calls will continue so long as the market moves higher. The final net price is then the cash price reduced by losses in the futures account. Whether price trend is up or down, net price is always the cash price plus the results of the “round turn” in futures from selling early and buying back at harvest. (Details on basis calculations and use and on margin accounting are available in *Agricultural Futures and Options, Principles and Strategies* by Purcell and Koontz, Prentice Hall, 1999, ISBN# 0-13-779943-8.)

3. *Setting a price floor by buying a put option.* The price floor or PFL is set by

$$\text{PFL} = \text{FUTURES STRIKE PRICE} + \text{BASIS} - \text{PUT PREMIUM}$$

Where

FUTURES STRIKE PRICE = the 10-cent increments for which corn futures options are traded;
PUT PREMIUM = the cost of the right to be short at a specific strike price.

Options on corn trade for “strike prices” in 10-cent increments (\$2.40, \$2.50, \$2.60, etc.). Producers can choose higher or lower price floors by buying put options for higher or lower strike prices. If the market goes down, the put option can be sold at a price, its premium, above its initial cost. The decline in cash prices is offset by the increasing premium value of the put option. Basis risk is still present because the put option will move, as it approaches maturity, to an option premium approaching the full unexpected decline in the cash market and thereby provide the exact forward price expected only when closing basis is the same as the allowed for basis early in the year. Option premiums will be higher in volatile markets and with more time left before expiration. Options can be a relatively costly way of acquiring price insurance. But if the market goes up, the producer will benefit as soon as the increase matches the option premium, and there are never margin calls from buying options.

Timing of Action Is the Key

No matter which of the three price risk management tools is selected, the key to a successful price risk management program is knowing when to take action—and having the discipline to take that action. The issue of timing is difficult. Often, the correct thing to do is to take action while prices are still trending higher. But many producers have trouble with this decision. What if the market goes up after the cash contract is signed or the futures contracts are sold? What is an opportunity cost (the chance to sell at higher levels) is often seen as a loss and as a mistake by producers, and they are reluctant to take action the next time the same scenario presents itself.

A number of approaches to technical analysis of bar charts for the corn market can help with this timing decision and the related willingness to take action. Learning to “read” the bar chart can help, and a few basic tools can be applied to the chart. This section introduces two of the most widely used technical tools. The intent is to demonstrate “chart reading” with these two selected chart patterns and, at the same time, start to build a reason for producers who either have trouble reading the chart or do not have the discipline to take appropriate actions on chart-based signals to look for a more objective approach.

Trend Line Sell Signals

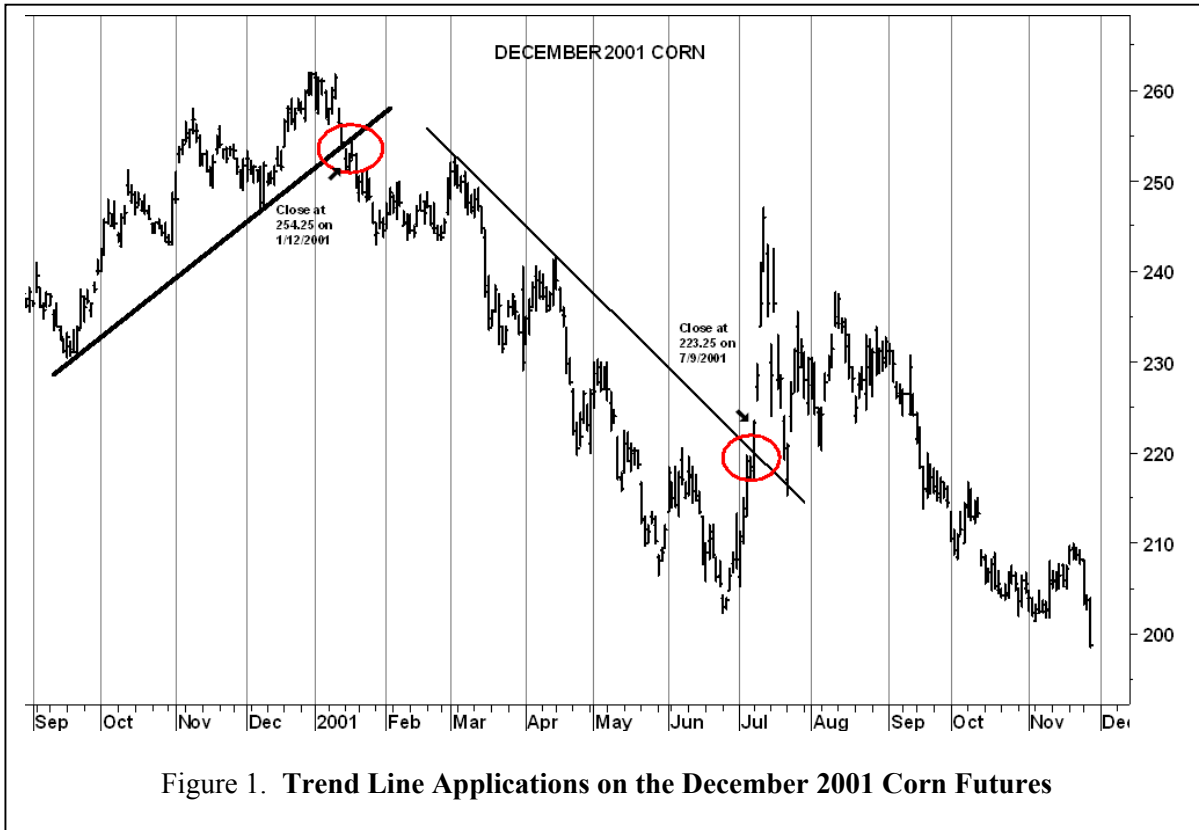
On any rally toward the top of the fundamental supply-demand price range for the year,¹ the corn market tends to turn up, surge too far to the upside, make a downward correction of the first rally, and then turn higher again. If this pattern develops, an *uptrend line* can be drawn across the initial low and the low in the subsequent downward correction. (This pattern is demonstrated in Figure 1.) If a widely recognized trend line can be established, the end of the uptrend in prices is signaled by a close below the trend line, a “sell signal” seen by everyone who watches the charts and observes the close. Forward pricing actions should be established on that signal whether cash contracts, futures, or options are used. A producer who sells futures directly on that signal may seek to be a “selective hedger,” seeking to follow a strategy that has price protection in place only when the market is trending lower. When the direction of price trend turns up, perhaps on a close above a *downtrend line*, the selective hedger buys back the short hedges to benefit from the rising cash prices. This approach cannot be used with cash contracts, and it can be cumbersome when using options. If the objective is to *manage the firm’s exposure to price risk* in such a way that downside protection and upside benefits are both possible, dealing directly in futures is usually the best approach.

The December 2001 corn futures (Figure 1) demonstrate an application of the trend line approach. Connecting the lows in September 2000 with the downward correction lows in December, a major *sell signal* is generated on January 12, 2001 with the close of 254.25 cents per bushel² below the trend line. This trend line would have been drawn within two or three days after the market trades up and “leaves” the lows in early December. A steep but usable downtrend line could have been drawn across the early March and April highs, and a *buy signal* is generated at a closing price of 223.25 on July 9. But the rest of the chart is not as clear on exactly what trend line to draw, and herein lies a difficulty for some market users. Do you connect the late June lows to the low in mid-July? This trend line is too steep for some chart watchers, and they would want to connect the late June lows with the lows in early August or even in mid-August. But all this starts to look more like an “art” than a “science.” Judgment is required, and clear and definitive rules cannot always be applied.

To elaborate, a producer might ask why not connect the September and late October lows early in the period? Rules that require the two lows to be at least 10 trading days apart will help keep the user from drawing numerous short-term “trends” on the chart, but that rule would have been met by the September and late October lows. As implied above, “don’t draw trend lines that are too steep” is another rule, but that rule is subjective and may be useless when electronic systems are setting the vertical and horizontal scales. An experienced user might be patient and not sketch a trend line using the very first downward correction in late October when the harvest for 2001 corn is 11 to 12 months away. But once again judgment is involved, and the lack of concrete and objective rules to follow bothers some users. Discipline is needed, but discipline is sometimes a scarce characteristic in volatile commodity markets.

¹ The first step is to look at the fundamentals to get some idea of the possible range of prices for the upcoming decision period. The publication by Kenyon and Lucas develops a procedure that is very useful for the corn producer. It can be accessed in PDF format at www.reap.vt.edu. Click on “publications” then “REAP Research Reports,” and look for *Corn Pricing Guide* by David Kenyon and Katie Lucas, REAP Research Report R038, December 1998, pp. 43.

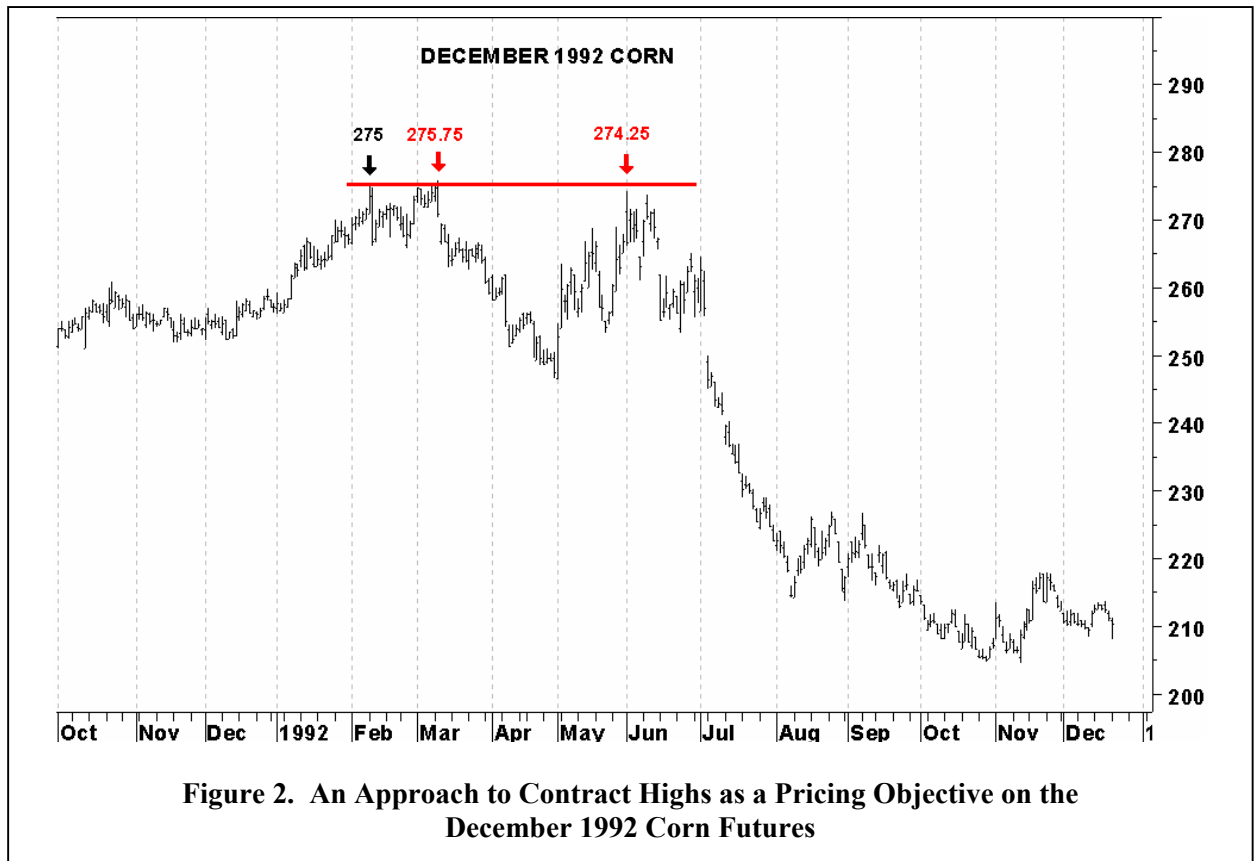
² The futures trade in cents per bushel; therefore, the charts show cents per bushel. When working directly with the charts and futures prices, I will stick with cents per bushel as a terminology. When writing about corn prices in general, I will, on occasion, use dollars per bushel.



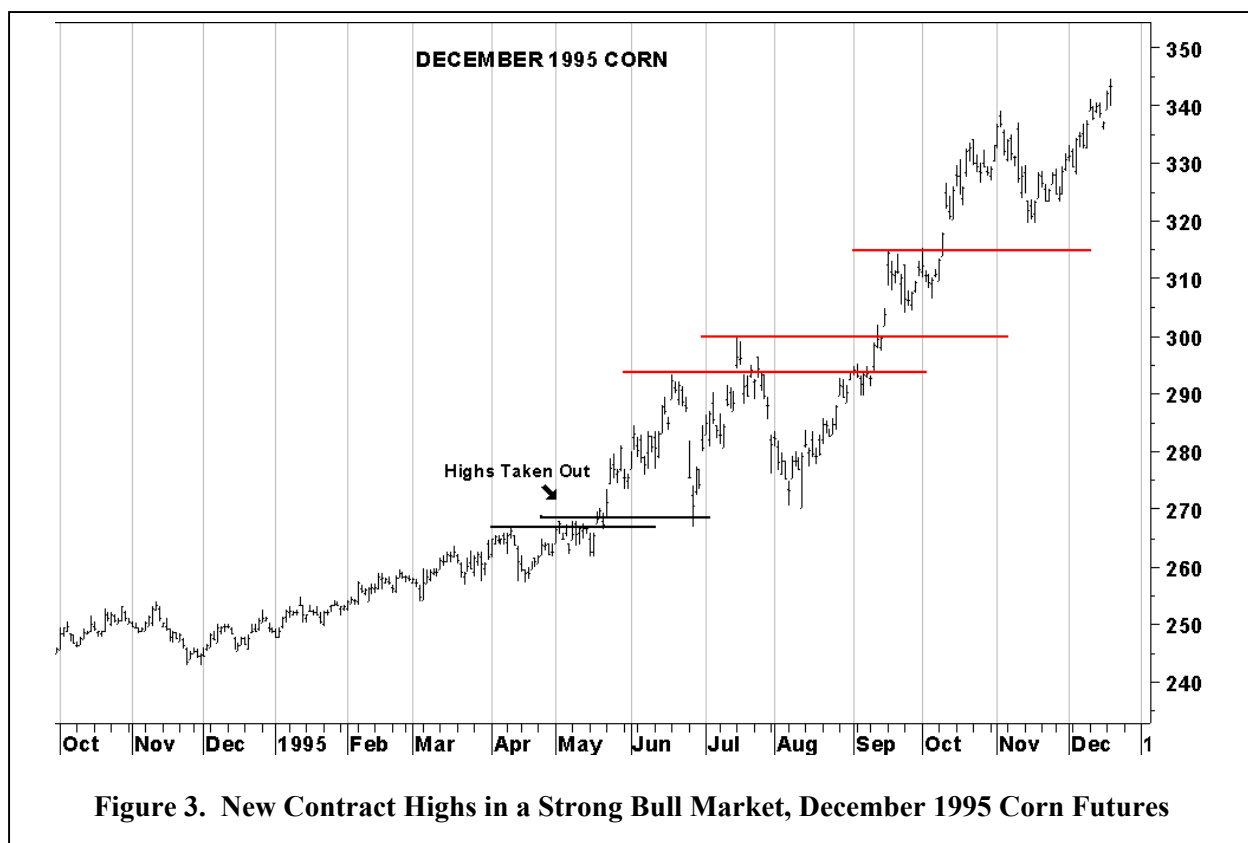
Selling Rallies to the Highs

A second and widely used chart-based strategy is to sell a rally to the *life-of-contract high* or to the high established after, say, October 1 of the prior year. This widely used strategy has a chance to get short hedges established near the high for the year, and it is one of the chart patterns that requires a producer to forward price when prices are still going up—the difficult-to-do scenario mentioned earlier. December 1992 (Figure 2) corn demonstrates.

The early-February post-harvest price surge reaches a price of 275. As soon as prices dip below this high, it becomes the high across which chart readers will mentally (or actually) draw a horizontal resistance plane. The market will often challenge such highs again, especially if they occur early in the year when supply-side numbers (acreage, planting period weather, corn prices relative to soybeans, etc.) are still uncertain. But if the consensus of the supply-demand balance has not changed when the market challenges that high again, *the market is likely to fail*. On this chart, the high on March 10 when the old high was again challenged was 275.75 and the close was at 270.75. A sell order placed at 273 or 274 on a *good 'til canceled* (GTC) basis just after the early February high is recorded would have placed short hedges near the high for the year. (Putting the sell order 2 to 3 cents below the resistance plane increases the chances of selling the futures. There is likely to be a horde of sell orders at and just below the old 275 high, especially if the 275 corn price is toward the top of the fundamental supply-demand ranges for the year that traders have worked out.) Note the later rally on June 1 quit at 274.25 as a cluster of sell orders just below the old high again turned the market lower. That June failure gave another chance to sell and place short hedges on challenges of the highs. *Apparently, the fundamental supply-demand picture had not changed enough to merit still higher prices in June.*



If the high such as the 275 on the December 1992 corn is, in fact, at or near the top end of the price range and consistent with the expected supply-demand dynamics for this year, the corn producer has a huge opportunity. Everyone wants the “high price for the year,” and this approach has a chance to get you forward priced near the high for the year. But occasionally, this surge to the high will come late in the year and if it is due to weather problems that are threatening yields, the market may move up through the high. Margin calls will be coming from the short futures positions, and the producer often feels as if he or she has failed and made a mistake. The December 1995 (Figure 3) corn demonstrates. Rallies to the April and May highs, at decent price levels given the 1994 corn market, were taken out and the market moved up to the 330 to 340 level. Producers who are selective hedgers often try to manage this price uncertainty by following a rule that buys back short hedges if the market closes *two consecutive days at new contract highs*, but this level of discipline is often missing—and it is not easy to acquire and keep such a big dose of discipline. Later, highs near 294, 300, and 315 were taken out as the weather impacts hit hard as harvest approached. Selling futures at 270 with a 10-cent basis forward prices corn at 260 subject to basis performance, and the 260 is well below the 320 to 330 that the cash market speculator would have garnered at harvest in 1995. Cumulative margin calls would have been some 60 cents per bushel if short futures positions at 270 were held, and some producers will have trouble financing sustained margin calls.



