THE IMPACT OF YIELD RISK ON SELECTED HEDGING STRATEGIES FOR EASTERN VIRGINIA CORN PRODUCERS

by

Jon McCanless

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APPROVED:

David Kenyon

Wayne Purcell

Ernest Bentley

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INTRODUCTION

1.1 PROBLEM

The importance of risk management to agricultural producers has increased substantially since 1972 because the amount of capital required in agriculture has increased, the cost of borrowing money has risen sharply, and the volatility of grain prices has increased. Larger cash flow requirements, combined with greater borrowing and capital costs, have increased the importance of revenue stabilization. Revenues are equal to the average price recieved per unit of the crop times the number of units sold. The variance of both quantity and price will therefore directly affect the revenues generated. Since price and quantity are the sole components of revenue, the producer's risk lies with price and quantity variability.

Many producers use forward contracts or hedge in futures markets to secure prices prior to harvest. Forward pricing allows a producer to value his crop over time and reduce the impact of large price moves. The effectiveness of forward pricing is reduced by the inability of a producer to accurately gauge production throughout the growing season. Selling too little of a crop forward reduces the stabilizing effect of a forward trade and allows harvest-time price to largely determine the

average value per unit. Selling forward more than is actually produced forces the producer to enter the cash market at harvest and purchase grain to meet the obligation. The over-hedged producer is technically a speculator in futures to the extent that his futures position is larger than his cash position. Effective forward pricing is dependent on reliable estimation of yields as early as possible during the growing season.

Previous work in the area of forward pricing by Cooper compared various routine and selective hedging strategies.[1] However, yields were assumed to be constant. This assumption hides the effect of yield variation on the performance of these various strategies in terms of total revenue and mean price per bushel. Heifner included yield risk in his research but only considered routine hedges that minimized risk. He ignored selective hedging strategies and did not investigate the effect of varying percentages sold forward on the relationship between price received and price variance. The relationship between price recieved and price variance was generally shown to be positive by Cooper; as price recieved increased, price variance increased. The rate at which this trade-off occurs using different marketing strategies with yield variation included is the key factor needed to determine the optimal market approach for an individual producer whether he is risk averse or a risk taker.

1.2 OBJECTIVES

The objectives of this research are:

1. to find those levels of hedging, in terms of percent of expected yield, that are most efficient for each strategy, and to
2. compare and contrast the trade-off between revenue received and revenue variance between certain routine hedges and certain selective hedging strategies that include yield risk.

1.3 FOOTNOTES

[1]The difference between routine and selective hedges is that certain price conditions must be present and the hedge may be lifted prior to harvest in a selective hedge. A routine hedge is placed and held until harvest regardless of price movement.

1.4 REFERENCES

Craig D. Cooper, "Incorporation of a Price Forecasting Equation Into Pre-Harvest Pricing Strategies for Corn", M.S. Thesis, Department of Agricultural Economics, VPI & SU, 1979.

Chapter II

REVIEW OF LITERATURE

This research builds and expands on Cooper's work. He compared several routine and selective hedging strategies using a mean price and price variance test. The mean-variance test Cooper used is a good measure of hedge strategy performance because it quantifies price received and the variance around the mean of those prices for each strategy. Selecting strategies with the smallest variance at each price level allows the use of an envelope curve to establish an efficient frontier. Therefore, mean variance testing will identify those labels that are efficient for each strategy and allow comparison of those labels within and between strategies.

In the mean-variance test, an efficient point is determined by comparing all observations. Those points that occur along a frontier where the least variance occurs for all means up to an observed mean for all means, and where the greatest mean occurs for all variances up to an observed variance for all variances.

Two striking dissimilarities exist between this research and Cooper's. Cooper developed and used a price forecasting equation to improve strategy performance and assumed yields to be constant. The price forecasting equation used in conjunction with a selective hedging routine did reduce price variability, but average price received was

less than the price recieved on unhedged production. Technical selective hedging strategies incorporating a four and ten day moving average, "offered reduced variance as well as higher average price than the unhedged production during the 1973-1977 period".[1] Since price forecasting is not the objective of this research and it did not seem to offer improved performance over technical tools, price forecasting was excluded from this research. The assumption of constant yields is unrealistic and constitutes a major risk for farmers. This research is designed to explore the effect of incorporating yield risk into hedging strategies.

Cooper used the market strategy of selling all production at harvest as a check for all other strategies. This is logical since this is a common practice among producers. In Cooper's research, the timing of hedges depended on either time, an asking price, a signal generated by a moving averaage, a price forecast, or a combination of the previous indicators. These strategies cover the range of conditions that would logically dictate execution of market transactions. Therefore, these conditions or indicators will be used in the strategies for this research. However, the percentages hedged at different times during the production season will be varied to determine the impact of yield risk on average revenue and revenue variance of yield risk.

Heifner acknowledged that yields vary and constituted a major part of the farmer's risk. He incorporated yield risk into his research to

establish some percentage of expected yield that would be hedged in order to minimize risk. This approach does not acknowledge the producer who is not totally risk averse and is willing to trade some amount of increased risk for an increase in price received. Heifner used county data to determine yield variance. He indicated the need for less aggregated farm data.

> "In principle, individual farm data should be used since part of the variation is averaged out when using aggregated data."

To understand the effect of farm data and its increased variation, data from the Eastern Virginia Research Station will be used to approximate the variability of individual farm data.

Heifner found that, over the years 1963-76, using midwest data, that:

> "When the yield risk effect and the basis risk effect are combined using equation (8), the indicated minimum risk forward selling level is about fity to seventy percent of the crop."[2]

Basis risk was not found to be a major risk factor. Heifner did feel that additional years of data and individual farm data would improve future research.

Peck analyzed the effect of hedging eggs on income stability. Prediction equations were employed for both basis and price to compute optimum hedge levels dependent on the risk averseness of the producer. Portfolio analysis was used in analyzing thirty one optimal hedge strategies. These strategies were based on four types of price forecasts:

1. using regression forecast;
2. using point forecast;
3. using futures forecast; and
4. using a total hedging strategy.

The hedging volume was consistenly 75-95% of production. Peck's strategies reduced risk four to twenty five fold in terms of revenue mean squared error, however the standard error showed little difference between a hedged and unhedged position due to adjustment of production by producer. In the case of grain farmers this would not be the case as production levels through the season cannot be adjusted. Peck did note that the consideration of yield variance would have rendered her analysis, "unnecessarily complex".3 Peck concludes that a total hedge program compared favorable with the optimal hedge routines. Peck's study, as did Cooper's, fails to indicate the advantage of price prediction in determining price levels for hedging.

Bolen, Baker and Hinton analyzed twelve marketing strategies each for corn and soybeans. Yield risk was not included. A mean variance test was conducted for two periods, 1965-1974, and 1971-1974. Strategies on the efficient frontier in either or both time periods were then compared at differing levels of risk averseness for the producer. The use of futures markets was relatively minor in favor of forward contracts. Futures contracts were too large in terms of minimum contract size and added too much complexity to the models, hence only several rather unsophisticated strategies were examined. However, in

either case a forward price was established and did function to reduce risk. The only forward pricing mechanism that was found to be efficient in terms of mean price received and price variance was selling one sixth of expected production each month over the period of April through September.

McKinnon examined the use of forward sales, grain storage, and money accumulation to stabilize income for farmers. In using forward sales, the farmer was allowed to place a hedge at planting and lift the hedge at harvest. No selective hedging routines were considered. McKinnon found that the more highly negative the correlation between yield and price, the smaller the amount that should be hedged. Therefore, as correlation between yield and price approached zero the amount hedged would approach expected yield.