Moving Average Guides to Price Risk Management

For some producers, more objective guides to pricing decisions would help. In the presence of farm policy with no supply management and increasing exposure to a global commodity market, a “safety net” may also be of interest. What happens to the farmer, for example, who waits for a rally toward a past high that is seen as offering acceptable prices, but the hoped for rally never comes? If a bearish market develops and corn goes well below \$2.00 at harvest, the viability of the farm operation may be at risk. Such a decline in price can mean big problems for the producer who struggles reading the chart and also for the producer who may read the chart correctly but still not gain protection because this is the one year the chart reading principle does not work.

There are other and more objective guides to the markets. Among a host of possibilities, moving average systems have advantages in that they are simple to calculate and monitor and they provide clear and unambiguous signals.

Moving averages are widely used in commodity and stock markets. Analysts often pay attention to a 50-day moving average (last 50 closing prices added and divided by 50) as an indicator of overall direction of price trend. Many technical measures of market activity use moving averages, and a common model is to use two moving averages with “crossover actions” to generate buy and sell signals.

The default set of moving averages in many electronic market and data services is the 9 and 18. A 9-day moving average is the last 9 closing prices added and divided by 9, and a moment’s reflection suggests it will be quicker to move higher when the market turns up than would an 18-day moving average. Similarly, the 9-day will move lower more quickly than the 18-day when the market tops and turns down.

A set of closing prices from February and March of the December 1998 corn futures is used to illustrate. The closing price for December corn and the 9-day and 18-day moving averages are shown starting March 12 (Table 1).

Table 1. 9 and 18-day moving averages, February and March 1998.

| Date | Closing Price | 9-Day MA | 18-Day MA |
|-------------|----------------------|-----------------|------------------|
| February 17 | 284.75 | | |
| 18 | 283.50 | | |
| 19 | 281.50 | | |
| 20 | 280.25 | | |
| February 23 | 279.50 | | |
| 24 | 279.00 | | |
| 25 | 280.25 | | |
| 26 | 279.25 | | |
| 27 | 279.50 | 281.000 | |
| March 02 | 284.25 | 280.944 | |
| 03 | 284.00 | 281.000 | |
| 04 | 284.25 | 281.306 | |
| 05 | 283.25 | 281.639 | |
| 06 | 286.00 | 282.194 | |
| March 09 | 287.75 | 283.167 | |
| 10 | 288.50 | 284.083 | |
| 11 | 288.50 | 285.111 | |
| 12 | 286.00 | 286.222 | 283.611 |
| 13 | 284.50 | 286.250 | 283.597 |
| March 16 | 281.25 | 285.944 | 283.472 |
| 17 | 281.25 | 285.944 | 283.472 |
| 18 | 282.00 | 285.472 | 223.556 |
| 19 | 279.00 | 284.694 | 283.444 |
| 20 | 275.50 | 283.333 | 283.250 |
| March 23 | 277.50 | 282.083 | 283.083 |

On March 23, the 9-day falls below the 18-day, generating a sell signal. Note that after the mid-March rally, the 9-day turned down more quickly than the 18-day. The sell signal did not come at the highs of the period near 288 to 289. It comes *after* a “top” has been recorded and the price trend is turning lower.

The December 1998 corn futures contract (Figure 4) demonstrates both the strengths and weaknesses of this system if it is used to guide a selective hedging program for a corn producer. Start the system on December 1 of 1997 to give a full 12 months to monitor prices for 1998 corn. The first sell signal occurs when the 9-day (in red—viewing these charts effectively will require color) moves down through the 18-day on December 16 at a closing price of 281.25. A subsequent buy signal (9-day moves up through the 18) occurs on January 23 at 284. This “round turn” trade loses 2.75 cents per bushel in the futures account and will cost, in commissions, about 1 cent per bushel (\$50 per round turn on a 5,000 bushel futures contract). The next sell signal comes on February 20 at 280.25 and that short position is bought back on March 10 at a closing price of 288.5, a loss of 8.25 cents. Clearly, corn producers will not be thrilled with this system in the choppy price action from December 1997 through March of 1998.

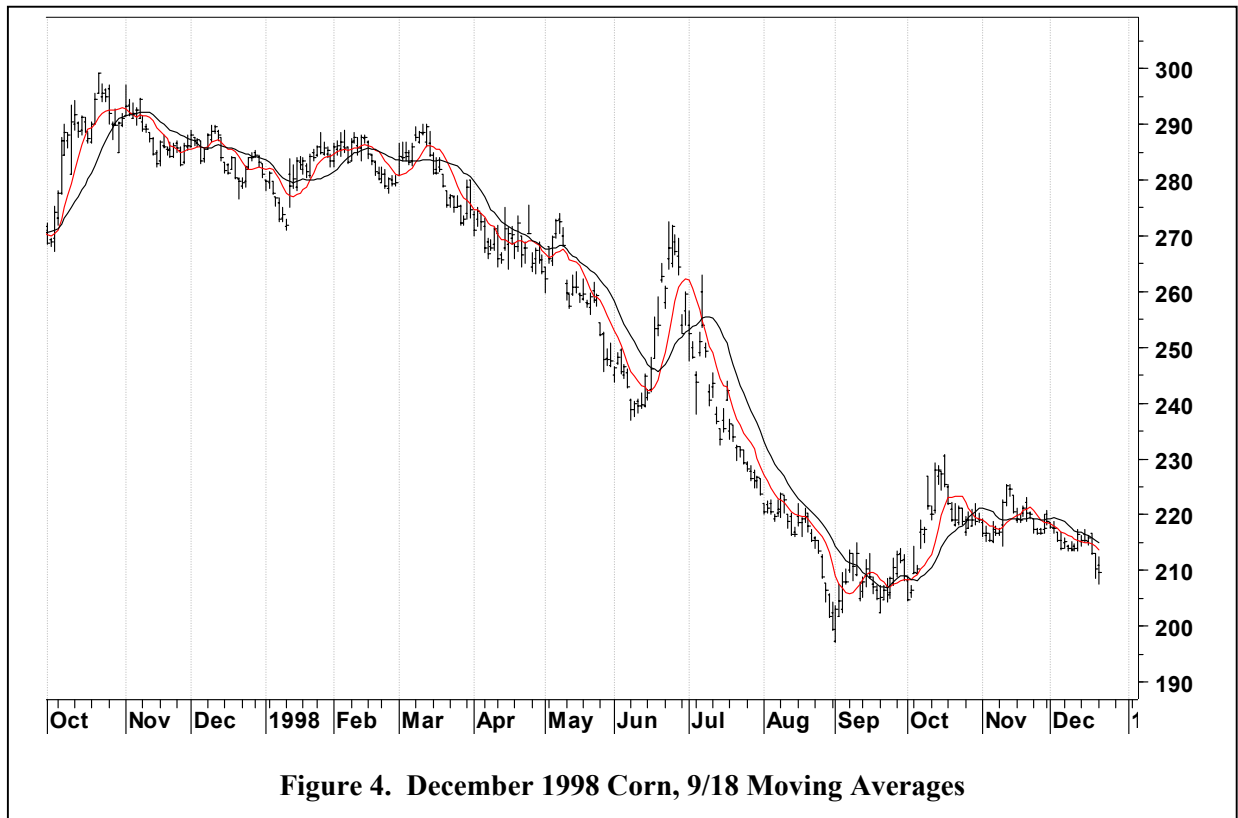


Figure 4. December 1998 Corn, 9/18 Moving Averages

But when the market patterns changed, the performance of the set of moving averages also changed. Short hedges would be in place from March 23 through June 19 when they are bought back as the 9-day moves up through the 18-day during a weather rally. The short hedges are replaced on a sell signal on July 8 at a close of 254 and are bought back on September 15 at 210.25, a gain of 43.75 cents. The 7 “round turn” trades during the year are summarized in Table 2. Of the 7, there are 4 negative trades and 3 positive trades with an overall gain of 51.25 cents less 7 cents in commissions (1 cent per bushel for each completed round turn) or 44.25 cents. If the cash futures basis is -10 cents per bushel, the cash price for cash market speculators would be around \$2.05 in early December with the futures around \$2.15. Adding the 44.25 cents to the \$2.05 puts price up near \$2.50. The “chart reader” would need a short position in the December futures at \$2.60 to match this \$2.50 net price.

In a volatile year like 1998, not all producers will be good enough at reading the chart and disciplined enough in their trading actions to add a net of 44.25 cents to their harvest-period selling price. And perhaps more important, what about the producer who was waiting on \$3.00 or \$3.10 futures in this market? After all, corn prices were at record highs in 1996—just two years back. Those \$3.00 prices were never offered in the December 1997 to December 1998 period, and the price received at harvest was \$2.00 or below, depending on basis levels.

Research on Optimal Moving Average Systems

If a moving average system is a good idea, as a guide to a selective hedging program and as a safety net, there is immediate interest in the optimum or profit-maximizing combination of moving averages for December corn. If the 9 and 18 work well, is there a set that works better? This interest launched a major

| Date | Action | Closing Price (¢/bu) | Net Trade (¢/bu) |
|------------------------|---------------|-----------------------------|-------------------------|
| 12/16/97 | Sell (S) | 281.25 | |
| 1/23/98 | Buy (B) | 284.00 | -2.75 |
| 2/20/98 | S | 280.25 | |
| 3/10/98 | B | 288.50 | -8.25 |
| 3/23/98 | S | 277.25 | |
| 6/19/98 | B | 262.75 | +14.50 |
| 7/8/98 | S | 254.00 | |
| 9/15/98 | B | 210.25 | +43.75 |
| 9/24/98 | S | 208.50 | |
| 10/5/98 | B | 209.75 | -1.25 |
| 10/29/98 | S | 218.75 | |
| 11/13/98 | B | 220.50 | -1.75 |
| 11/25/98 | S | 216.75 | |
| 12/21/98 | Closeout | 209.75 | +7.00 |
| Overall gain: | | 51.25¢ | |
| Gain less commissions: | | 44.25¢ | |

research effort to search for and test the effectiveness of the best moving average combination for December corn futures.

The research effort involved a number of steps:

1. Since most producers will not start thinking about the next corn crop until after harvest, the period examined is December 1 of the prior year to November 1 of the current year. Most producers will have completed harvest by November 1. Therefore, November 1 is selected as a “closeout” date if any short futures positions are not bought back by the moving averages generating a buy signal before November 1.
2. All combinations of moving averages from 2 to 70 were tested across all December corn futures contracts from 1990 through 2000.
3. To help eliminate the frequent and often losing trades in choppy markets (review the first half of the December 1998 futures in Figure 4), penetration requirements were tested. For the December corn futures of the 1990s, penetration requirements of 0, .25, .50, 1.0 and 2.0 cents per bushel were tested. If, for example, the most profitable moving averages were the 18-day and the 21-day with a 1.0 cent penetration rule (the 18-day must be below the 21-day moving average by *at least 1.0 cent* before the sell signal is confirmed and executed at the close of the day), a signal is generated.³ The 18-day must be above the 21-day by at least 1.0 cent for a buy signal to be confirmed and executed. The intent is to eliminate some of the frequent and losing trades like those early trades on the December 1998 corn and to focus on major moves in the market.
4. A 1.0 cent per bushel commission cost is assessed each time a round turn (sell to place short hedges and later buy back) is completed. This assumption results in commissions of \$50 per round-turn on 5,000 bushel corn futures contracts.

³ Historically, my research has shown that taking the short position at the open the next day did not change the results significantly, but I did not test that here.

5. The optimal moving average and penetration requirement for a short hedging system was the set with the highest average gain across the 11 years in the 1990-2000 period. This optimum was, in fact, the 18- and 21-day moving averages with a 1.0 cent penetration requirement.
6. There were no interest costs charged for any margin money on deposit with the broker since the system is a “short only” program. Gains in the futures account during prolonged down trends can be moved into interest bearing accounts with the brokerage firm and could offset interest costs of any limited margin requirements when the markets move higher. The buy signal will usually lift short hedges when price trends turn up before any margin call would be issued, but there is no guarantee of zero margin calls in very volatile “weather” markets.

The Research Results

For each year, the data and information presented are:

1. A table showing results from the 9 and 18 and the optimal 18 and 21 with a 1.0 cent penetration rule. There was no intent to test the 9 and 18 and the optimal set to see if performance of the two is statistically different. The interest was in whether another system does better than the “baseline” 9 and 18 that is in many internet technical systems to guide trade in commodities and stocks.
2. Graphs showing the behavior of the 9-day (in red) and the 18-day moving average, and the 18-day (in red) and 21-day moving average set with a 1.0 penetration rule on the December futures charts for the particular year.
3. A brief review of the performance and the strengths and weaknesses of the averages during each year with special attention to the years that show prolonged trends either up or down. In “down” years, the good performance is obvious: short hedges are in place for all or most of the price declines. In “up” years, the goal is to get most of the benefits of the upward trending cash markets and not have those benefits taken away by short hedges and margin calls.
4. A look at the net prices after commissions compared to cash prices at harvest assuming a negative 15-cent per bushel basis. The cumulative contribution to cash flow from the moving average systems across 1990-2000 is also presented.
5. Reports on out-of-sample tests of the 18/21 system on the December 2001 corn futures and on the performance of the 18/21 system with a 1.0 cent penetration rule during 1980-1989.

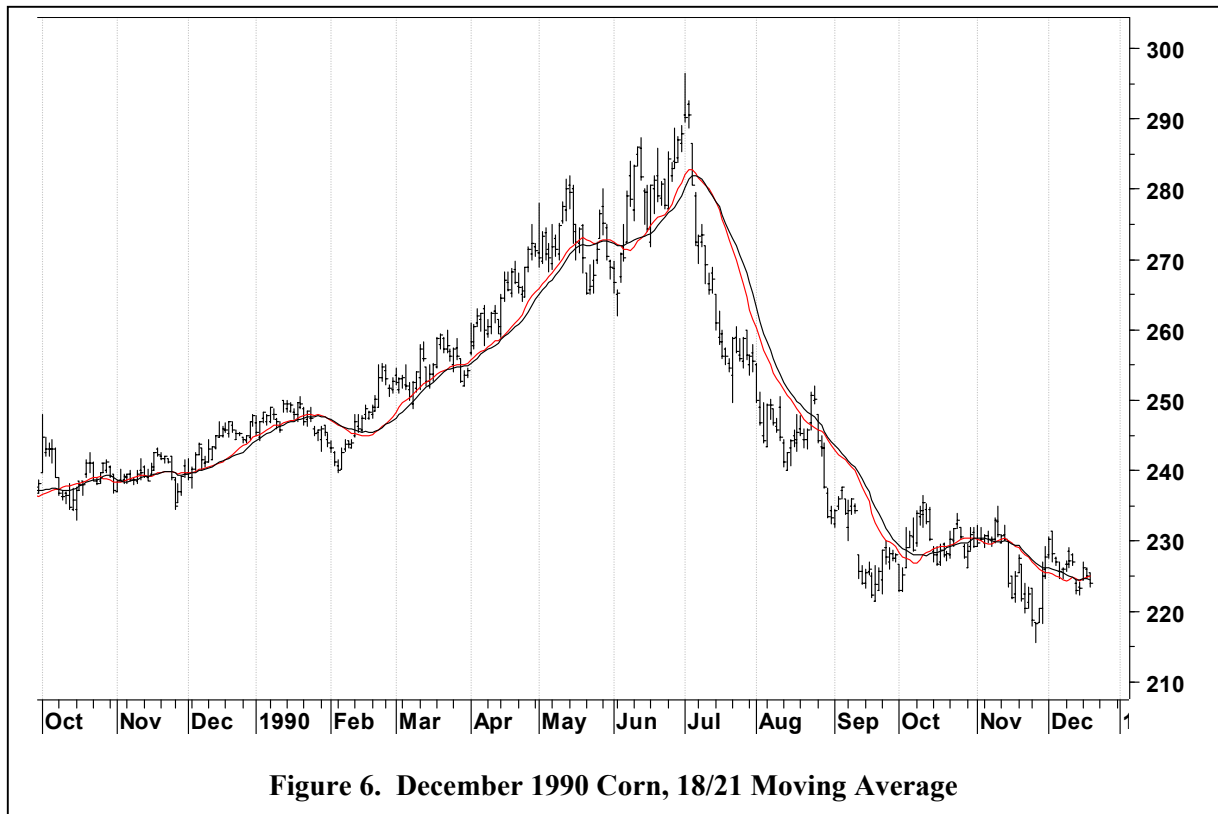
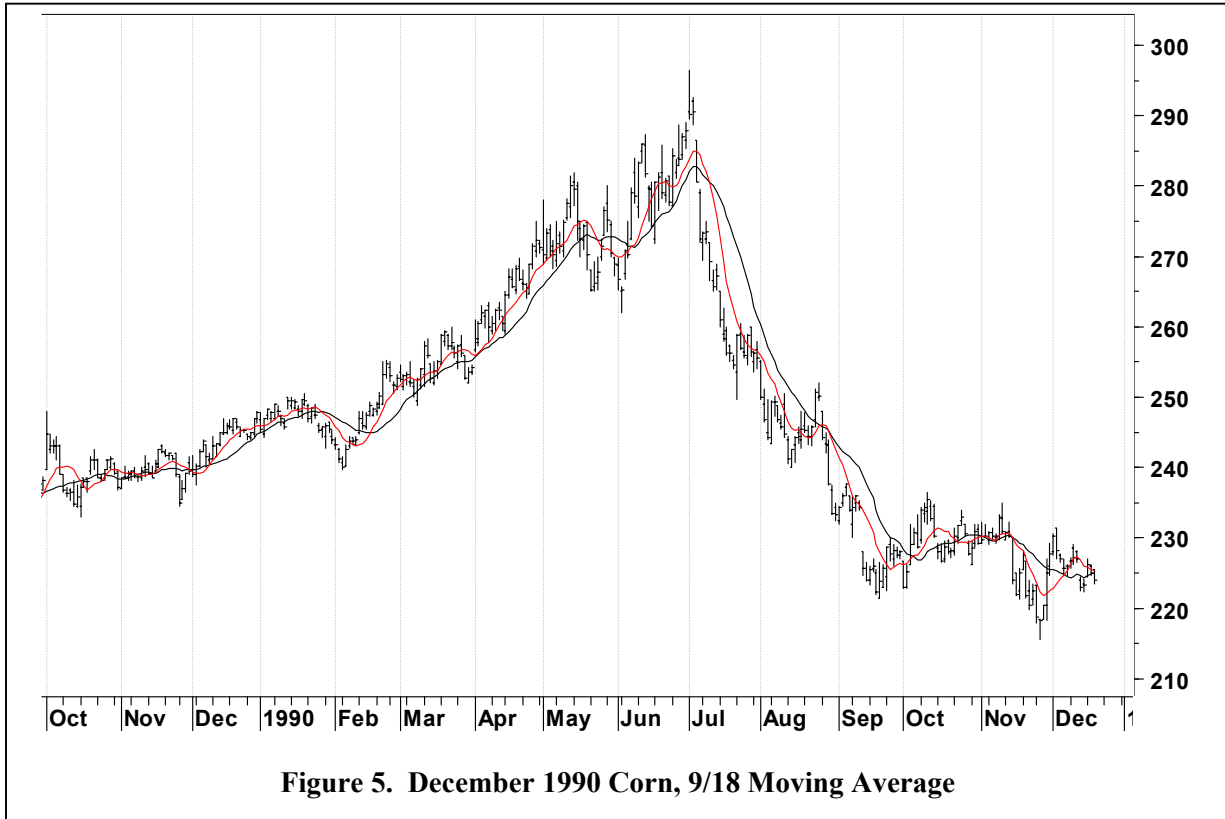
The research tests a selective hedging philosophy. When prices turn down, short hedges are placed. When prices turn up, the short hedges are bought back so that the producer can benefit from higher prices in the cash market. The producer is never long futures. The idea is to *manage exposure to price risk* to ensure the viability of the business.

| Table 3. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1990 | | | |
|---|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 12/1/89 | Sell (S) | 239.00 | |
| 12/8/89 | Buy (B) | 241.25 | -2.25 |
| 1/26/90 | S | 245.75 | |
| 2/16/90 | B | 248.25 | -2.50 |
| 5/23/90 | S | 267.75 | |
| 6/7/90 | B | 279.00 | -11.25 |
| 7/12/90 | S | 265.75 | |
| 8/28/90 | B | 243.25 | 22.50 |
| 8/29/90 | S | 237.75 | |
| 10/4/90 | B | 230.75 | 7.00 |
| 10/23/90 | S | 231.75 | |
| 11/1/90 | Closeout | 229.75 | 2.00 |
| | | Overall gain: | 15.5¢ |
| | | Gain less commissions: | 8.5¢ |
| 18/21 and 1-Cent Penetration System | | | |
| 6/8/90 | S | 278.50 | |
| 6/18/90 | B | 280.50 | -2.00 |
| 7/20/90 | S | 254.50 | |
| 11/1/90 | Closeout | 229.75 | 24.75 |
| | | Overall gain: | 22.75¢ |
| | | Gain less commissions: | 20.75¢ |

1990 Review

The 9/18 generated losing trades in the choppy December 1989-June 1990 period (Table 3). These choppy markets are difficult for moving average systems, and the losses offset most of the nice gains from the sell signals on July 12 and August 29. The 9/18 entered short hedges more quickly when the price break came in July, signaling a short position on July 12 at a closing price of 265.75 and generating a 22.5 cent gain by late August. Figure 5 shows the trading patterns.

The 18/21 with the 1-cent penetration rule recorded a small loss in June and then did not generate a sell signal until the July price break, and the sell signal to place short hedges did not get confirmed until July 23 at 258.75. Once the sell signal was generated, however, the short position was held until closeout on November 1 at 229.75. This first year tested demonstrates the tradeoff between the two moving average systems. The optimum system avoids most of the losing trades in choppy markets but may be later than other systems (as in July in this year) getting short hedges established. Figure 6 shows the trading patterns for the 18/21.



An insert is useful here to remind the user about performance of the 18/21 with the 1-cent penetration requirement. Figure 6 appears to show the 18-day crossing the 21-day on a number of occasions, which is the case, but only 2 round-turn trades were reported.

A sell-signal is not accepted, recall, when the 18-day moves down through the 21-day *until the 18-day is below the 21-day by at least 1 cent*. The intent of the “penetration rule” is to avoid frequent and often losing trades during choppy markets. In Figure 6, the 18-day was not below the 21-day by 1.0 cents or more at the close until June 8. All the crossovers from December 1989 through May 1990 are thus ignored. Note that the price trend was up in direction until late June and early July. The selective hedger does not want to have short hedges in place in an upward trending market.

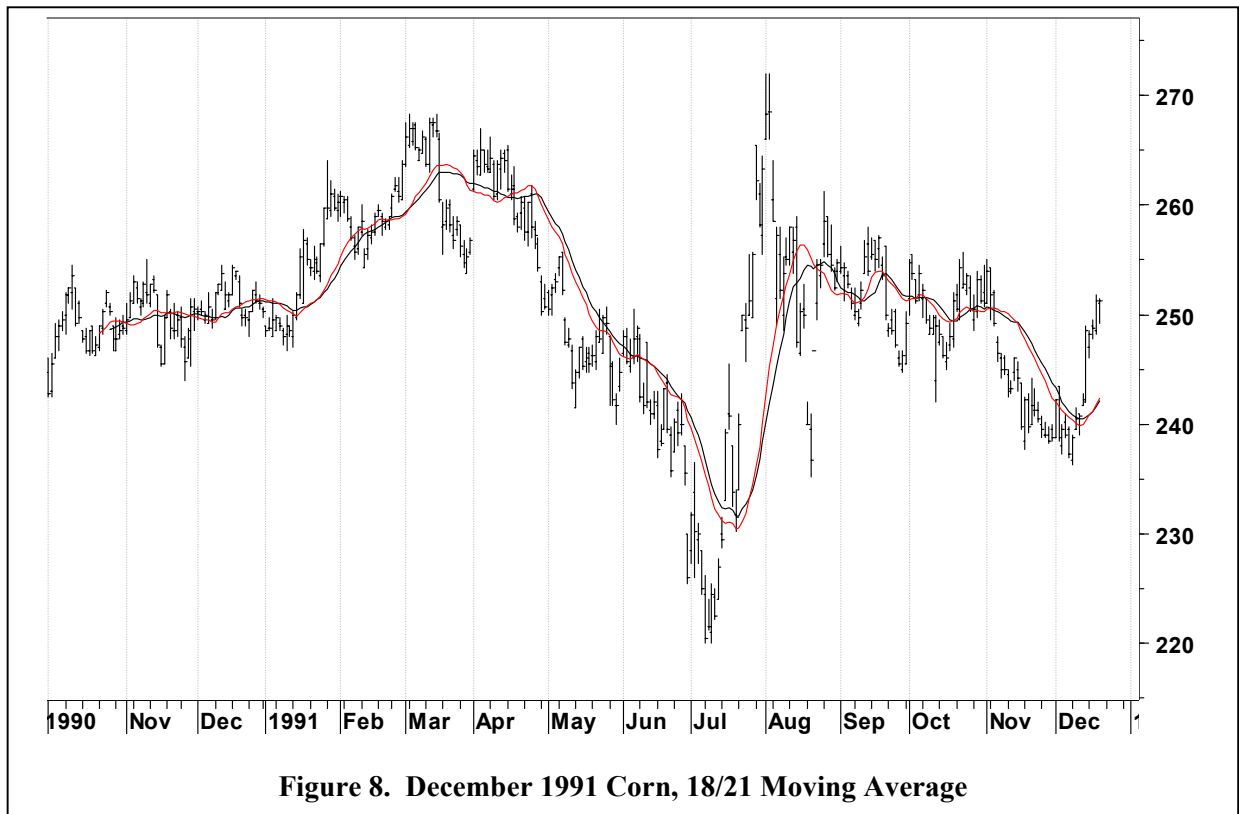
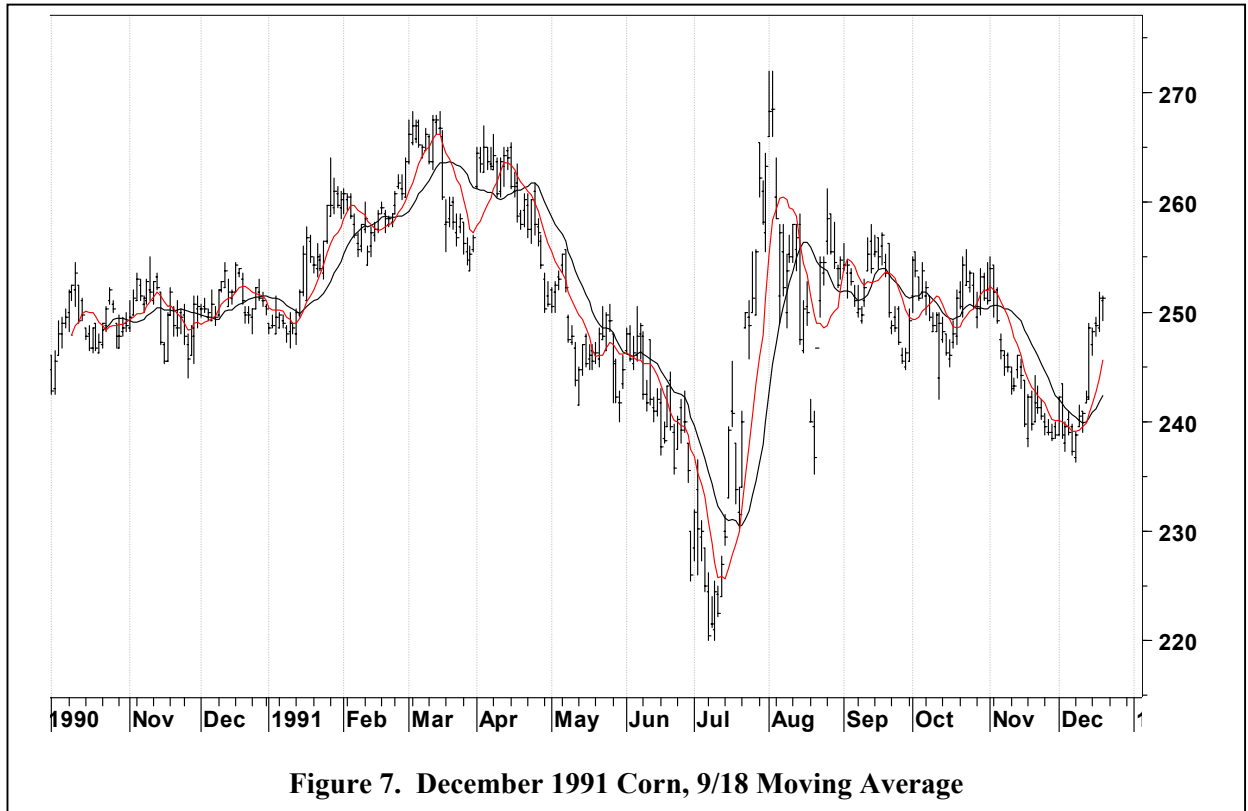
But even the 18/21 with the penetration rule makes “mistakes.” Note the June 8 short hedges were bought back on June 18 in a very volatile market at a small loss. And this “mistake” was costly—the subsequent short hedges on July 20 were at a close of 254.50, over 20 cents below the earlier short hedges at 278.50. Ideally, the original short hedges at 278.50 would not be bought back during the volatile June market, but they were. The best attitude to adopt is that the 18/21 with a penetration requirement is trying to avoid mistakes, but even the optimum system cannot eliminate all mistakes in volatile markets. What the system does accomplish is the right balance between getting into or out of the futures market at the right times and avoiding frequent losing trades in choppy markets.

| Table 4. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1991 | | | |
|---|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 12/31/90 | Sell | 250.25 | |
| 1/17/91 | Buy | 256.75 | -6.50 |
| 2/14/91 | S | 257.50 | |
| 2/26/91 | B | 261.75 | -4.25 |
| 3/20/91 | S | 261.75 | |
| 4/8/91 | B | 264.25 | -2.50 |
| 4/22/91 | S | 257.50 | |
| 6/3/91 | B | 248.00 | 9.50 |
| 6/5/91 | S | 246.25 | |
| 7/22/91 | B | 240.00 | 6.25 |
| 8/15/91 | S | 250.25 | |
| 8/30/91 | B | 254.75 | -4.50 |
| 9/16/91 | S | 255.50 | |
| 9/20/91 | B | 250.00 | 5.50 |
| 9/25/91 | S | 247.25 | |
| 10/10/91 | B | 249.75 | -2.50 |
| 10/16/91 | S | 246.00 | |
| 10/28/91 | B | 250.50 | -10.50 |
| Overall gain: -9.5¢ | | | |
| Gain less commissions: -18.5¢ | | | |
| 18/21 and 1-Cent Penetration System | | | |
| 4/10/91 | S | 263.75 | |
| 7/30/91 | B | 258.25 | 5.50 |
| 8/26/91 | S | 258.50 | |
| 9/16/91 | B | 255.50 | 3.00 |
| Overall gain: 8.5¢ | | | |
| Gain less commissions: 6.5¢ | | | |

1991 Review

The 9/18 recorded losses in the early choppy markets (Table 4). The early June period demonstrates why penetration rules help. The April 22 short hedge position with the 9/18 was bought back on June 3, and a new sell signal replaced the short hedges almost immediately on June 5. This type of frequent trading is frustrating and often means losses or missing protection on part of the move to lower prices. The short hedge was replaced on June 5 only slightly below the “buy back” price of 248.00, but placing the hedge at or near the earlier buyback price is not always the case. The 18/21 system avoided these “in and out” trades with only two round turn trades. Figures 7 and 8 record performance of the moving averages.

The chart reader may look at the early August prices above \$2.70 and say “sell up here.” But that period would have been difficult to manage. The market closed two consecutive days above the early-year highs, a widely recognized buy signal. But the unlikely then occurred—the market failed the next day and dropped back below the old contract high and then moved lower. Across 30 years of experience, I would expect the markets to go down after two consecutive closes at new highs no more than 5 to 10 percent of the time.