II.1 FOOTNOTES

[1]Heifner, p. 6.

[2]Heifner, p. 9.

[3]Peck, p. 418.

Chapter III

STRATEGY SELECTION

The yield and weather data used in this research were collected at the Eastern Virginia Research Station in the northern neck area of Virginia for corn for the years 1951 to 1979. This area was chosen for several reasons. The Eastern Virginia Research Station is located in Richmond county and has accurate yield and weather data extending back through 1951. Most importantly, this yield data accurately reflects normal farm practices and varieties. The yield data used is the average yield of many varieties with differing maturities. The use of localized data such as this reduces the masking effect of more highly aggregated county data. Price data for the northern neck represents realistic, competitively determined values for corn in one of the major grain producing areas of the state. This region produces a surplus over what can be consumed in the area by either livestock or industry. The existence of this surplus causes corn produced in the area to be valued either as livestock feed in the Shenandoah Valley, or as export grain at the port of Norfolk. Both markets compete for grain over a wide area. Therefore, corn produced in the northern neck is competitively priced relative to corn in the midwest.

Cooper used production costs and basis data for the northern Tidewater area of Virginia. The area encompassed by the northern neck is roughly congruous with the northern Tidewater area. By using

essentially the same area, the validity of Cooper's strategy selection and conclusions can be maintained since the period covered is the same except for one more year of data.

Selection of strategies and research procedures is greatly affected by correlation between price and yield. McKinnon demonstrated that the percentage of the crop that should be hedged hedged decreased as the negative correlation between yield and price increased. Therefore, for years 1950-1978 the correlation of yields and prices in the northern neck area was determined. To determine the sample correlation coefficient, each county was treated individually to avoid reduction in variation of the data via aggregation. Price received at harvest was deflated by the producers price index (1967 = 100).[1, 2, 3] The correlations between yield and price for 1951-1979 are shown in Table 1.

All four counties indicated a positive correlation between price and yield. None of the correlation coefficients are statistically significant at the 10 percent level. Hence, little if any dependent relationship exists between yield and price. Therefore, yield and price risk can be treated separately without concern for their interaction.

The lack of correlation between corn price and yield is related to the small portion of total U.S. production produced in Virginia. Table 2 indicates that Virginia has produced less than one percent of U.S. production in the last several years. Therefore, corn prices in Virginia are influenced more by U.S. yield than Virginia yields.

Table 1. Correlation Between Yield and Price For Corn In The Northern Neck, 1951-1979.

County	Correlation Coefficient	t-Statistic
Westmoreland	.17	.91
Lancaster	.07	.35
Northumberland	.10	.52
Richmond	.16	.87

Table 2. Percent of U.S. Corn Production Produced in Virginia, 1975-1979.

Year	U.S. Production	Virginia Production	VA/U.S.
	million bu.		%
1975	5840.8	49.7	0.9
1976	6289.2	47.6	0.8
1977	6505.0	30.8	0.5
1978	7267.9	50.4	0.7
1979	7938.8	51.0	0.6

Source:
Virginia Agricultural Statistics, 1980.

Since the objective of this research is to analyze the impact of yield risk on various marketing strategies, a yield model was developed to predict corn yields. These yield predictions are used to determine what quantity to hedge at various points during the production season depending upon anticipated yields.

III.1 YIELD PREDICTION MODELS

Before any percentage of expected yield can be priced, some idea must be formed as to the size of the crop expected. The crop yield in any particular year is determined by two types of factors:

1. those which tend to remain relatively stable over a period of years, and
2. those which may fluctuate widely from year to year.

Factors of production on a well maintained farm such as soil fertility, cultural practices, seed quality and pest management do notchange drastically from one year to the next. Therefore, the quality of these factors will show up in the general productivity level of the farming operation over a series of years. These will be called the stable factors of production. Weather, however, can change dramatically from year to year. Excluding disasters such as tornadoes, hail, hurricanes, and other acts of God, temperature and rainfall can cause wide changes in yields of corn from one season to the next. Rainfall and temperature will be labelled the unstable factors of production. A yield prediction equation must include both stable and unstable factors of production to approximate reality.

The stable factors of production are included as a trend over time. The prediction of yield prior to planting is dependent entirely upon this trend because the unstable factors of production have not occurred and cannot be predicted. The predicted yield prior to planting is labelled YPH. The estimated equation for yield (YPH) based on trend over the years 1951-1979 is:

$$YPH = -65.37 + 2.57\ YR$$
$$(-1.36)\ (3.53)$$
$$R2 = .31 \quad D\text{-}W = 1.96$$

where:

YPH = yield in bushels per acre, and

YR = 51 for 1951, 52 for 1952, --- 79 for 1979.

The equation indicates that the stable factors of production have increased yields 2.57 bushels per acre over the study period. The actual and predicted yields for each year are in Table 5.

Another prediction was needed during the growing season to reflect the effects of unstable production factors. This prediction would adjust any hedged positions based on the earlier YPH prediction. In a year of favorable growing conditions, the second prediction would increase the size of the hedge to maintain the same percentage as was hedged using YPH. In a year of unfavorable weather conditions, the amount hedged would be reduced for the same reason. This would more accurately show the effect of any "X" percentage hedged on revenue received and variance.

Table 3. Predicted and Actual Yields

Year	April Prediction (YPH)	July Prediction (YJ)	Actual Yield
51	66	99	103
52	68	73	64
53	71	25	31
54	73	24	39
55	76	68	95
56	79	95	89
57	81	66	51
58	84	82	120
59	86	94	92
60	89	98	75
61	91	142	79
62	94	103	107
63	97	84	30
64	99	90	113
65	102	121	156
66	104	83	93
67	107	124	131
68	109	97	124
69	112	107	110
70	115	120	117
71	117	135	106
72	120	141	129
73	122	131	131
74	125	130	163
75	127	155	173
76	130	130	162
77	132	75	43
78	135	130	162
79	138	152	168

The two variables included under the heading of unstable conditions are rainfall and temperature. Available soil moisture more correctly identifies the amount of water available to the plant, but creates significant problems in data collection, especially for the average farmer. Both rainfall and temperature data are easy to collect and a good, historical data base was already available.

Aldrich, Scott, and Leng indicate that moisture stress can reduce yields over forty percent if the stress occurs during the silking and tasseling stage.[4] Normally, this stage of growth occurs in the northern neck area during late June and early July. To locate the most critical time period, weekly rainfall totals from the beginning of May through the third week of August individually, and summed from April 1 were correlated with yield (Table 4). The individual totals for the third and fourth weks in June, the first and second week of July, and the first week in August were found to be significant. The first week in August and the first week in July were the most significant. Totals summed from April 1 through the first, second, third, and fourth weeks of July and the first three weeks of August were all significant. The most significant were the second and third weeks of August. These weeks in August are not representative of the silking and tasseling period though, because ears at that time have already filled out. This indicates that pollenation occurred several weeks prior. The high correlation with mid to late August sums more likely is response to the total years rain. Another problem with August sums is that they occur

so late during the growing season that they are of no value in predicting yields earlier in the growing season when producers are making hedging and contracting decisions. If the initial hedge position is carried late into the growing season past the time at which yield has been affected, then the producer has either been over or underhedged for a period of time in which price movements may be adverse. Therefore, unnecessary risk is incurred.

Initially many models were estimated using the weekly rainfall and accumulated rainfall from April 1 plus the trend variable YR to account fore the stable factors of production. In essence, the rainfall variables acted upon the stable factors to adjust the trend for individual years rainfall. Several of the estimated coefficients for rainfall were negative, a result inconsistent with known agronomic relationships. After considerable testing of models, the following three models proved to be the most acceptable in terms of agronomic principles and statistical properties (Table 5).

All three models have low R^2 values, indicating relatively poor predictive ability. The only rainfall variable that was significant was rainfall during the first week of July (JY1). Rainfall during this week corresponds to the silking and tasseling period so crucial to corn production. Due to these considerations, JY1 was the only moisture variable included in the yield prediction model.

Table 4. Correlation Between Rainfall and Yields. 1951-1979.

Data Symbol[a]	Correlation Coefficient
J3	.306*
J4	.278*
JY1	.368*
JY2	.328*
JY4	.268
A1	.382*
SJY1	.218*
SJY2	.255*
SJY3	.347*
SJY4	.368*
SA1	.428*
SA2	.480*
SA3	.435*

[a]The letter J denotes June, JY denotes July, A denotes August. The numeral indicates the week of the month. The letter S indicates the sum of rainfall from April 1 through the week shown.

*significant at the 5 percent level.

Table 5. Yield Prediction Equations Including Rainfall.[a, b]

Equation Number	Estimated Coefficients	R^2	D-W
1	-77.1 + 2.68 YR + 5.85 J3 (-1.46) (3.17) (0.71)	.35	2.06
2	-80.28 + 2.67 YR + 2.27 J3 + 6.68 J4 (-1.52) (3.16) (0.25) (1.01)	.38	2.12
3	-102.28 + 2.62 YR + .91 SJY1 + 20.6 JY1 (-1.74) (3.17) (.60) (1.75) 2.79 J3 - .75 J4 (.31) (-.09)	.46	2.05

[a]Dependent variable is yield per acre (YJ).

[b]Numbers in parenthesis are t-scores.

Extremely hot temperatures can adversely affect corn yields. In the presence of adequate soil moisture, temperatures in excess of 90 degrees farenheit have been found to reduce plant growth.[5] Temperature data gathered at the Eastern Virginia Research Station in terms of daily highs was used to identify heat stress that could affect yields. The temperature variable was constructed by adding together for a week the number of degrees above 90 degrees farenheit each day. For example, if during a week the high temperature on two days was 94 degrees farenheit and on no other day did the temperature exceed 90 degrees farenheit; the temperature variable for that week would be 8. The temperature variable was computed by week starting on July 1. Including the temperature variable in the yield model allows for any combination temperature and moisture conditions to be reflected. Under certain conditions, the two variables may interact for an exaggerated effect or cancel each other out. The temperature variable for the first week in July was labelled JYT1. Subsequent weeks and months follow the same scheme used for rainfall. The temperature variable for the weeks in July and August were added to the equation containing trend (YR) and moisture the first week in July (JY1). The best forecasting equation in terms of correct signs on coefficients and statistical significance is:

$$YJ = -12.53 + 1.71\ Yr + 25.65\ JY1 - 1.23\ JYT1$$

$$(-.30)\quad (2.85)\qquad (3.11)\qquad (-3.20)$$

$$R^2 = .63 \qquad D.W. = 1.92$$

This equation indicates that yields tend to increase about 1.7 bushels per acre per year due to improvements in the stable factors of production. The coefficient on moisture indicates each one inch of rain during the first week of July adds 25 to 26 bushels per acre to yield. The temperature coefficient indicates a 1.2 bushel decrease in production for each degree accumulated over 90 degrees farenheit during the first week of July. This model explains 63 percent of the variation in corn yields based on data available after the first week in July. The actual yields and predicted yields in April and July are contained in Table 5.

III.2 STRATEGY SELECTION

The strategies selected for analysis were chosen for one of two reasons. Some strategies were identical to Cooper's to permit an analysis of the impact of yield risk on strategy results. Other strategies were selected because it is anticipated producers would be able to understand and use the strategies if they prove successful. The five strategies analyzed were:

1. Sell all production at harvest,
2. Hedge various percentages of expected production at planting,
3. Hedge varying percentages of crop by month using routine hedge method,
4. Hedge when the futures price minus the basis is greater than asking price using the same percentages and timing as Strategy 3, and

5. Hedge various percentages of the crop at selected times with signals generated by a 4 and 10 day moving average.

A hedge constitutes the assumption of an opposite position in the futures market equal to or less than your position in the cash market. Routine hedging allows the establishment of a position in the futures market without regard to price or price relationship. Selective hedging establishes price levels or relationships that must be satisfied before a futures position for the purpose of hedging can be initiated.

The years analyzed in this research are 1973 through 1979. Earlier data was not considered because pre 1973 grain markets did not exhibit the price volatility characteristic of grain markets since 1972. Also, the outlook for grain markets in the future is more typical of the 1973-and-after period than the pre-1973 period. The U.S. became more active in world grain markets in the post-'73 period, therefore, the efect of changed in world markets had increased impact on prices of grain domestically.

In an effort to simplify this research without sacrificing significant accuracy, broker's commissions are assumed to be $.01 per bushel per round turn (1 buy and 1 sell). The proportion of expected yield that is hedged will determine the proportion of $.01 per bushel that will be charged to average price received. For example, if 100% of expected yield is hedged, then $.01 per bushel is charged to average price per round turn. For the purpose of this research, the planting

date for corn will be April 15 or the first trading day thereafter. October 1 or the first trading day thereafter will be the harvest date. It is assumed that the farmer will be able to hedge in any size lot so as to circumvent the real-life contract specifications of 5,000 and 1,000 bushel.

III.2.1 Strategy 1

The strategy of selling all production at harvest is used as a control for the other strategies. Selling the entire crop at harvest represents the absence of forward pricing mechanisms and therefore reflects the performance of hedging strategies versus no hedging.

III.2.2 Strategy 2

The second strategy initiates a hedged position at planting and lifts this position at harvest. The estimate of yield used at planting is YPH. The modified yield prediction YJ is used after the first week of July to adjust the size of the hedge for increased or decreased expected yield. Several percentages of yield beginning at 5 percent and increasing by increments of 5 percent to 100 percent of expected yield were hedged at planting.

III.2.3 Strategy 3

Strategy 3 (a place and hold strategy) was designed to determine the impact on price and price variance of hedging various percentages of expected yield during the growing season. The strategy starts by hedging 100 percent in month t. This would constitute one label. Each strategy possesses infinite capability for variation. In each case, several variations were tested and each variation was designated as a "label". The next label would hedge 90 percent in month t and 10 percent in month t+1. The third label would hedge 80 percent in month t, 10% in month t+1, and 10 percent in month t+2. This would continue until all t months in one production cycle were involved. (In this case, the set of months equals 6, April through September.) At this point, additional 10 percent reductions in the amount hedged in month t are distributed evenly among the remaining t-1 months. This strategy begins hedging 90 percent in April and progresses to the concluding strategy label which hedges 10 percent in September. Additionally, two out of sequence labels were analyzed. Startegy label J2 involved hedging 5 percent each month April through September and strategy label K2 involved hedging 10 percent each of these months. As in Strategy 2, the YPh and YJ yield predictions respectively are used to conform hedge volume to expected yield. Table 6 contains the percentages of teh expected yield that were hedged by month of the growing season and its corresponding label. For example, label AO indicates 90% of expected yield was hedged in April and the remaining 10% in May. Label IO