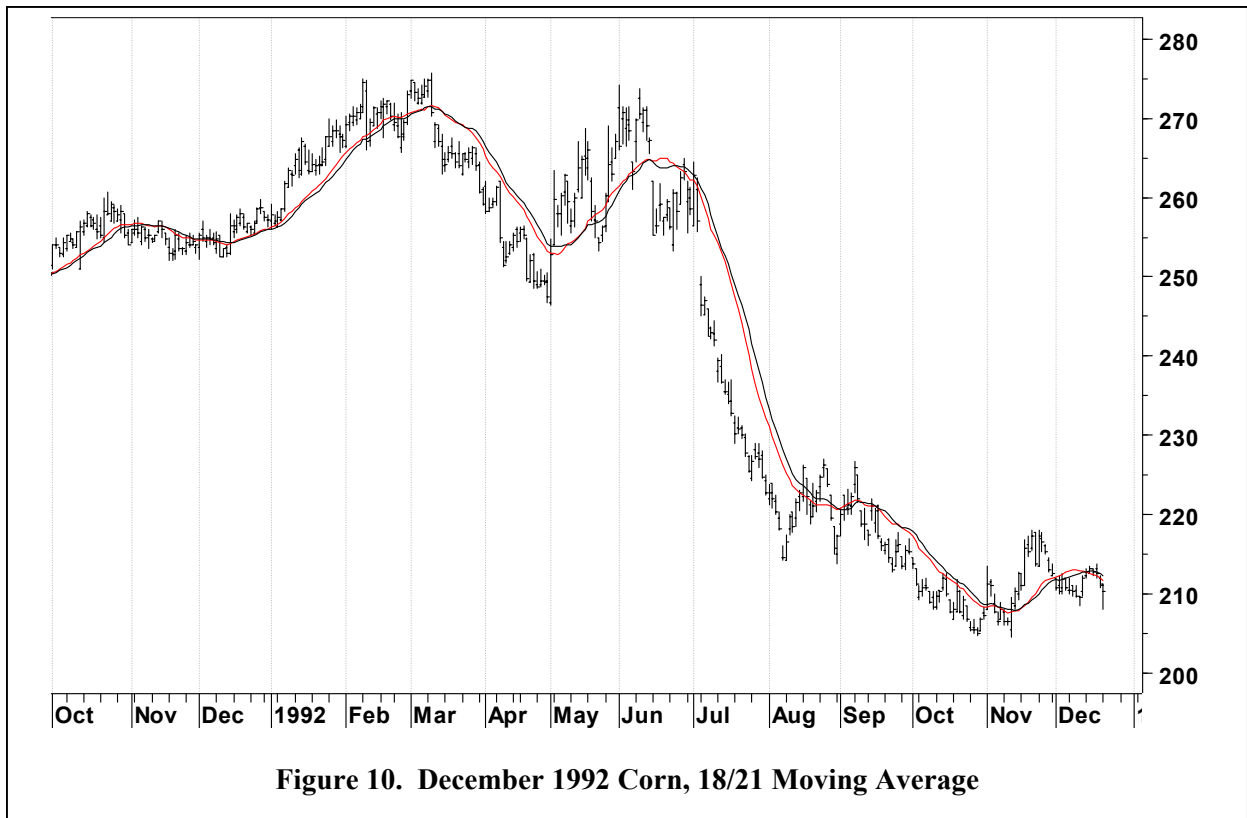
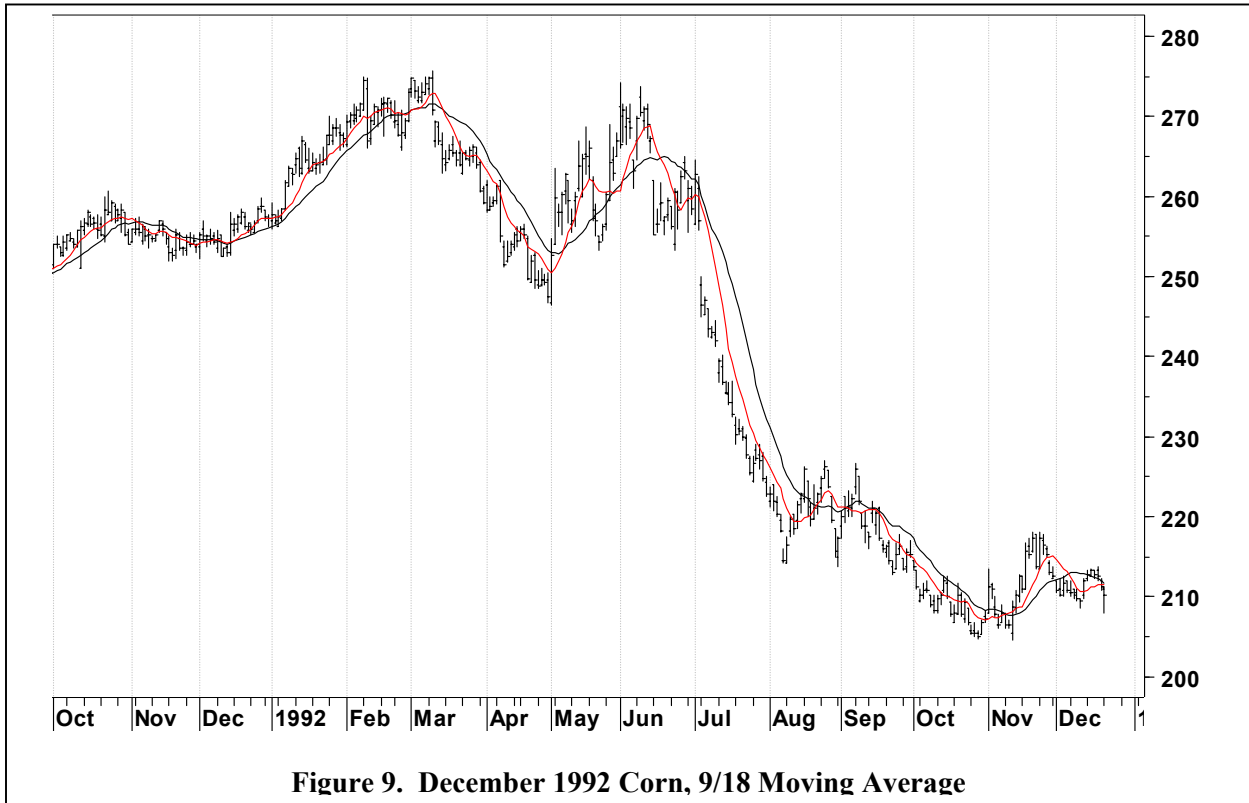


| Table 5. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1992 | | | |
|---|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 2/28/92 | Sell (S) | 273.00 | |
| 3/5/92 | Buy (B) | 273.00 | 0.00 |
| 3/16/92 | S | 264.25 | |
| 5/7/92 | B | 262.75 | 1.50 |
| 5/28/92 | S | 263.00 | |
| 6/2/92 | B | 270.75 | -7.75 |
| 6/17/92 | S | 259.25 | |
| 8/21/92 | B | 222.75 | 36.50 |
| 9/3/92 | S | 221.25 | |
| 11/1/92 | Closeout | 211.25 | 10.00 |
| | | Overall gain: | 40.25 ¢ |
| | | Gain less commissions: | 35.25 ¢ |
| 18/21 and 1-Cent Penetration System | | | |
| 4/1/92 | S | 258.25 | |
| 5/20/92 | B | 257.00 | 1.25 |
| 7/20/92 | S | 230.25 | |
| 11/1/92 | Closeout | 211.25 | 19.00 |
| | | Overall gain: | 19.0 ¢ |
| | | Gain less commissions: | 17.0 ¢ |

1992 Review

The 9/18 was significantly better than the 18/21 in 1992 (Table 5). The big difference was the short hedges placed on 6/17/92 that generated 36.50 cents before commissions. In early July (Figure 9), the 9-day came close to the 18, but did not cross it to generate a buy signal. Had that buy signal occurred, the system would have missed much of the July-August price decline.

The same patterns were a problem for the 18/21. Summer-period short hedges were not replaced until July 20 at 230.25, missing much of the decline from the 260 to 270 level. Overall, the 9/18 netted 18.25 cents more than the 18/21. If cash selling price were \$2.00 during harvest, corn was \$2.35 (\$2.00 plus \$.35 gain in the hedges) with the 9/18 and only \$2.17 or so as a net price for corn with the 18/21. Configured to avoid frequent trades and mistakes, the 18/21 system is slower to generate sell signals. The 9/18 entered short hedges in mid-June at 259.25, and the 18/21 was much later on July 20 with the entry price at a much lower 230.25. Figures 9 and 10 record the patterns for the year.

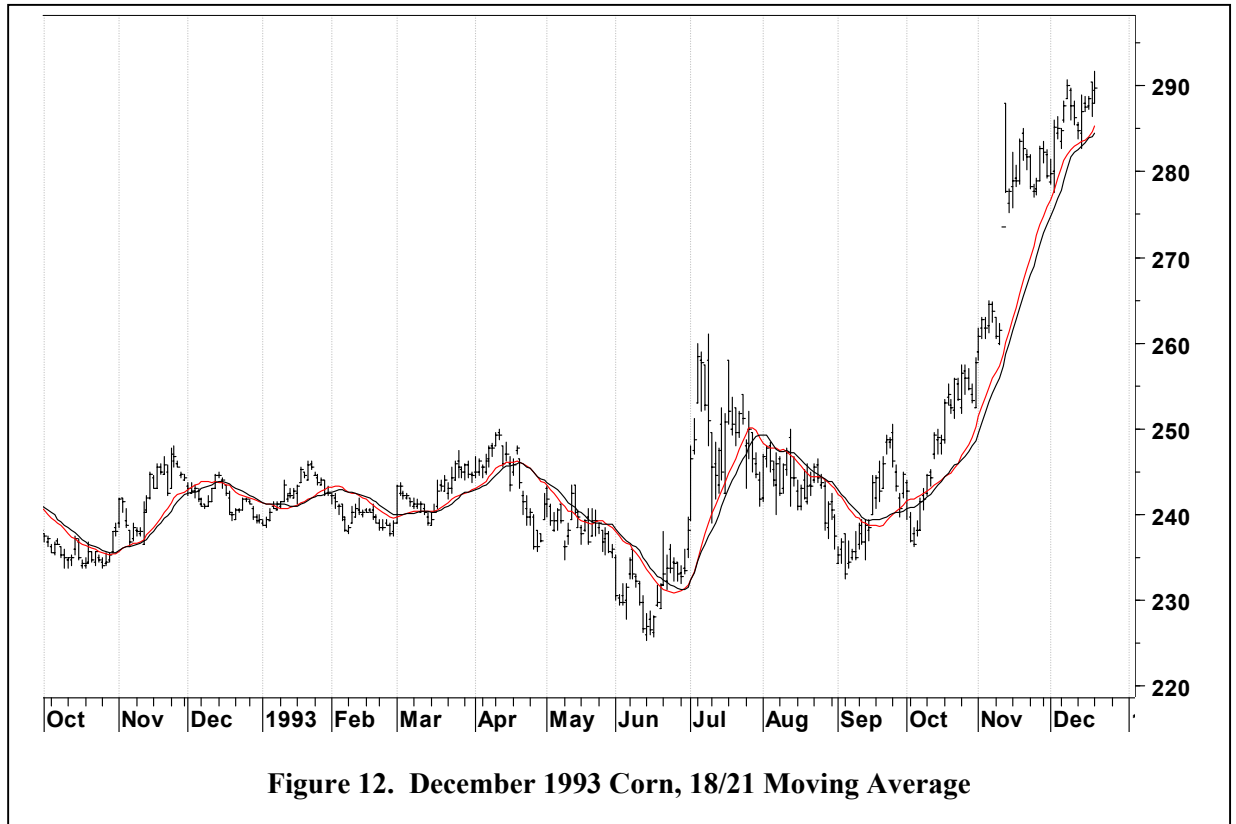
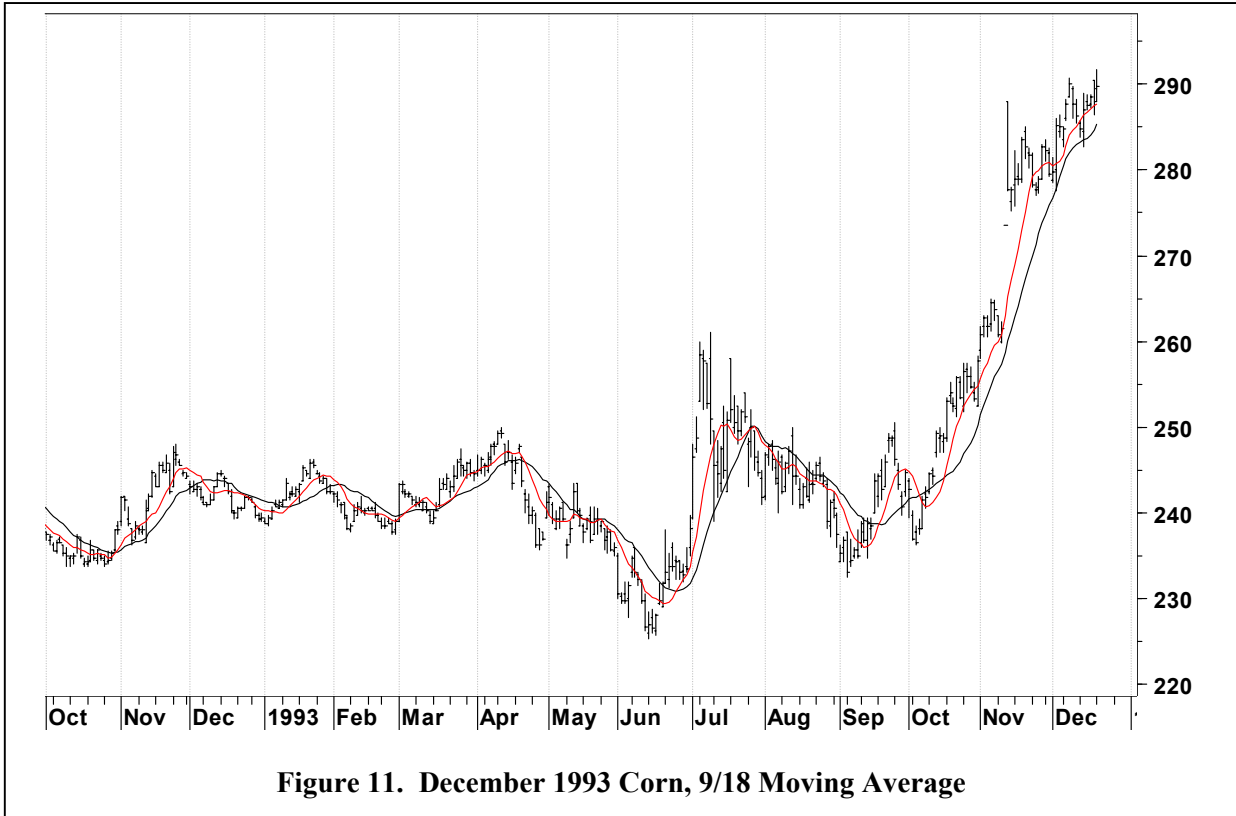


| Table 6. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1993 | | | |
|---|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 12/7/92 | Sell (S) | 241.00 | |
| 1/13/93 | Buy (B) | 242.25 | -1.25 |
| 2/3/93 | S | 241.00 | |
| 3/3/93 | B | 242.25 | -1.25 |
| 4/23/93 | S | 239.75 | |
| 5/18/93 | B | 239.25 | .50 |
| 5/19/93 | S | 236.75 | |
| 5/21/93 | B | 239.25 | -2.50 |
| 5/25/93 | S | 236.75 | |
| 6/25/93 | B | 233.00 | 3.75 |
| 7/27/93 | S | 250.00 | |
| 9/20/93 | B | 244.25 | 5.75 |
| 10/7/93 | S | 241.50 | |
| 10/15/93 | B | 248.75 | -7.25 |
| | | Overall gain: | -2.25 ¢ |
| | | Gain less commissions: | -9.25 ¢ |
| 18/21 and 1-Cent Penetration System | | | |
| 8/3/93 | S | 247.75 | |
| 10/4/93 | B | 237.00 | 10.75 |
| | | Overall gain: | 10.75 ¢ |
| | | Gain less commissions: | 9.75 ¢ |

1993 Review

A quick glance at the charts (figures 11 and 12) shows a choppy sideways market with a strong move up through harvest. In these conditions, the desired end result is to be able to benefit from the high cash prices that developed late and not have them taken away by losses from short hedge positions.

In this year, the 18/21 fared much better than the 9/18 with an after commissions gain of 9.75 cents versus a 9.25-cent loss with the 9/18 (Table 6). The buy-back on October 4 by the 18/21 turned out to be especially favorable, giving the producer the benefit of the move from 237 up to the 265 area in early November and up to 285 later in the year. The 9/18 sold on October 7 because of the late September price dip. Calling a downward correction in an upward trending market a “top” and signaling short hedges is a typical mistake of moving average systems. The October sale by the 9/18 lost 7.25 cents before commissions. The 18/21 system avoided this mistake, and that is the intent of the penetration requirement.

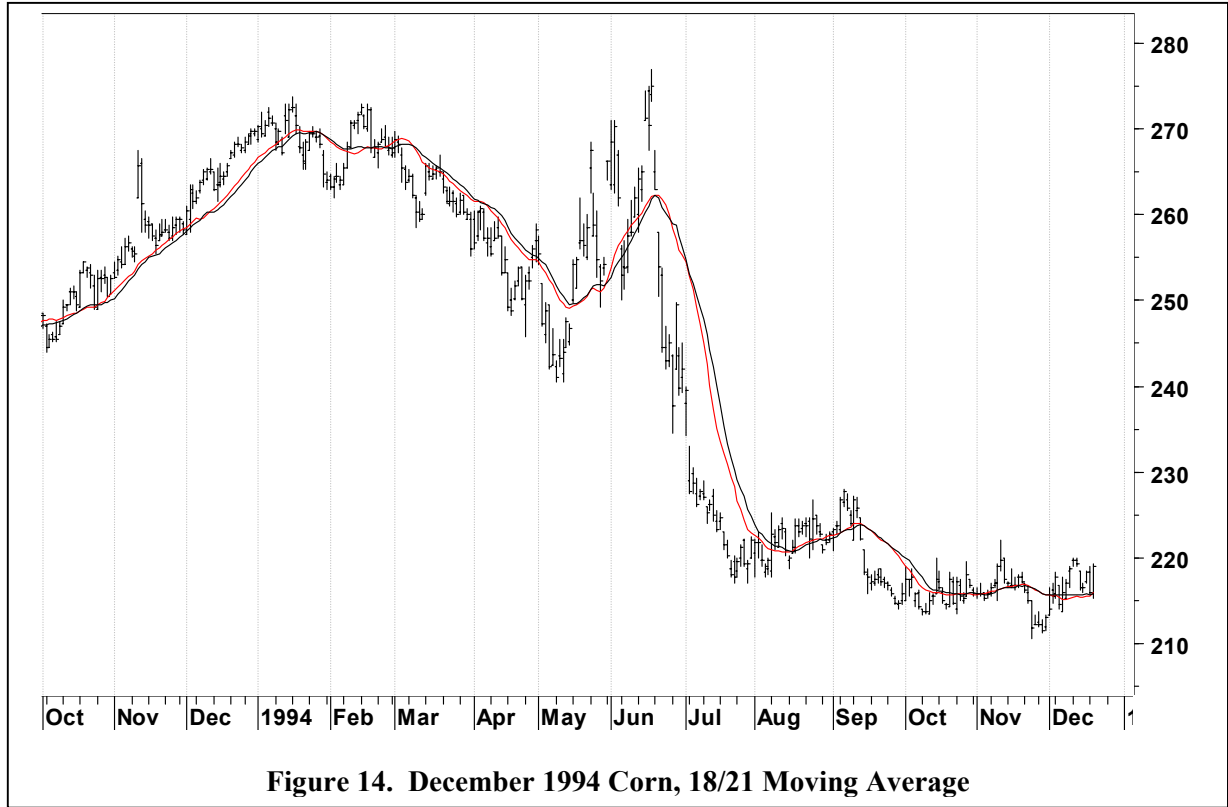
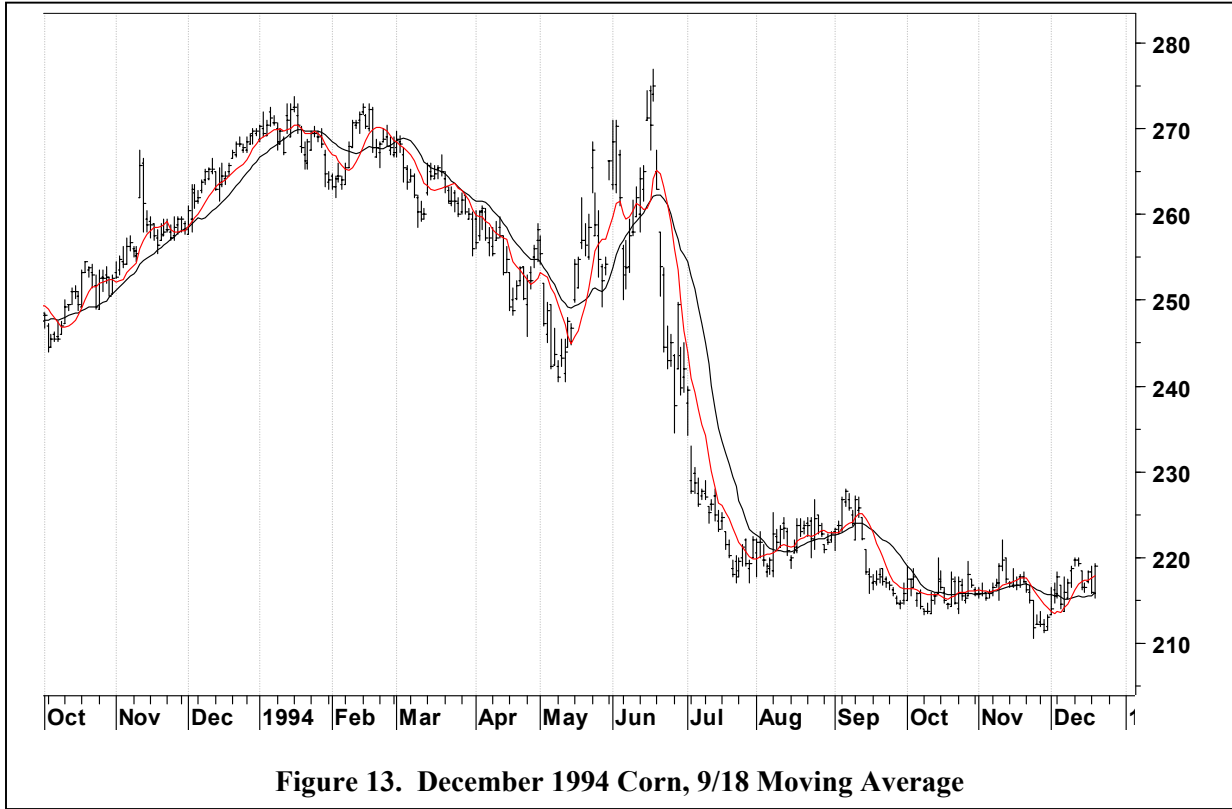