Table 6. Strategy 3, Labels, Percent of Expected Yield Hedged and Timing of Hedge

Strategy Label	Months April	May	June	July	August	September
AO	90	10	0	0	0	0
BO	80	10	10	0	0	0
CO	70	10	10	10	0	0
DO	60	10	10	10	10	0
EO	50	10	10	10	10	10
FO	40	12	12	12	12	12
GO	30	14	14	14	14	14
HO	20	16	16	16	16	16
IO	10	18	18	18	18	18
JO	0	100	0	0	0	0
KO	0	90	10	0	0	0
LO	0	80	10	10	0	0
MO	0	70	10	10	10	0
NO	0	60	10	10	10	10
OO	0	50	12.5	12.5	12.5	12.5
PO	0	40	15	15	15	15
QO	0	30	17.5	17.5	17.5	17.5
RO	0	20	20	20	20	20
SO	0	10	22.5	22.5	22.5	22.5
TO	0	0	100	0	0	0
UO	0	0	90	10	0	0
VO	0	0	80	10	10	0
WO	0	0	70	10	10	10
XO	0	0	60	13.3	13.3	13.3
YO	0	0	50	16.6	16.6	16.6
ZO	0	0	40	20	20	20
A1	0	0	30	23.3	23.3	23.3
B1	0	0	20	26.6	26.6	26.6
C1	0	0	10	30	30	30
D1	0	0	0	100	0	0
E1	0	0	0	90	10	0
F1	0	0	0	80	10	10
G1	0	0	0	70	15	15
H1	0	0	0	60	20	20
I1	0	0	0	50	25	25
J1	0	0	0	40	30	30

Table 6. (con't.)

Strategy Label	Months April	May	June	July	August	September
K1	0	0	0	30	35	35
L1	0	0	0	20	40	40
M1	0	0	0	10	45	45
N1	0	0	0	0	100	0
O1	0	0	0	0	90	10
P1	0	0	0	0	80	20
Q1	0	0	0	0	70	30
R1	0	0	0	0	60	40
S1	0	0	0	0	50	50
T1	0	0	0	0	40	60
U1	0	0	0	0	30	70
V1	0	0	0	0	20	80
W1	0	0	0	0	10	90
X1	0	0	0	0	0	100
Y1	0	0	0	0	0	90
Z1	0	0	0	0	0	80
A2	0	0	0	0	0	70
B2	0	0	0	0	0	60
C2	0	0	0	0	0	50
D2	0	0	0	0	0	40
E2	0	0	0	0	0	30
F2	0	0	0	0	0	20
G2	0	0	0	0	0	10
H2	0	0	0	0	0	0
J2	5	5	5	5	5	5
K2	10	10	10	10	10	10

indicates 10% was hedged in April and 18% was hedged in each of the remaining months May through September.

III.2.4 Strategy 4

Strategy 4 involves hedging of production similar to strategy three except the futures price (FP) minus the basis (B) must be greater than asking price (AP) before a hedge is placed.

$$FP - B = AP$$

The asking price consists of fixed and variable production costs, a 7 percent return to management based on estimated gross sales per acre and a 10 percent profit based on total production cost per acre. The costs are representative of the Northern Neck area of Virginia and were updated yearly. The total costs plus management and profit were divided by expected yield to determine asking price. Each year had two asking prices, one based on the yield estimate calculated in April and another based on the July yield estimate. For example, in 1979 total production costs, return to management, and profit was $250.48 per acre. The April yield estimate (YPH) was 138 bushels. Therefore, the asking price was $1.82 per bushel ($250.48/138). After July 7, the yield estimate changed to 152 bushels, so one asking price dropped to $1.64 per bushel ($250.48/152). Table 8 contains the estimated and actual asking prices used. Detailed budgets for each year are in Appendix A. Only during adjusted for basis.

July, August and September, 1977 were asking prices less than futures Basis, the local cash price minus futures, was estimated by averaging the harvest basis for the three previous years. Northern Tidewater market area cash prices and December corn futures prices on October 1 were used to calculate the basis. When the crop was sold at harvest, the actual basis was used in calculating the average price recieved. The estimated and actual basis numbers used are in Table 7.

III.2.5 Strategy 5

In Strategy 5, a certain percentage of the crop is hedged when the 4-day moving average crosses the 10-day moving average from above.&u6 When the 4-day moving average crosses the 10-day moving average from below all futures positions are liquidated. This trading is initiated at planting and continues until October 1 when all hedges are lifted and the corn is sold on the cash market. The schedule of label percentages in this strategy is identical to Strategy 2. The percentage hedged begins at 5 percent and increased in increments of 5 percent to 100 percent.

Table 7. Estimated and Actual Asking Prices

Year	Estimated Yields Apr. 15	Estimated Yields July 8	Actual Yield	Total Costs $/ac.	Asking Prices Apr. 15	Asking Prices July 8	Asking Prices Actual
1973	122	131	131	137.89	1.13	1.05	1.05
1974	125	130	163	184.91	1.48	1.42	1.13
1975	127	155	173	226.52	1.78	1.46	1.31
1976	130	130	162	218.79	1.68	1.68	1.35
1977	132	75	43	222.18	1.68	2.96	5.17
1978	135	130	113	231.54	1.72	1.78	2.05
1979	138	152	168	250.48	1.82	1.65	1.49

Table 8. Estimated and Actual Basis[a]

Year	Basis Estimate	Basis Actual
	$/bu.	
1973	- .11	-.28
1974	- .17	-.32
1975	- .25	-.26
1976	- .29	-.35
1977	- .31	-.24
1978	- .28	-.17
1979	- .25	-.07

[a]Cooper, p. 120.

III.3 FOOTNOTES

[1]Producers Price Index data taken from Economic Report of the President, U.S. Government Printing Office, Washington, January, 1979.

[2]Prices taken from Virginia Agricultural Prices, Virginia Cooperative Crop Reporting Service, Bulletin 25, November 1963 and Bulletin 46, September 1979.

[3]Yields taken from Farm Statistics, USDA Reporting Service, Virginia Cooperative Crop Reporting Service, VDACS, July 1967 and July 1979.

[4]Aldrich, Scott, Leng Modern Corn Production, Second Edition, 1975, A & L Publications, Champaign, IL, p. 213.

[5]Aldrich, Scott, Leng, p. 21.

[6]Cooper analyzed many combinations of moving averages and found the 4 and 10 day moving average to be the best in terms of profits generated over the years 1972-77.

Chapter IV

RESULTS AND ANALYSIS

The first objective in analyzing the results is to find the sub-strategies within each strategy that lie on the efficient frontier of mean revenue received and variance of revenue. If a strategy label lies on the efficient frontier, there is no other label that resulted in a higher revenue for that level of variance. Also, for a given revenue level, no other label has a smaller variance.

For each strategy, only those labels which lie on the efficient frontier will be discussed here. The mean revenue and variance received for each label in each strategy may be found in Appendix B.

Strategy 1 is the control and has only one label. As such, it is not being tested but noted for comparison.

Mean Revenue - $ 358.81

Revenue Variance - $28,496.31

Strategy 2 has twenty labels representing the portion of expected production hedged at planting time beginning at five percent and incrementally increasing by units of five to one hundred percent. Thos labels which pass the mean-variance test are: 100, 90, 80, 70, 65, 55, 45, 40, 30, 25, 20, 15, 10, 5.

As the percent hedged at planting decreased, the mean revenue and variance increased across all labels. Figure 1 shows that none of the Strategy 2 labels had a mean or variance equal to or greater than the results of Strategy 1, and the results for each label lay on or near the efficient frontier. In years 1973, 1974, 1975 and 1979, the futures price in October was greater than the futures price in April when the initial hedge was placed. Additional trades were made in July to adjust the amount hedged in line with the new yield prediction but these were relatively small and of little consequence. The net effect on revenue in those years was negative due to losses on futures contracts. Yield was underestimated in all of these years, which slightly diminished the negative revenue impact relative to a proportionately correct hedge. During 1976, 1977, and 1978, net gains were made on futures contracts, and in 1977 and 1978, yield was overestimated which increased the positive revenue effect relative to a proportionately correct hedge. In 1976, yield was underestimated and the gain on futures trading was minimal so as to have little effect. As reflected by the results in Appendix B, the net effect over all years within a given label was to lower mean revenue and because gains from futures trading occurred in two of the three lowest revenue years, the variance of revenue was also reduced. Overall, the mean and variance were positively proportional to the percentage of expected production hedged at planting.

Strategy 3 is composed of different levels of hedging at different times during the growing season. The efficient labels for this strategy

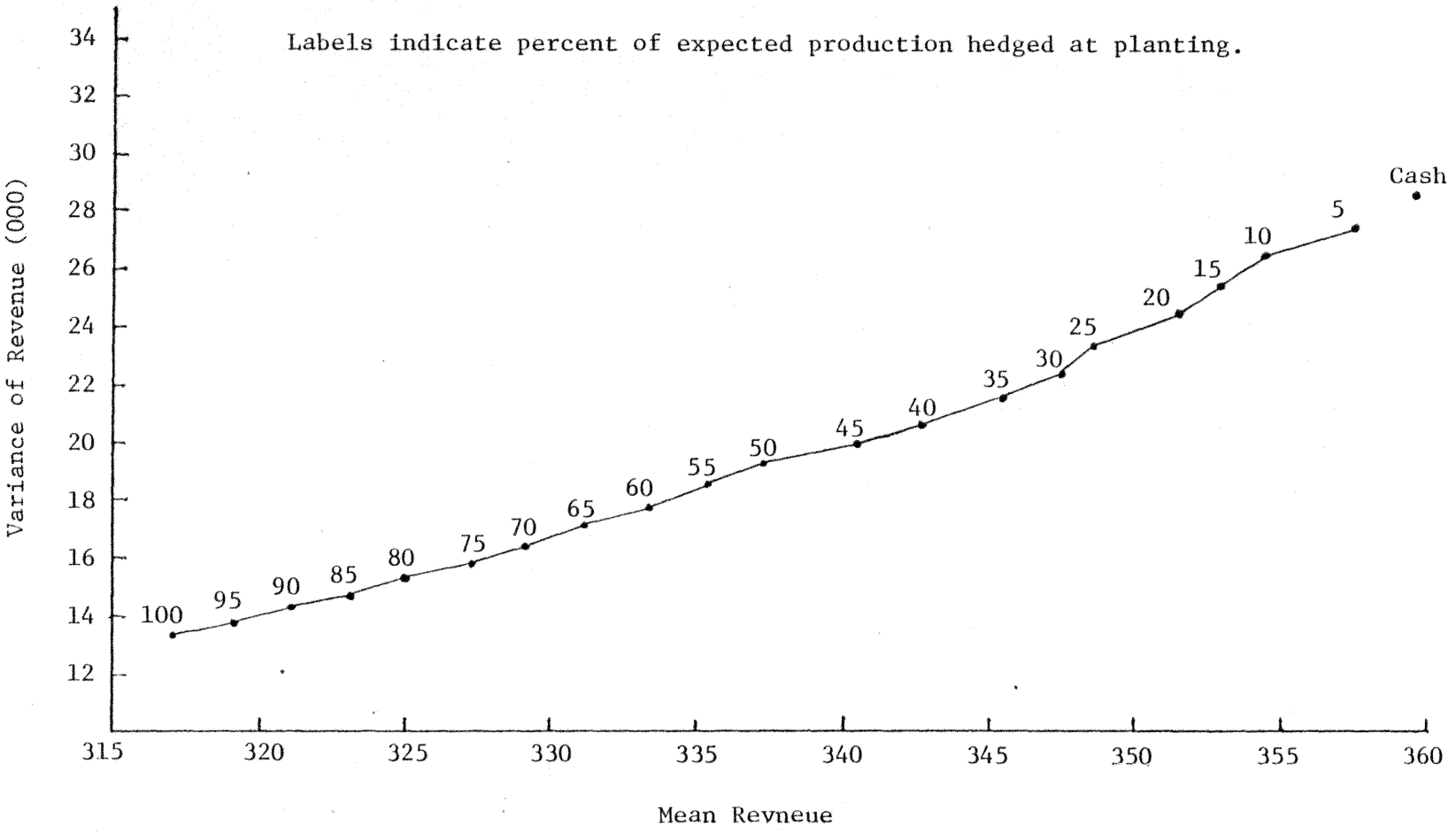

Figure 1. Strategy 2 Efficient Label Mean Revenues and Revenue Variances ($/Acre).

are shown in Figure 2 and the mean revenue variance and percentage of production hedged by label are shown in Table 9. Figure 2 indicates that label BO resulted in the lowest mean revenue and smallest variance. Label BO also resulted in the largest percentage of expected yield being hedged earlier in the year than any other efficient label. The label with the next highest mean and variance was TO under which a larger percentage of expected production was hedged earlier in the season than all other efficient labels except BO. Table 9 demonstrates that among the efficient labels, the mean revenue and variance increase across labels is the result of the timing of hedges and not the percentage of production hedged. All of the efficient labels involved hedge levels of 100% of expected yield. Therefore, the yield effect of over or under hedging would be represented equally in each of the efficient labels. Of the twelve efficient labels for Strategy 3, nine initiate a hedge position in the month of June and eight of these are the initial futures trade for that label. Table 9 indicates that revenues and variances increase as the percentage of production hedged in June decreases.

Table 10 contains the mean December futures price and variance for April through September for 1973-1979. June is the month of lowest variance, but has the fifth highest mean price. The later months of July, August, September and October respectively have the highest mean price and variance which corresponds to the higher mean revenues and variances of those labels which involve hedging a larger proportion of expected yield later in the season. The lowest mean revenue and