| Table 7. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1994 | | | |
|---|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 1/20/94 | Sell | 266.25 | |
| 2/14/94 | Buy | 272.50 | -6.25 |
| 3/1/94 | S | 268.75 | |
| 3/24/94 | B | 261.50 | 7.25 |
| 3/25/94 | S | 260.00 | |
| 5/20/94 | B | 258.50 | 1.50 |
| 6/15/94 | S | 271.25 | |
| 6/16/94 | B | 270.50 | .75 |
| 6/23/94 | S | 243.00 | |
| 8/9/94 | B | 221.75 | 21.25 |
| 9/19/94 | S | 217.25 | |
| 10/24/94 | B | 217.25 | .00 |
| Overall gain: 24.5 ¢ | | | |
| Gain less commissions: 18.5 ¢ | | | |
| 18/21 and 1-Cent Penetration System | | | |
| 6/28/94 | S | 249.50 | |
| 11/1/94 | Closeout | 215.75 | 33.75 |
| Overall gain: 33.75 ¢ | | | |
| Gain less commissions: 32.75 ¢ | | | |

1994 Review

Both systems covered most of the 40 to 50-cent break from June into August (Table 7). The 9/18 picked up 21.25 cents and the 18/21 a bigger 33.75 cents at the closeout on November 1 with a closing price of 215.75. The 18/21 sell signal on June 28 came on the specific day that the close moved up sharply. Note that had the sell signal come on June 27 or June 29, the gains would have been about 10 cents lower. Figures 13 and 14 record the performances of the 9/18 and 18/21, respectively.

Selling a rally up to the January-February high would have placed short hedges near 270, but a glance at the chart suggests the chart reader would not have seen a clear buy-back signal. Any trend line across the June-July collapse would have been extremely steep. Both moving average systems were effective, with the 18/21 performance quite impressive. By adding the 32.75 cents back to the 215.75 level on November 1 at the close, you get the equivalent of having short hedges in place near 250 and holding them through harvest.

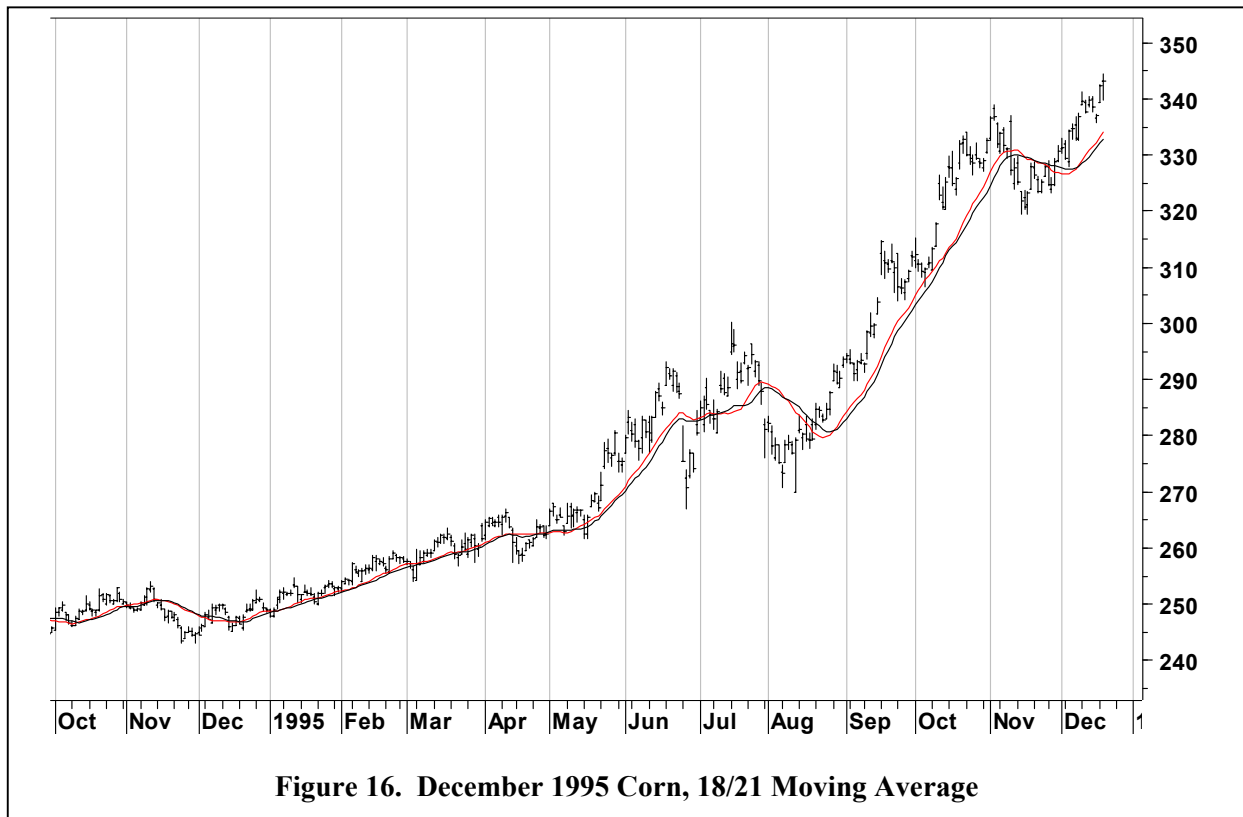
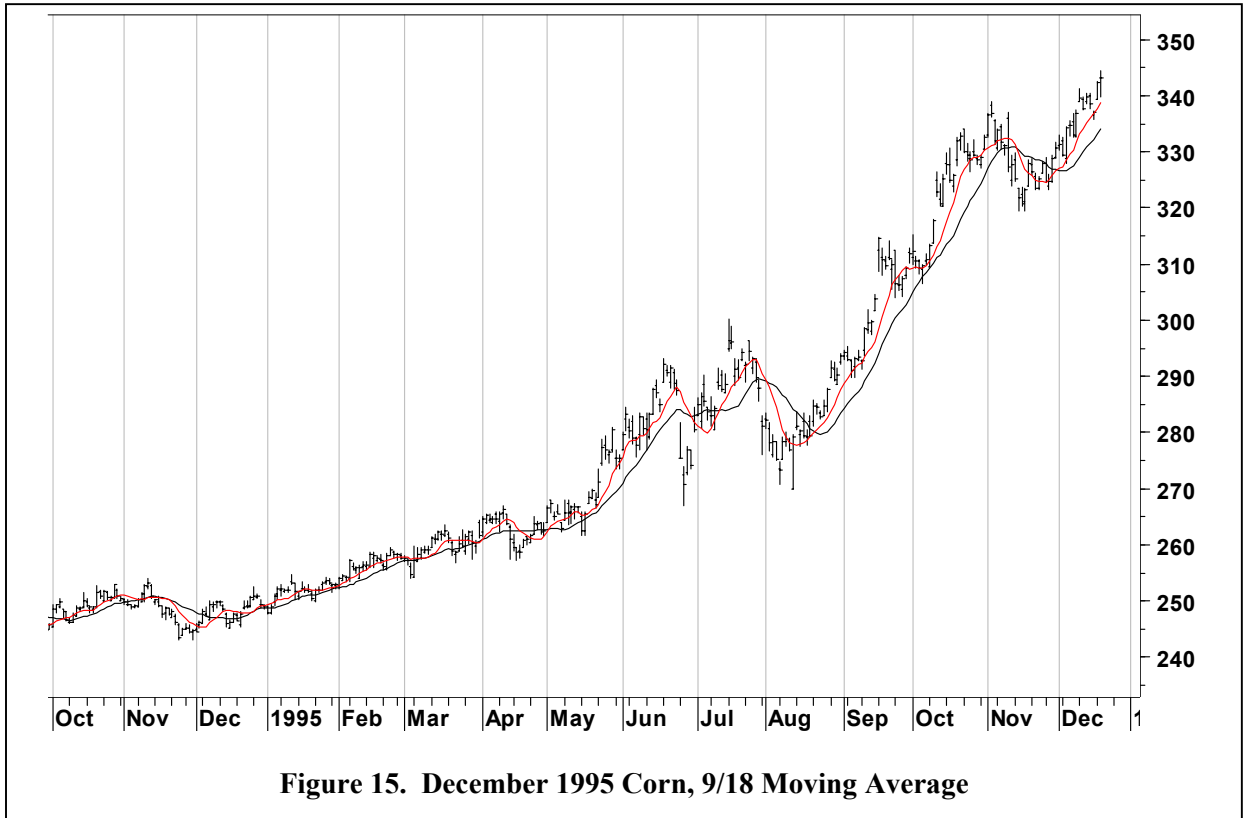


| Table 8. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1995 | | | |
|---|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 3/10/95 | Sell (S) | 259.25 | |
| 3/13/95 | Buy (B) | 261.25 | -2.00 |
| 3/30/95 | S | 260.50 | |
| 4/3/95 | B | 264.75 | -4.25 |
| 4/20/95 | S | 260.75 | |
| 5/2/95 | B | 267.50 | -6.75 |
| 6/30/95 | S | 280.50 | |
| 7/13/95 | B | 287.75 | -7.25 |
| 8/2/95 | S | 278.25 | |
| 8/22/95 | B | 284.50 | -6.25 |
| | | Overall gain: | -26.50 ¢ |
| | | Gain less commissions: | -31.50 ¢ |
| 18/21 and 1-Cent Penetration System | | | |
| 7/18/95 | S | 296.25 | |
| 7/24/95 | B | 292.25 | 4.00 |
| 8/11/95 | S | 279.25 | |
| 8/31/95 | B | 292.25 | -13.00 |
| | | Overall gain: | -9.0 ¢ |
| | | Gain less commissions: | -11.0 ¢ |

1995 Review

The trend was up all year. A selective hedger will want to benefit from as much of the price increase as possible, with price moving up 60 to 70 cents from pre-planting levels. The 9/18 lost 31.50 cents after commissions (Table 8), taking away some 50 percent of the cash market gains. The 18/21 lost 11 cents, only about 13 to 14 percent of the roughly 80-cent cash gains. Figures 15 and 16 show the moving averages in a year in which the market trended high all year.

Looking back on a year like 1995, the ideal position is to be exposed to the cash market with no short hedges in place. But it is impossible to know when such a year is coming. Note the price discovery at the Chicago Board of Trade was for prices near 250 before planting with the USDA-imposed 7.5 percent set-aside of acreage already known at that time. The acreage reduction was perhaps a necessary condition for a price surge, but it was the bad weather in mid summer, the early frost in September bringing lower yields, and the presence of big exports and heavy feed use in the U.S. that brought \$3.30 to \$3.40 price levels. With the 18/21 system, net price would have been well above \$3.00. November 1 futures closed at 336.50, and the 18/21 system only took 11 cents away from harvest period prices. In an upward trending market, this performance is good and is exactly what the producer will want to see. You do not want to see downside protection come at the cost of much or all of the upside benefits in a year like 1995.

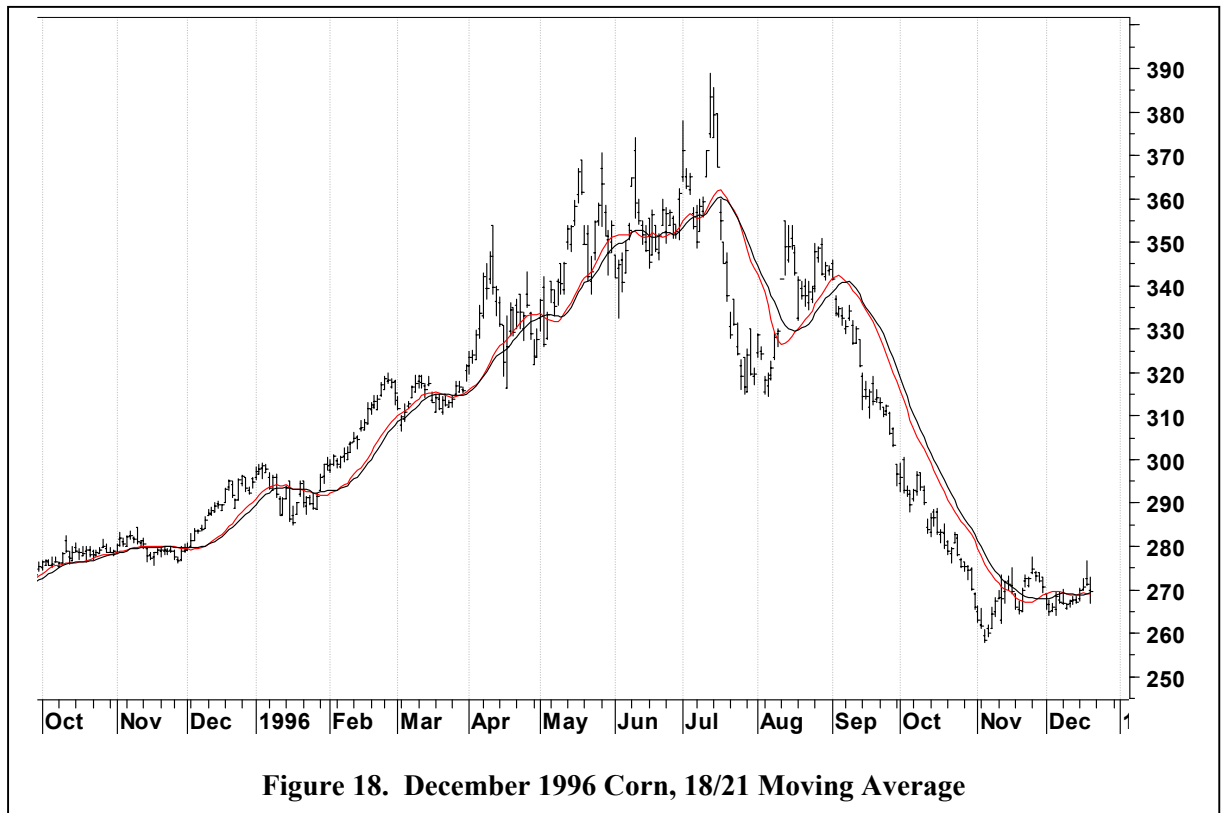
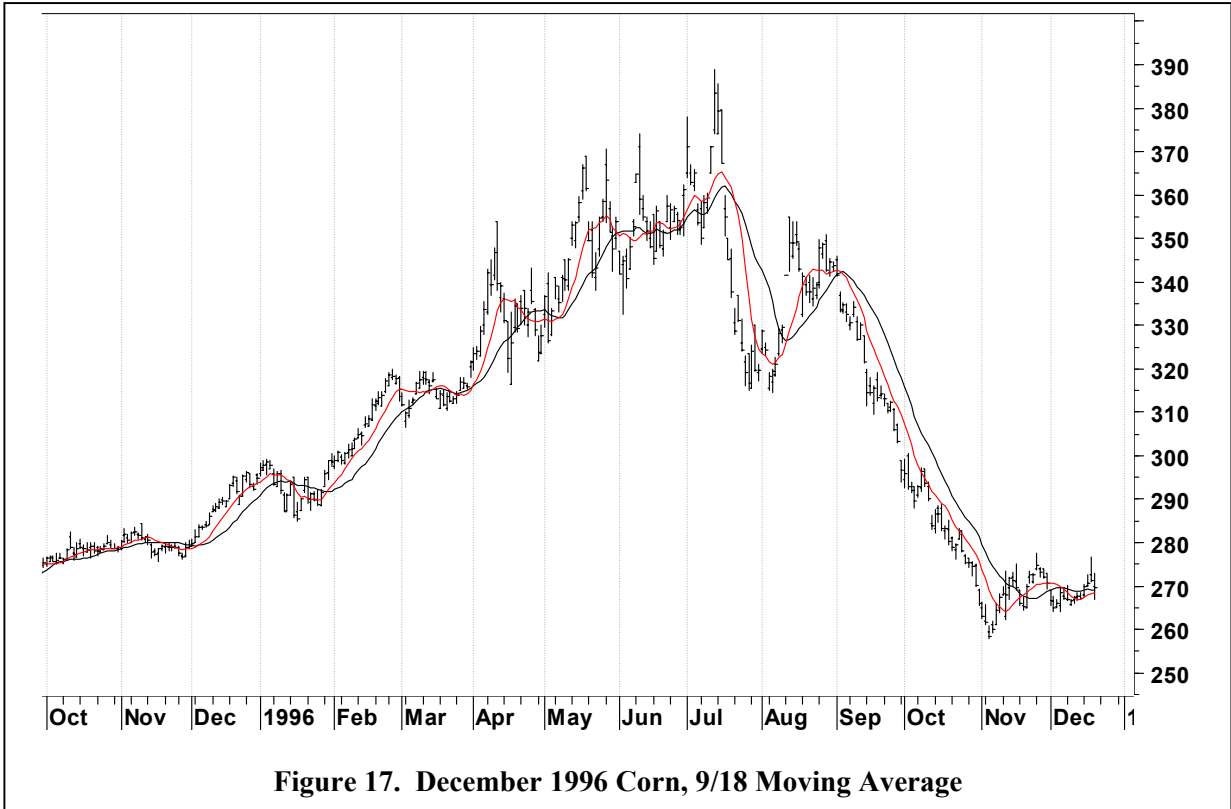