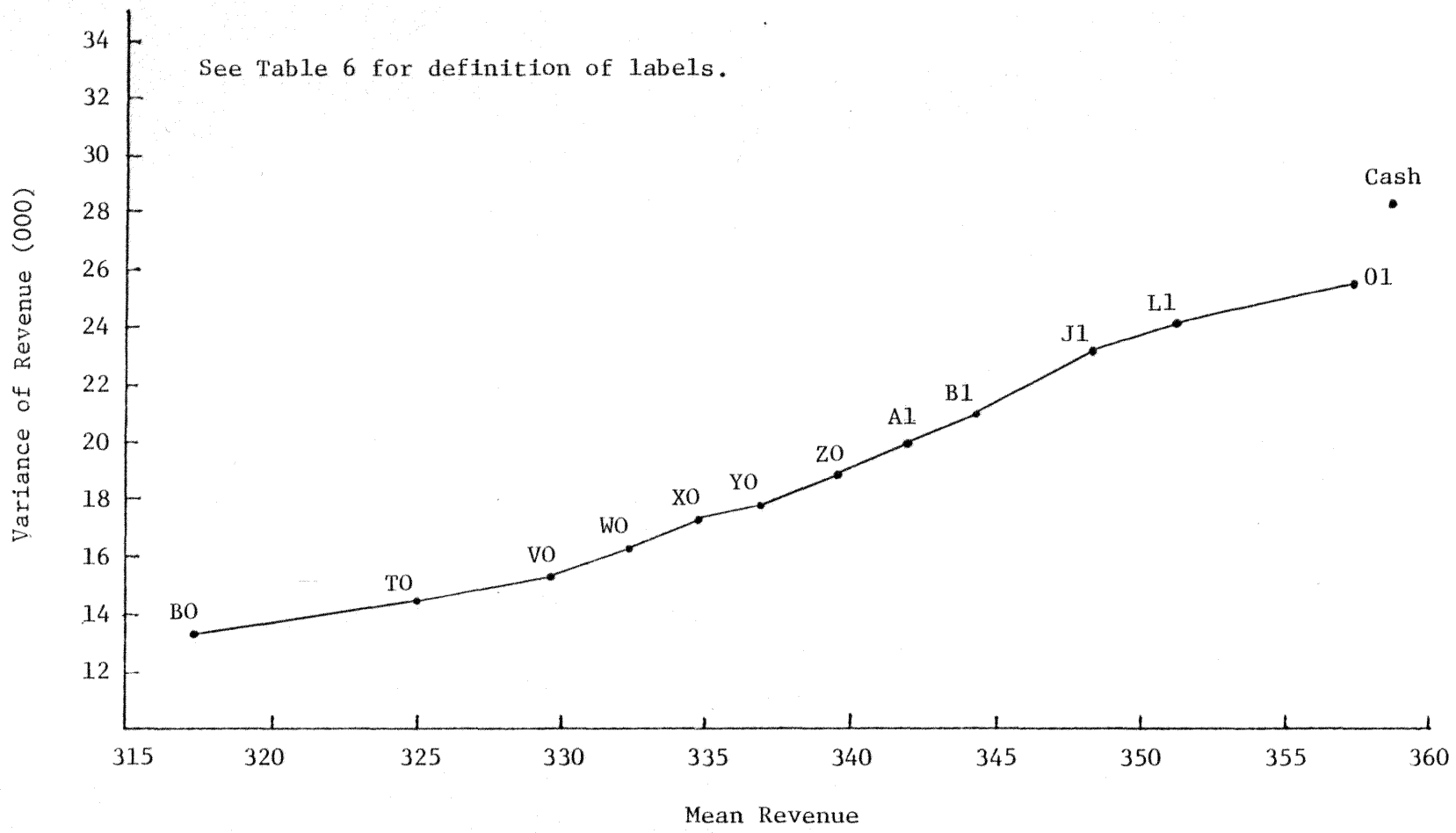

Figure 2. Strategy 3 Efficient Label Mean Revenues and Revenue Variances ($/Acre).

Table 9. Strategy 3 Efficient Label Revenues Variance and Percent Hedged by Month.

Label	Mean Revenue	Variance	% Hedged By Month April	May	June	July	Aug.	Sept.
BO	317.20	13,373.72	80	10	10	-	-	-
TO	324.96	14,275.93	-	-	100	-	-	-
VO	329.64	15,355.83	-	-	80	10	10	-
WO	332.39	16,265.26	-	-	70	10	10	10
XO	334.86	17,141.13	-	-	60	13.3	13.3	13.3
YO	337.13	17,957.37	-	-	50	16.6	16.6	16.6
ZO	339.54	18,997.20	-	-	40	20	20	20
A1	342.06	19,970.85	-	-	30	23.3	23.3	23.3
B1	344.28	21,076.27	-	-	20	26.6	26.6	26.6
J1	348.51	23,184.91	-	-	-	40	30	30
L1	351.26	24,097.48	-	-	-	20	40	40
O1	357.57	25,461.58	-	-	-	-	90	10

Table 10. December Futures Price Mean and Variance by Month, 1973-1979.

Month	Mean Price	Price Variance
	$/bushel	
April	245.36	1,616.04
May	241.27	1,066.02
June	251.77	812.25
July	263.05	1,898.34
August	275.43	2,599.98
September	269.11	2,562.38

expected yield later in the season. The lowest mean revenue and variance label B0 involves hedging 80% of expected yield in April, 10% in May and 10% in June. This is the only efficient label where hedging before June occurs. The reason is that in 1977, the lowest revenue year, the December futures price in April was higher than the futures price in all other months that year. The relatively small range of December futures prices in April contributed to the low variance of revenue.

The Strategy 4 results were similar to Strategy 3 except that an asking price was determined and made a requirement for initiation of a hedged position. This stipulation prevented hedging in only three months out of the seven years observed: July, August, and September of 1977. Table 11 and Figure 3 indicate that the efficient label results for Strategy 4 differ only slightly from Strategy 3. The J1 label exited the efficient label set and the N1 label entered. The asking price requirement was of little consequence since that price level could consistently be obtained through hedging based on the expected yields. A price greater than asking price was received each year except 1977 when yield was only 43 bushels per acre.

The Strategy 5 results, observed in Figure 4, resemble those of Strategy 2 in that as the percentage of expected yield hedged increases, mean revenue and variance decrease. Compared to Strategy 2, the decrease in revenue as variance declines is smaller, hence at a given