| Table 9. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1996 | | | |
|---|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 1/16/96 | Sell (S) | 286.25 | |
| 1/30/96 | Buy (B) | 298.75 | -12.50 |
| 3/12/96 | S | 317.50 | |
| 3/15/96 | B | 313.25 | 4.25 |
| 3/22/96 | S | 313.25 | |
| 4/1/96 | B | 323.50 | -10.25 |
| 4/24/96 | S | 333.00 | |
| 5/7/96 | B | 335.25 | -2.25 |
| 6/3/96 | S | 341.75 | |
| 6/14/96 | B | 348.25 | -6.50 |
| 7/22/96 | S | 328.75 | |
| 8/13/96 | B | 349.00 | -20.25 |
| 9/5/96 | S | 334.75 | |
| 11/1/96 | Closeout | 263.00 | 71.75 |
| Overall gain: 24.25¢ | | | |
| Gain less commissions: 17.25¢ | | | |
| 18/21 and 1-Cent Penetration System | | | |
| 5/6/96 | S | 339.0 | |
| 5/20/96 | B | 349.50 | -10.50 |
| 7/26/96 | S | 316.75 | |
| 8/20/96 | B | 337.75 | -21.00 |
| 9/11/96 | S | 326.75 | |
| 11/1/96 | Closeout | 263.00 | 63.75 |
| Overall gain: 42.25¢ | | | |
| Gain less commissions: 40.25¢ | | | |

1996 Review

A difficult year by any measure, record high cash corn prices were recorded in August of 1996. The December futures topped in July, trading up to \$3.90.

The 9/18 gained 12.75 cents after commissions, with a huge 71.75-cent gain from 9/5/96 to November 1 (Table 9). The 18/21 did not get the confirmed sell signal until 9/11/96. The close was 8 cents below the close on September 5 when the 9/18 system gave its sell signal, and the 18/21 system generated 63.75 cents by November 1. These results are again direct evidence of the difference in moving average systems. The systems that are quicker to signal a trade will sell closer to the highs, but they make mistakes in the choppy markets like those through June and July. The more disciplined systems, the 18/21 with a penetration requirement, often miss some of the price move before a sell signal is generated, but they do not generate the frequent, losing trades in a choppy market. With about a \$2.70 futures price level during harvest, the 9/18 gave a net price, after commissions, equivalent to about a \$2.87 futures price, and the 18/21 pushed that up to about a \$3.10 futures price equivalent or \$2.95 to \$3.00 in cash, depending on basis. Figures 17 and 18 show the moving average performances.

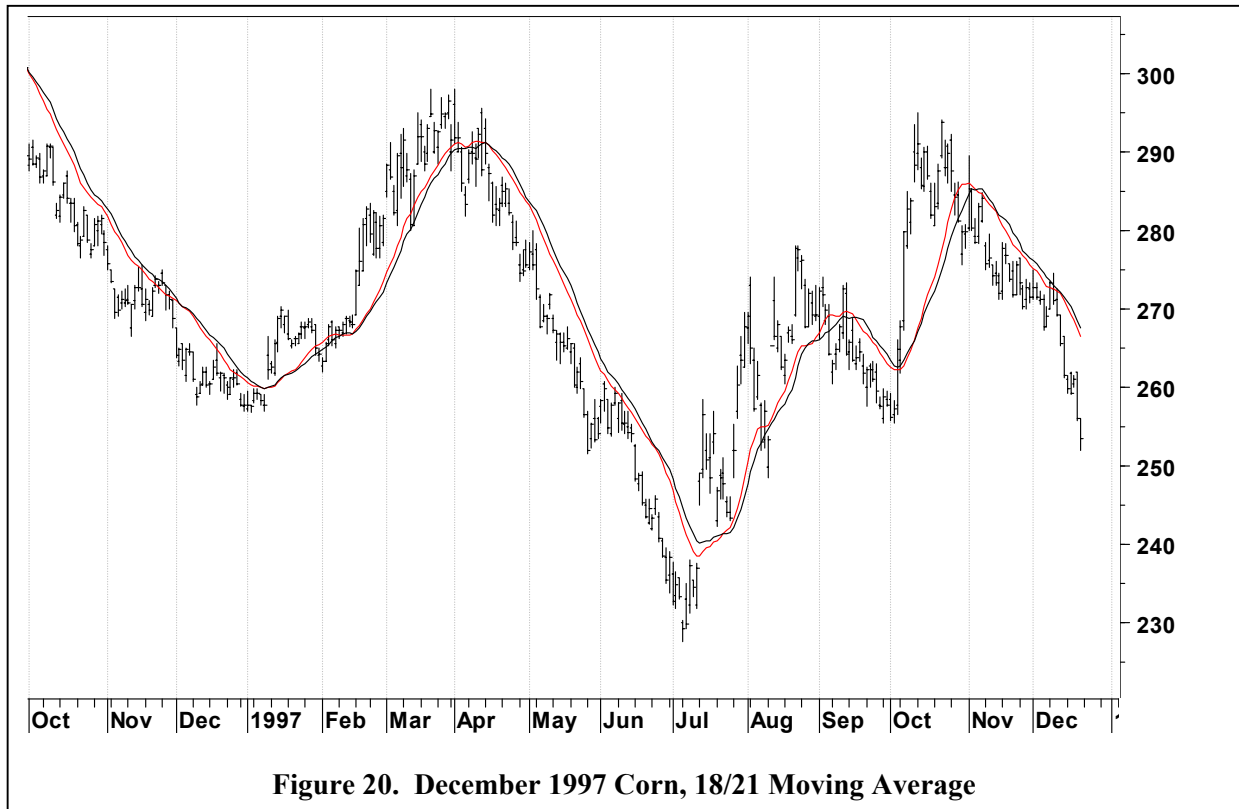
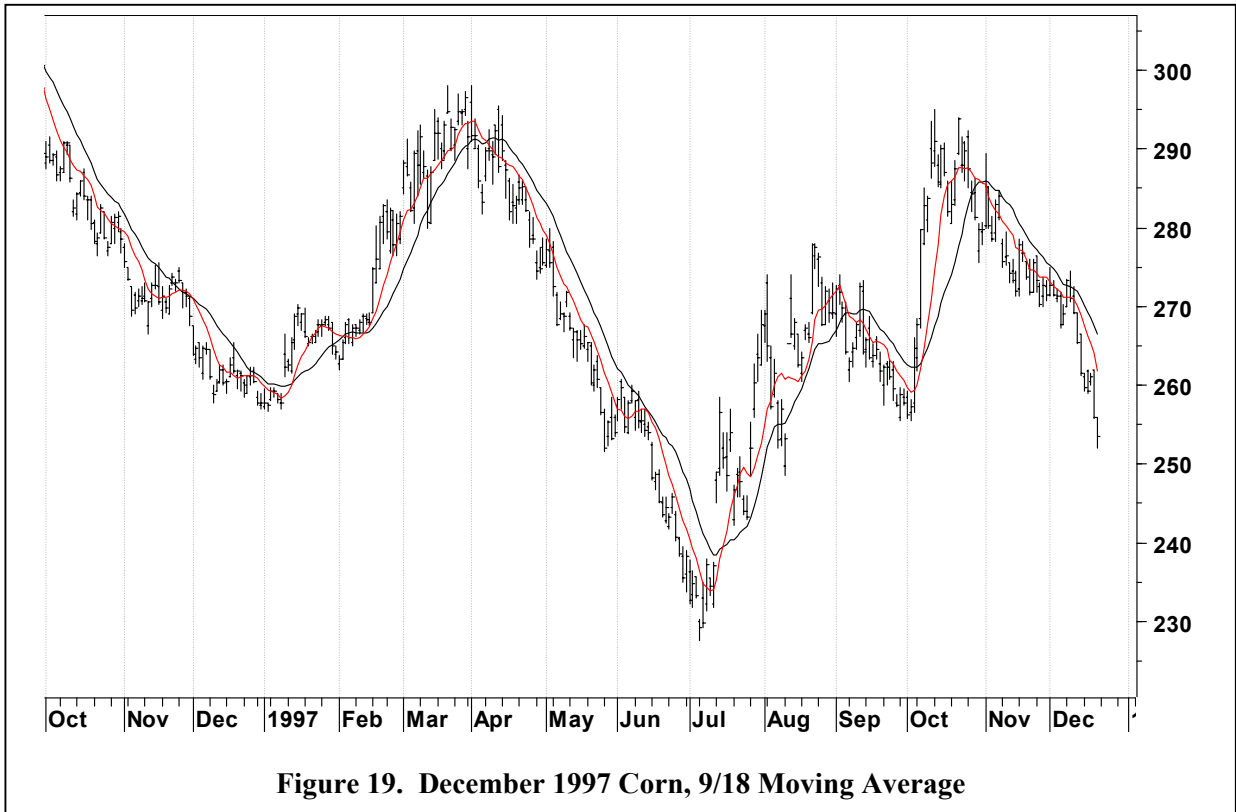


| Table 10. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1997 | | | |
|--|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 12/2/96 | Sell (S) | 264.00 | |
| 1/15/97 | Buy (B) | 268.75 | -4.75 |
| 2/5/97 | S | 267.75 | |
| 2/13/97 | B | 268.25 | -.50 |
| 4/9/97 | S | 289.00 | |
| 7/16/97 | B | 250.75 | 38.25 |
| 9/8/97 | S | 263.00 | |
| 10/8/97 | B | 282.75 | -19.75 |
| 10/31/97 | S | 279.75 | |
| 11/1/97 | Closeout | 285.25 | -5.50 |
| Overall gain: 7.75 ¢ Gain less commissions: 2.75 ¢ | | | |
| 18/21 and 1-Cent Penetration System | | | |
| 5/5/97 | S | 272.50 | |
| 7/28/97 | B | 252.00 | 20.50 |
| 9/19/97 | S | 261.75 | |
| 10/15/97 | B | 290.00 | -28.25 |
| Overall gain: -7.75 ¢ Gain less commissions: -9.75 ¢ | | | |

1997 Review

The generic 9/18 is better than the 18/21 in this particular year (Table 10). After commissions, gains were 2.75 cents for the 9/18 compared to -9.75 cents for the 18/21. Examination of the transaction dates shows why. The September 19 sell signal from the 18/21 placed short hedges at 261.75. In early October, the market traded up abruptly, gaining 40 cents in six days after a bullish USDA report. The buy signal on October 15 was at a close of 290, within 10 cents of the life-of-contract high.

The 18/21 with a 1-cent penetration rule was the optimal set for the 1990-2000 period because it does delay action on occasion and tends to avoid frequent trades. The unusually steep price increase in October 1997 proved to be a problem with the “delaying action” of the 18/21, eventually prompting a buy signal at a relatively high 290. December futures on November 1 were at 285. The 9/18 would have boosted this amount to 287, the 18/21 would pull net futures price down toward 275. Figures 19 and 20 show performances during a very volatile year.

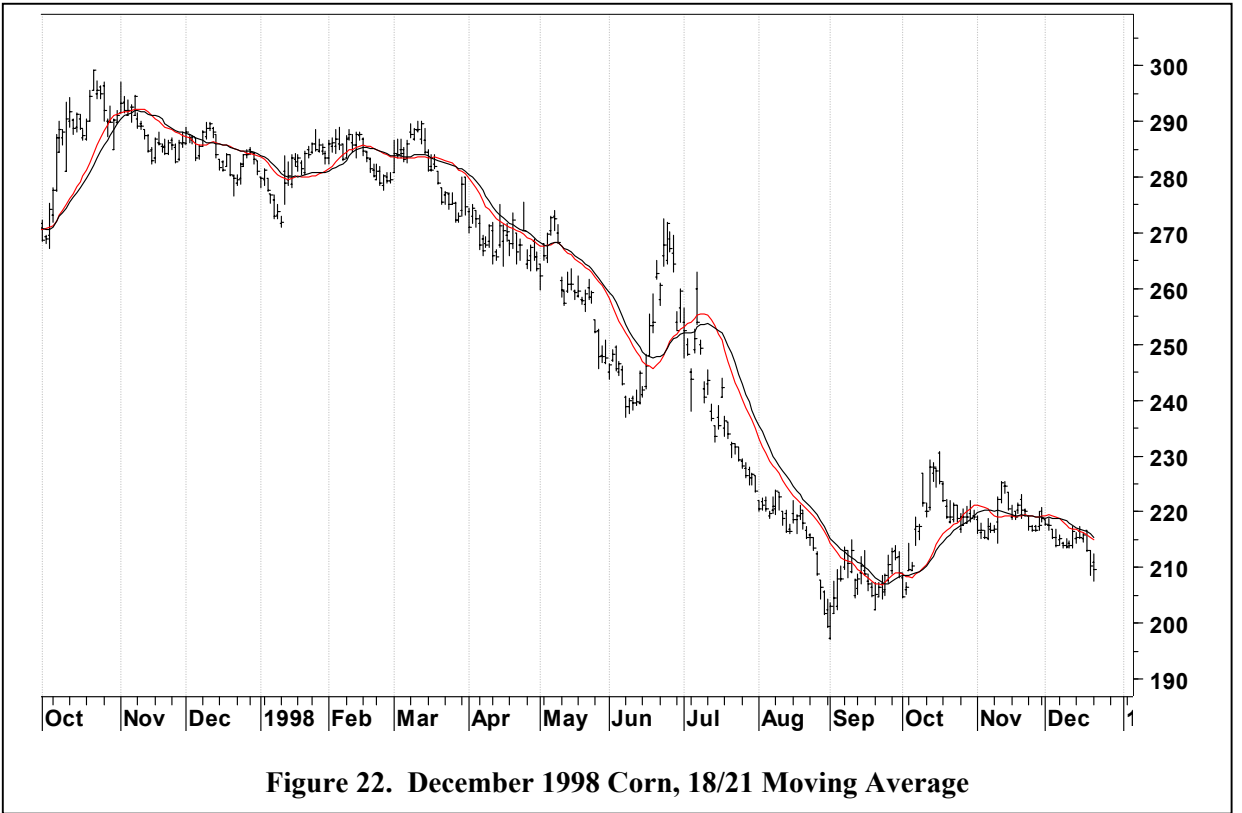
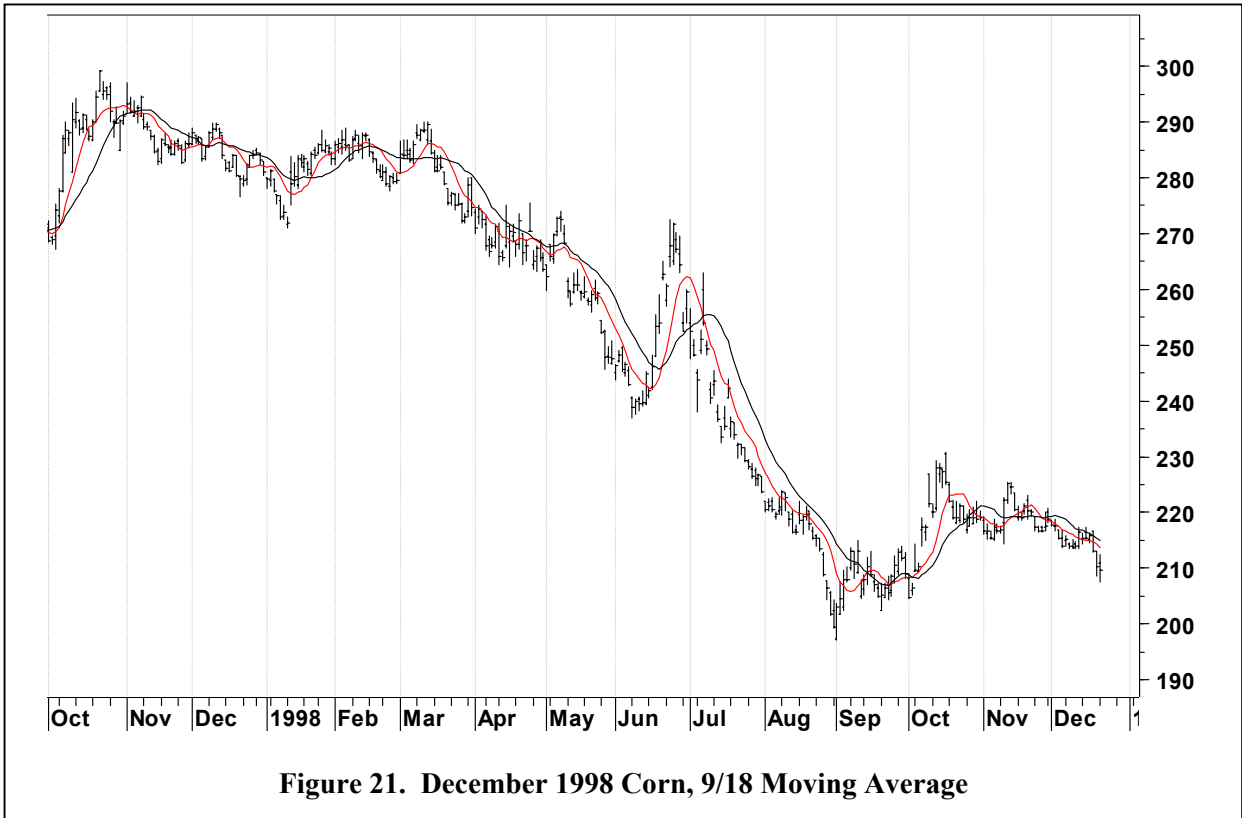