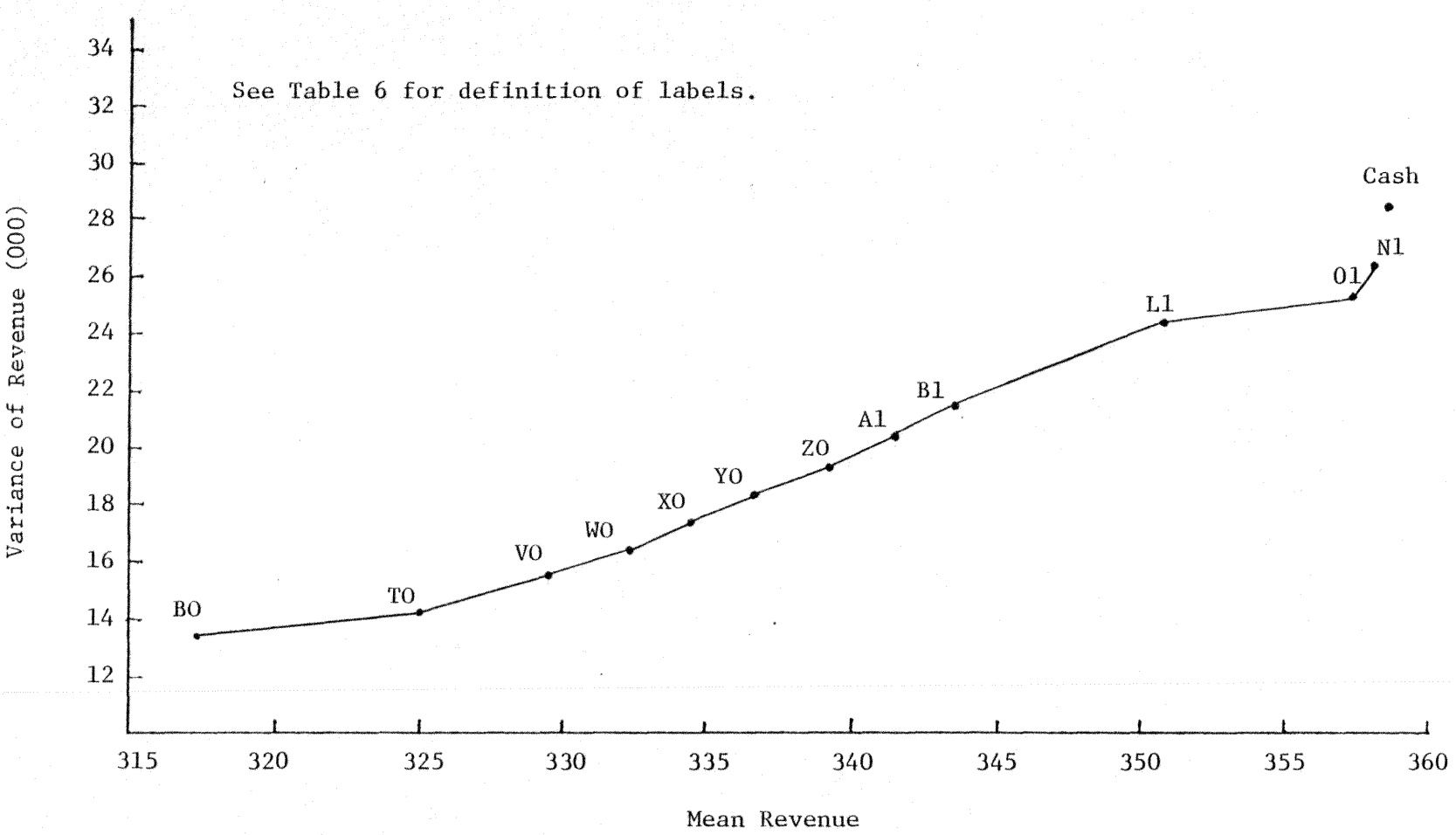

Figure 3. Strategy 4 Efficient Label Mean Revenues and Revenue Variances ($/Acre).

Table 11. Strategy 4 Efficient Label Revenues Variance and Percent Hedged by Month.

Label	Mean Revenue	Variance	% Hedged By Month					
			April	May	June	July	Aug.	Sept.
BO	317.20	13,373.72	80	10	10	-	-	-
TO	324.96	14,174.60	-	-	100	-	-	-
VO	329.40	15,480.41	-	-	80	10	10	-
WO	332.31	16,361.83	-	-	70	10	10	10
XO	334.62	17,273.38	-	-	60	13.3	13.3	13.3
YO	336.83	18,127.23	-	-	50	16.6	16.6	16.6
ZO	339.17	19,206.58	-	-	40	20	20	20
Al	341.63	20,221.72	-	-	30	23.3	23.3	23.3
Bl	343.79	21,369.68	-	-	20	26.6	26.6	26.6
Ll	351.01	24,253.68	-	-	-	20	40	40
Ol	357.76	25,340.88	-	-	-	-	90	10
Nl	358.23	25,448.71	-	-	-	-	100	-

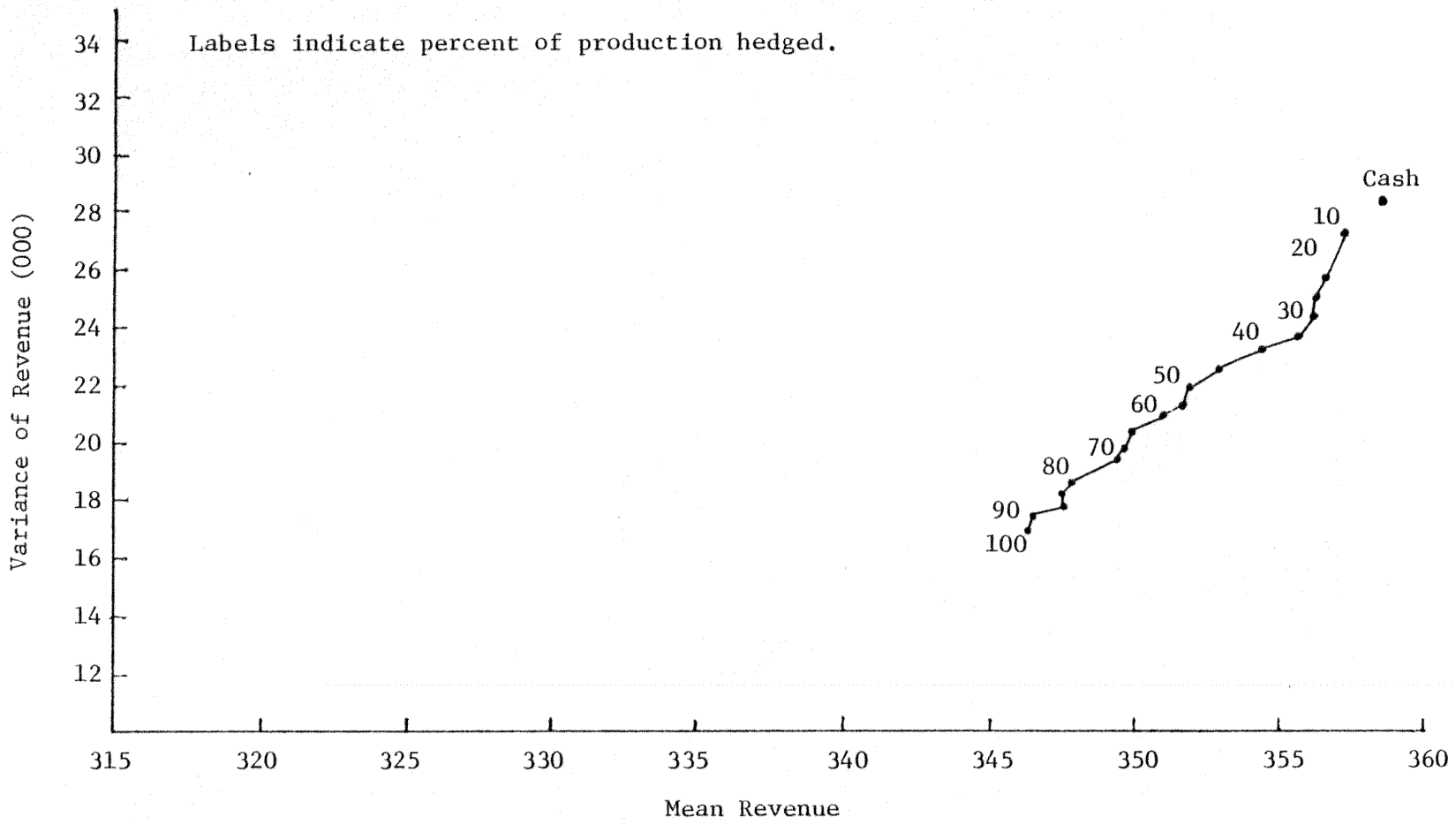

Figure 4. Strategy 5 Efficient Label Mean Revenues and Revenue Variances ($/Acre).

variance level, the efficient frontier for Strategy 5 lies to the right of Strategy 2. Strategy 5 employed a 4 and 10 day moving average to generate place and lift signals for the hedged position in 5 percent increments similar to Strategy 2. The reason that increased hedge levels generate decreased mean revenue and variance is that the use of the 4 and 10 day moving average causes net losses on futures trading in the four highest revenue years and net profits on futures trading in the three lowest revenue years. Overall, the net loss was greater than the net gain resulting in lower mean revenue with increased hedged levels. In two of the years during which the 4 and 10 day moving average generated profits, the yield was overestimated by the prediction model such that excess revenues were acquired relative to proportionately correct hedge. All four years in which losses were generated by the moving averages the yield was underestimated. A proportionately correct hedge would have resulted in lower total revenues and therefore losses would have been larger. The low correlation between yield and price for the northern neck area identify this as coincidence and not an established pattern. The combination of over and under hedging in profitable and unprofitable futures trading years respectively along with the strong performance of the 4 and 10 day moving average during the most profitabl years, 1977 in particular, explains the decreased risk-revenue tradeoff of Strategy 5 relative to Strategies 2-4. This is seen graphically as a steeper positive slope of the efficient frontier.