| Table 11. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1998 | | | |
|--|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 12/16/97 | Sell | 281.25 | |
| 1/23/98 | Buy | 284.00 | -2.75 |
| 2/20/98 | S | 280.25 | |
| 3/10/98 | B | 288.50 | -8.25 |
| 3/23/98 | S | 277.25 | |
| 6/19/98 | B | 262.75 | 14.50 |
| 7/8/98 | S | 254.00 | |
| 9/15/98 | B | 210.25 | 43.75 |
| 9/24/98 | S | 208.50 | |
| 10/5/98 | B | 209.75 | -1.25 |
| 10/29/98 | S | 218.75 | |
| 11/1/98 | Closeout | 216.75 | 2.00 |
| | | Overall gain: | 48.0 ¢ |
| | | Gain less commissions: | 42.0 ¢ |
| 18/21 and 1-Cent Penetration System | | | |
| 6/1/98 | S | 246.25 | |
| 7/1/98 | B | 252.50 | -6.25 |
| 7/17/98 | S | 242.25 | |
| 10/15/98 | B | 227.25 | 15.00 |
| | | Overall gain: | 8.75 ¢ |
| | | Gain less commissions: | 6.75 ¢ |

1998 Review

The 9/18 performed well, reaping a large gain from the July 8 short hedges which were bought back near the lows on September 15 at 210.25. The 18/21 went short at a lower price of 242.25 cents on a later date of July 17. With the 18/21 system, a confirmed buy signal was not generated until 10/15/98, and the price was up to 227.25 cents. The timing on these July-based short hedges was the primary difference between the two systems.

In this type of year, the delaying and confirming actions of the 18/21 with a penetration rule hurt performance (Table 11). But as is clear by this point, having looked at earlier years, this weaker performance by the 18/21 is the exception and not the rule. The 18/21 with the 1 cent penetration requirement avoids frequent losing trades. This attribute is very important over time. Figures 21 and 22 show moving average performances for the 9/18 and 18/21, respectively.

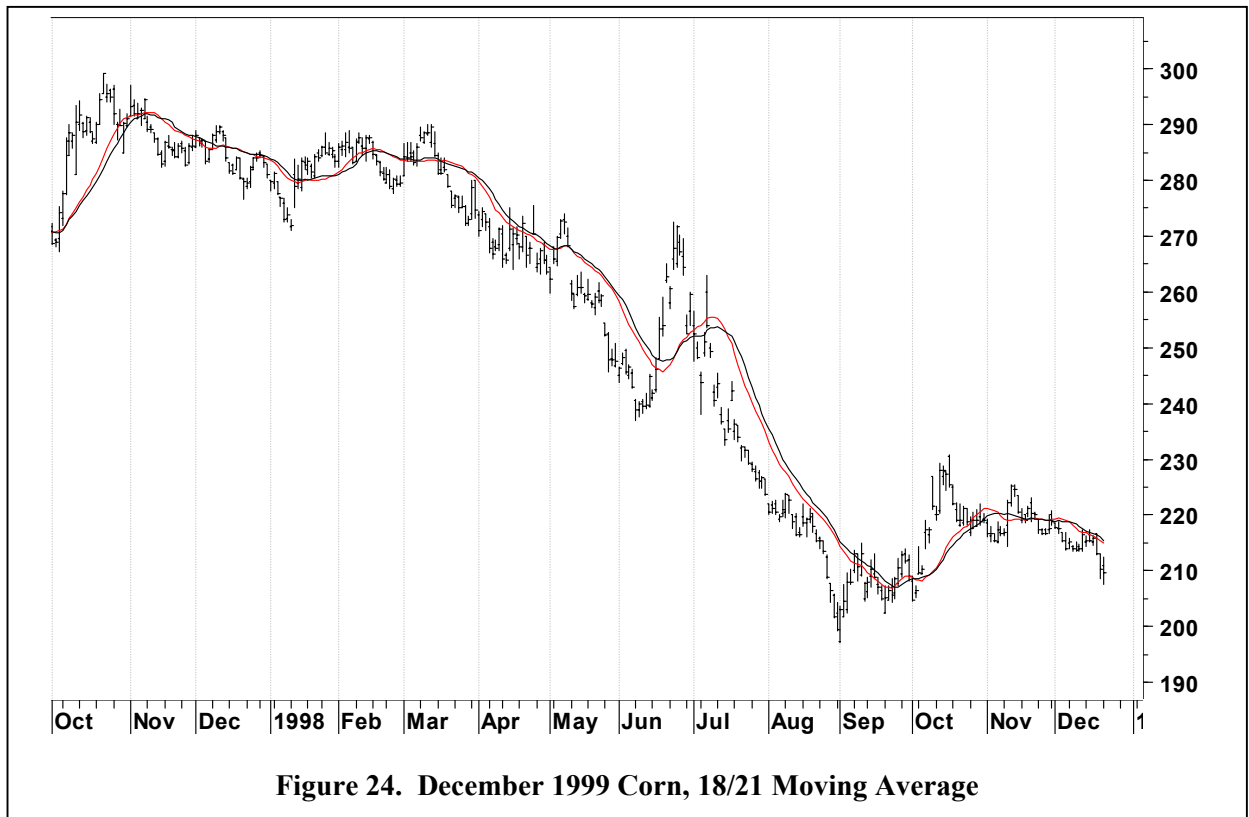
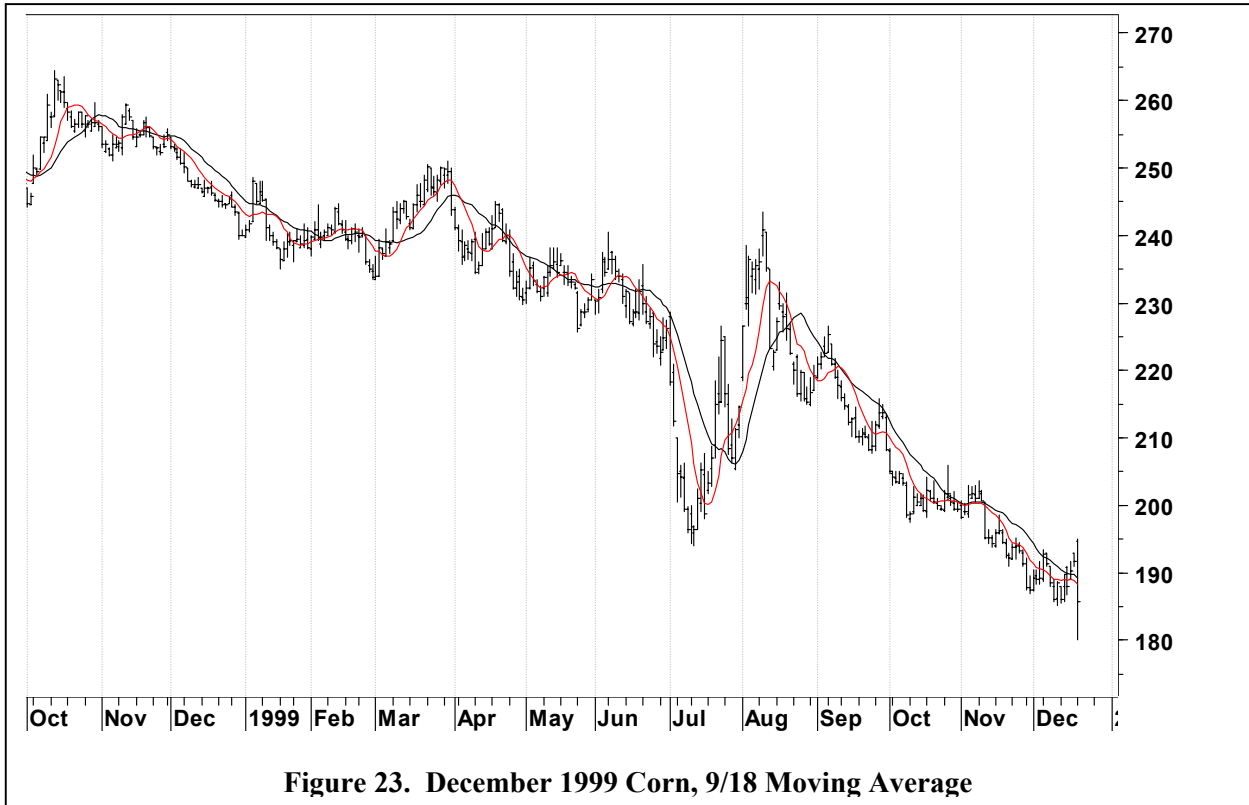


| Table 12. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 1999 | | | |
|--|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 2/24/99 | Sell | 236.00 | |
| 3/11/99 | Buy | 245.00 | -9.00 |
| 4/6/99 | S | 236.75 | |
| 4/23/99 | B | 240.00 | -3.25 |
| 4/30/99 | S | 230.50 | |
| 5/18/99 | B | 234.50 | -4.00 |
| 5/25/99 | S | 228.75 | |
| 6/8/99 | B | 236.50 | -7.75 |
| 6/18/99 | S | 231.75 | |
| 7/26/99 | B | 216.50 | 15.25 |
| 8/23/99 | S | 220.00 | |
| 9/13/99 | B | 216.00 | 4.00 |
| 9/16/99 | S | 212.75 | |
| 11/1/99 | Closeout | 198.25 | 14.50 |
| Overall gain: 9.75 ¢ | | | |
| Gain less commissions: 2.75 ¢ | | | |
| 18/21 and 1-Cent Penetration System | | | |
| 4/19/99 | S | 241.00 | |
| 8/4/99 | B | 236.50 | 4.50 |
| 8/31/99 | S | 219.25 | |
| 11/1/99 | Closeout | 198.25 | 21.00 |
| Overall gain: 25.50 ¢ | | | |
| Gain less commissions: 23.50 ¢ | | | |

1999 Review

The results are typical of what happens if the price discovery process shows a sustained period of choppy and sideways action. The 9/18 had lost 24 cents before the June 18 sell signal (Table 12), but the set earned 15.25 on that sell signal and added 14.50 cents into the end of the period. The 18/21 gave a sell signal on April 4 and did not buy those positions back until early August. In August, the 9/18 generated a sell signal on August 23, and the 18/21 was slower with the signal coming on August 31.

The optional 18/21 with a 1-cent penetration kept the producer short during the spring months and then generated large gains late in the year. But the cost of avoiding those short-term trades that often lose money is again apparent. The 18/21 is much slower to get a confirmed sell and later buy signal, and it will often sell well off the highs and buy back well above the lows. Still, the 18/21 system was much better in 1999 because it did avoid the early losing trades. Figures 23 and 24 show patterns for 1999.

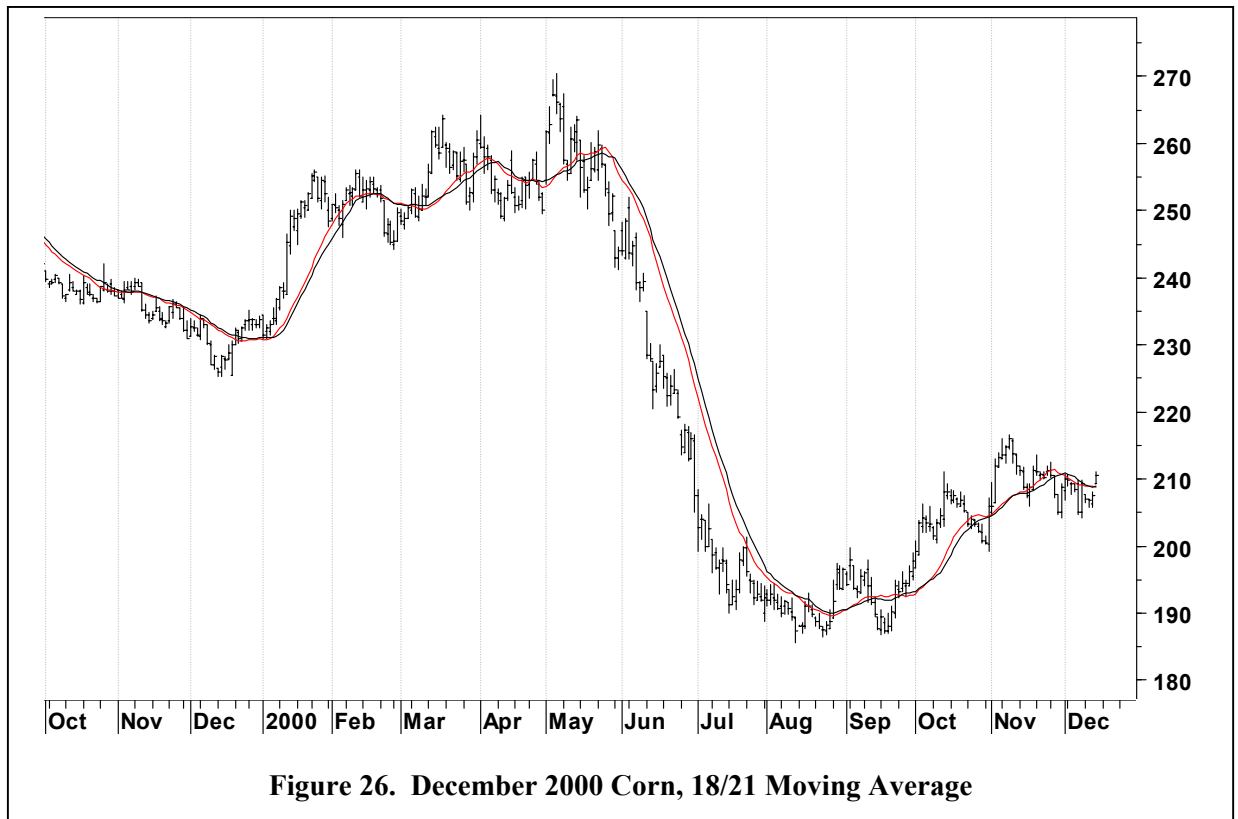
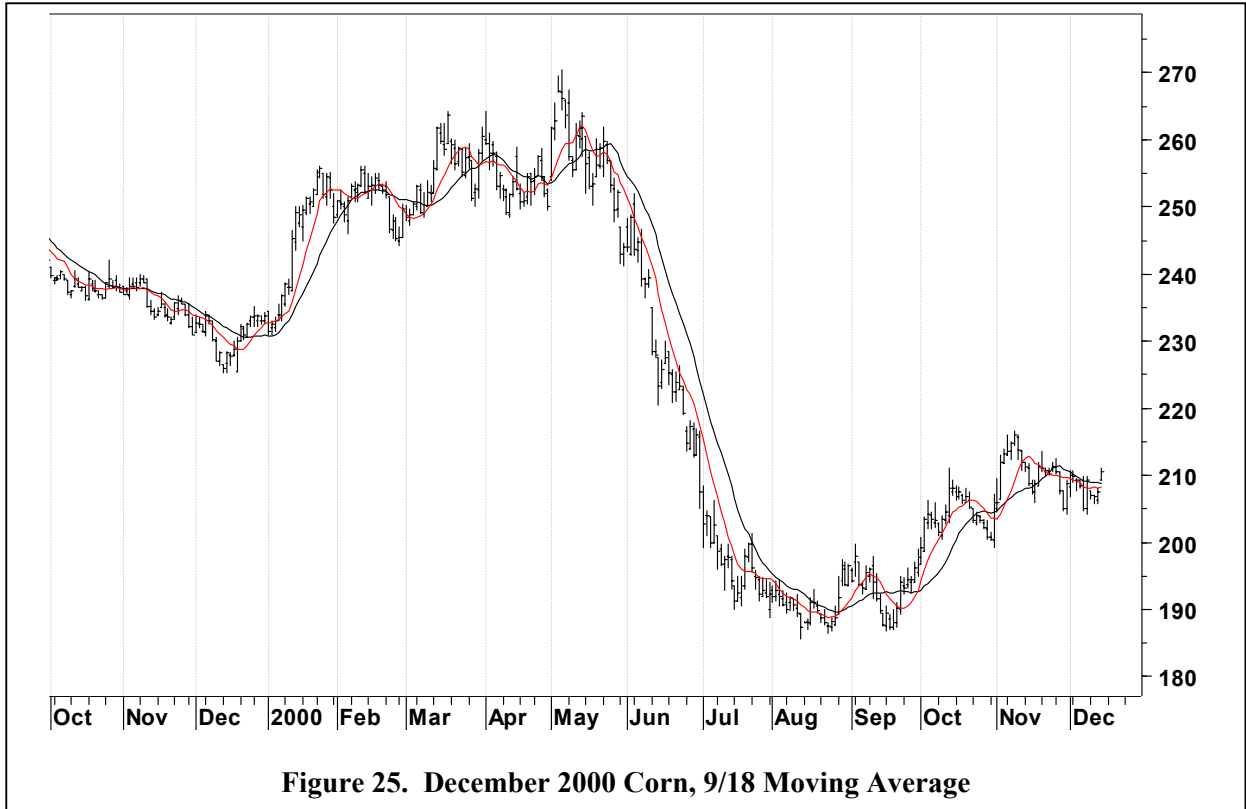


| Table 13. Transaction Dates, Transaction Prices, and Nets for Each Round Turn Trade in a Shorts Only Selective Hedging Program for Corn, 2000 | | | |
|--|---------------|---|-------------------------|
| Date | Action | Transaction (Closing) Price (¢/bu) | Net Trade (¢/bu) |
| 9/18 System | | | |
| 2/8/00 | Sell (S) | 252.75 | |
| 2/15/00 | Buy (B) | 253.25 | -.50 |
| 2/25/00 | S | 245.25 | |
| 3/10/00 | B | 252.00 | -6.75 |
| 3/31/00 | S | 260.50 | |
| 5/1/00 | B | 261.75 | -1.25 |
| 5/17/00 | S | 253.50 | |
| 8/29/00 | B | 196.50 | 57.00 |
| 9/18/00 | S | 189.50 | |
| 9/29/00 | B | 197.75 | -8.25 |
| 10/27/00 | S | 200.75 | |
| 11/1/00 | Closeout | 206.00 | -5.25 |
| Overall gain: 35.0 ¢ | | | |
| Gain less commissions: 24.0 ¢ | | | |
| 18/21 and 1-Cent Penetration System | | | |
| 5/30/00 | S | 243.00 | |
| 10/1/00 | B | 204.50 | 38.50 |
| Overall gain: 38.50 ¢ | | | |
| Gain less commissions: 37.50 ¢ | | | |

2000 Review

Both systems performed well in 2000. A glance at the charts in Figures 25 and 26 shows why. A major and sustained move down from May into August shows none of the choppy actions that prompt “mistakes” in a moving average selective short hedging program. The 9/18 sold on May 17 and bought back on August 29 earning 57 cents on this single trade (Table 13). The 18/21 sold later on May 30 and bought back much later on October 1, earning 38.5 cents for the one “round turn” action.

Losses for the 9/18 both before and after the May to August price break pulled the after-commissions gain down to 24.0 cents, well below the net 37.5 cents for the 18/21. Both systems, however, would have significantly improved the net price for the year. When there is a sustained price decline with no choppy price movement, virtually any moving average system will be profitable. In this type of market, the “safety net” feature of moving averages is important. A year earlier, prices near \$3.00 were offered. The producer waiting on \$2.90 futures price in 2000 never saw that opportunity: futures prices during much of harvest were below \$2.00.



Summary on Performance

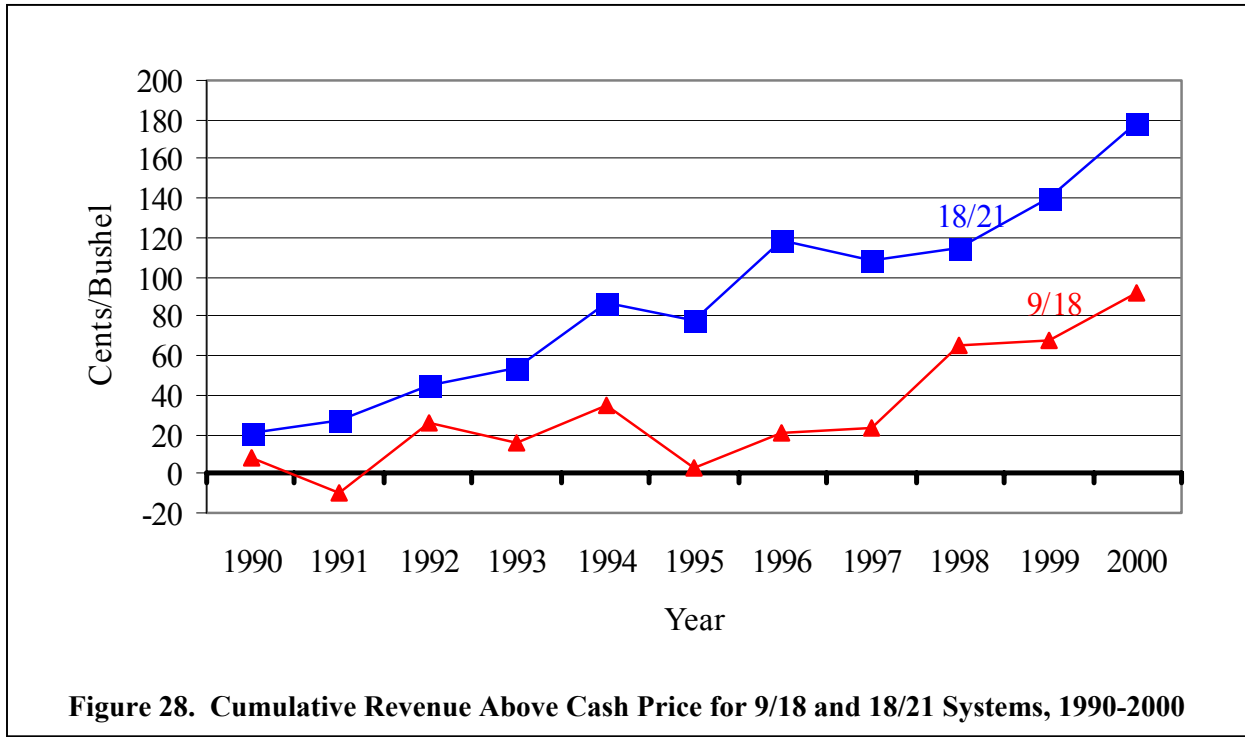
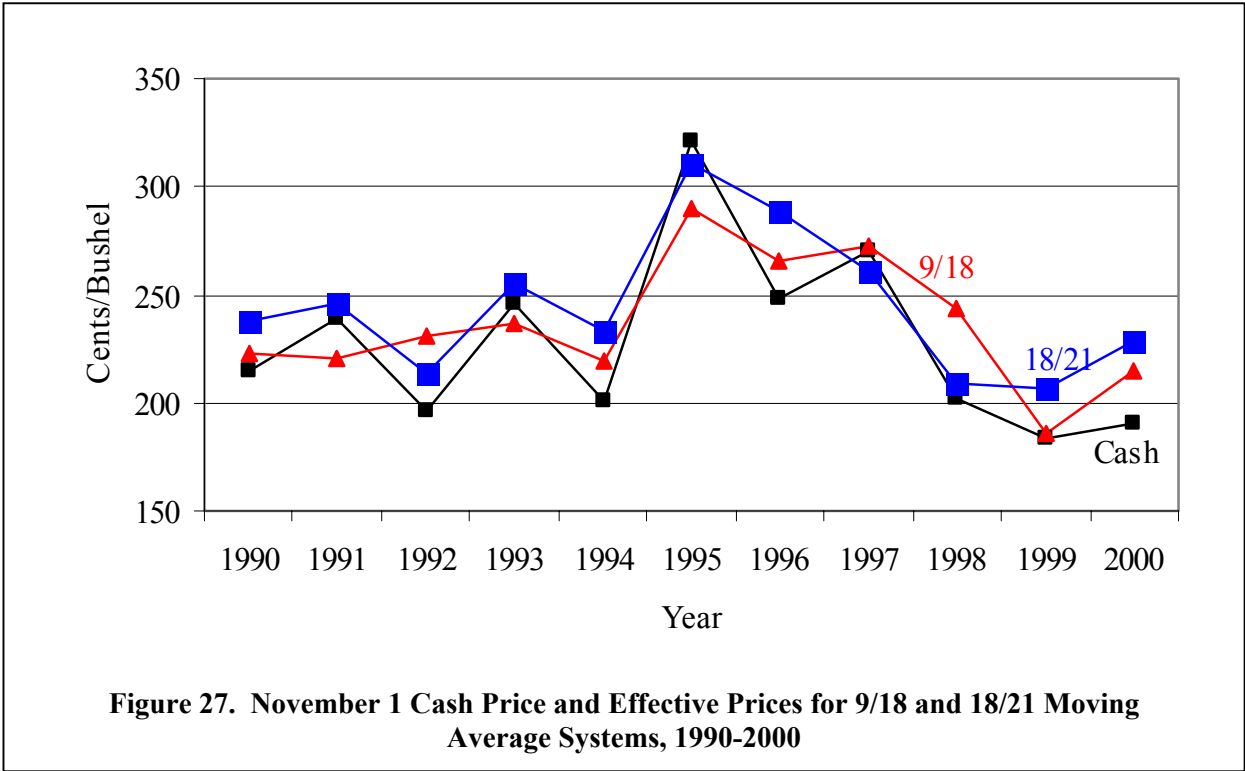
Table 14 records the results by year and across the 1990-2000 study period. The average net effective price after commissions was 236.77 and 244.39 for the 9/18 and 18/21 systems, respectively. These levels were 8.38 cents above cash for the 9/18 and 15.79 cents above cash for the 18/21 system with the 1.0 cent penetration requirement.

| Table 14. Moving Average Contributions, November 1 Prices for December Futures and Cash Prices (-\$0.15 basis) and Effective Final Prices for 9/18 and 18/21 Systems, 1990-2000 | | | | | | |
|--|------------------------------|--------------|-------------------------------------|--|-----------------------------|--------------|
| | <i>After Commissions Net</i> | | | | <i>Effective Price With</i> | |
| Year | 9/18 | 18/21 | November 1 December Corn | Cash Price with -\$0.15 Basis | 9/18 | 18/21 |
| | (¢ per bushel) | | | | | |
| 1990 | 8.50 | 20.75 | 229.75 | 214.75 | 223.25 | 237.50 |
| 1991 | -18.50 | 6.50 | 254.00 | 239.00 | 220.50 | 245.50 |
| 1992 | 35.25 | 17.00 | 211.25 | 196.25 | 231.50 | 213.25 |
| 1993 | -9.25 | 9.75 | 260.75 | 245.75 | 236.50 | 255.50 |
| 1994 | 18.50 | 32.75 | 215.75 | 200.75 | 219.25 | 233.50 |
| 1995 | -31.50 | -11.00 | 336.50 | 321.50 | 290.00 | 310.50 |
| 1996 | 17.25 | 40.25 | 263.00 | 248.00 | 265.25 | 288.25 |
| 1997 | 2.75 | -9.75 | 285.25 | 270.25 | 273.00 | 260.50 |
| 1998 | 42.00 | 6.75 | 216.75 | 201.75 | 243.75 | 208.50 |
| 1999 | 2.75 | 23.50 | 198.25 | 183.25 | 186.00 | 206.75 |
| 2000 | 24.00 | 37.50 | 206.00 | 191.00 | 215.00 | 228.50 |
| Average | 8.34 | 15.79 | 243.39 | 228.39 | 236.77 | 244.39 |

These increases are significant economically. The 18/21 is statistically different from zero but not from the 9/18 at the .05 level. The 16-cent increase with the 18/21 is 7.0 percent of the 228.39 average cash price. The \$2.44 average price for the 18/21 would put the corn grower on sound financial ground for all who are not high-cost producers. The only years in which the net prices for the 18/21 were below the cash market price were 1995 and 1997, two years that saw strong upward moves in price—especially in 1995. The “opportunity cost” was only 11.0 cents (cash price of 321.50 less 18/21 net price of 310.50) for the 18/21 system in 1995 and only 9.75 cents in 1997. In both years, net prices from the 18/21 were quite good at 310.50 and 260.50 for 1995 and 1997, respectively.

Figure 27 plots the results of a cash strategy, the 9/18, and the 18/21 across 1990-2000 and Figure 28 shows the cumulative revenue streams plotted as departures from the cash price. A 500-acre farm with 150-bushel yields would produce 75,000 bushels per year, and 16 cents more per bushel on average means an added \$12,000 per year.

In reviewing performance, the risk protection component of the moving averages should not be ignored. The moving average systems will *always* have short hedges in place for at least part of any sustained break in price, providing an important “safety net” component. The objective of hedging is to reduce risk exposure, and the moving average systems can provide that reduction in risk and still leave open the benefits from a sustained move up in price. Protection does not have to carry a cost since average price after commissions was up nearly 16 cents per bushel with the 18/21 system.



Testing Out of Sample

The 18/21 system was selected by analyzing the 1990-2000 period. If users are to have confidence in the system, it must work in years outside the data period used to pick the best set of averages. Figure 29 shows the 18/21 with a 1 cent penetration requirement on the December 2001 corn futures. The first short hedges were confirmed on 1/30/01 at a closing price of 245.50 and bought back on July 16 at 228.50. Gross returns on this trade were 17.0 cents. After the midsummer surge, a sell signal was confirmed on August 7 at 227.75. Since the averages did not show a confirmed buy signal prior to November 1, these short positions were closed out at the November 1 daily settlement price of 204.00.

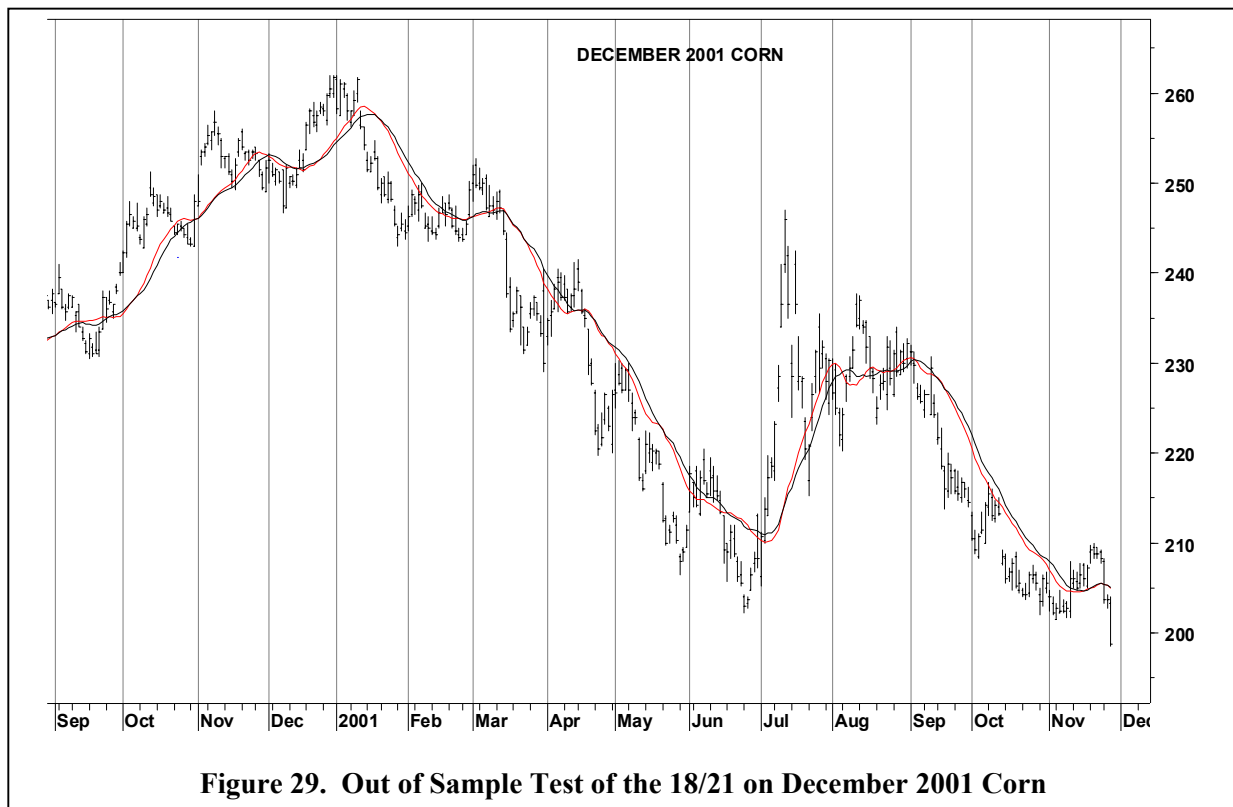


Figure 29. Out of Sample Test of the 18/21 on December 2001 Corn

Combined, the two round turn trades generated 40.75 cents, 38.75 cents after commissions. With a - \$0.15 basis on November 1, cash corn would have been \$1.89. The 18/21 system would have boosted that price to \$2.28. Recall that the trend line approach also could have worked well in this year. The December 2001 corn was used at the beginning to demonstrate use of trend lines. Reading the chart effectively and using tools such as trend lines with discipline can and will beat the 18/21 on occasion. But the 38.75 cents after commissions suggests the system was very effective in this out-of-sample test.

Analysis of the 1980-1989 December corn futures provided added evidence that the 18/21 with a 1-cent penetration will be effective in other years. The 18/21 with a 1-cent penetration was not the profit maximizing combination for the 1980s, but the system performed well. It was at the 69th percentile in the array of results for the 1980s, indicating only 31 percent of the possible combinations performed better. The optimal set of moving averages for the 1980s was the 22/41 with a 1-cent penetration, which earned an average of 26.93 cents per bushel, and the 18/21 with a 1-cent penetration earned 20.38 cents per bushel. The system deserves the attention of producers who would prefer objective measures of the December corn futures in terms of sell and buy signals in a selective hedging program.

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