Table 12. Strategy 1 to 5 Efficient Label Mean Revenues and Variances.

Strategy	Label Description	Mean Revenue	Variance of Revenue (000's)
3	01-90% Aug., 10% Sept.	358	25
5	35%-4 & 10 hedge 35%	355	24
5	40%-4 & 10 hedge 40%	354	23
5	50%-4 & 10 hedge 50%	352	22
5	60%-4 & 10 hedge 60%	351	21
5	65%-4 & 10 hedge 65%	350	20
5	75%-4 & 10 hedge 75%	349	19
5	85%-4 & 10 hedge 85%	348	18
5	95%-4 & 10 hedge 85%	346	17
3	WO-70% June, 10% July, 10% Aug., 10% Sept.	332	16
3	VO-80% June, 10% July, 10% Aug.	330	15
3	TO-100% June	325	14
2	100%-Hedge 100% expected yield at planting	317	13

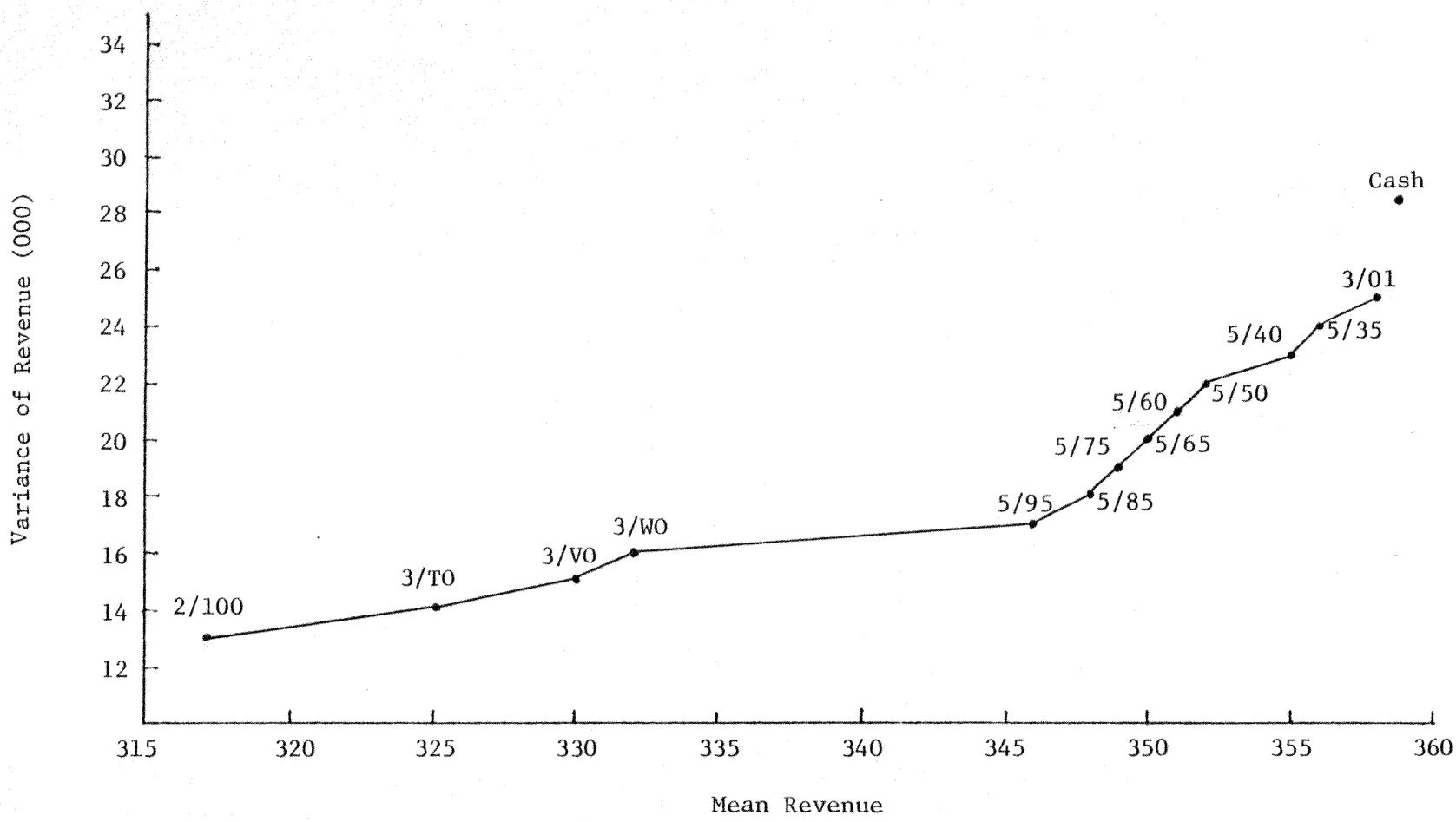

Figure 5. Strategy 1 to 5 Efficient Label Mean Revenues and Variances ($/Acre)

Chapter V

SUMMARY AND CONCLUSIONS

This research had two major objectives. The first was to determine what percentage of expected corn production should be hedged at various times during the growing season. The second was to determine if these percentages varied among alternative routine and selective hedging strategies. Yield and weather data from the Eastern Virginia Research Station for the years 1951-1979 were used to predict yields at planting and after the first week in July. These data was used rather than county data because aggregated data tends to underestimate individual farm yield variation.

At planting, expected yield was predicted as a function of time. Time is used as a proxy variable to capture the aggregate impact of changes in soil fertility, cultural practices, seed quality and pest management, over time. A new yield estimate was made after the first week in July after the critical silking period. The July yield forecast is a function of rainfall and number of accumulated degree days above 90 farenheit during the first week of July. All hedge positions were adjusted after the first week in July to reflect the new yield estimate.

December futures prices and local harvest cash prices were used. Basis estimates prior to harvest were the average (mean) of the prior three years. Budgets for cost of production were constructed by

extension agents in the northern neck area to reflect local agronomic practices and local price structures for inputs.

The strategies analyzed were selected for either their performance in Cooper's recent study of hedging strategies for this area or their similarity to normal hedging practices. The strategies were analyzed over the seven year period 1973-1979. The mean revenue per acre and variance of revenue were computed for each strategy and compared to each other and cash marketing.

All of the strategies analyzed produced lower average revenue per acre and reduced revenue variance compared to exclusive use of the cash market. This result is consistent with the findings of Cooper, Bolen, et. al., and Heifner with respect to routine hedging strategies. The efficient strategies in terms of trade-off between mean revenue and revenue variance range from a 1 percent decrease in revenue associated with a 4 percent decrease in variance to 11 percent decrease in revenue associated with a 48 percent decrease in variance. Some risk averse producers may find this large reduction in revenue variance attractive enough though revenue per acre is reduced.

Incorporating yield risk into the hedging strategy analysis produced several significant results compared to previous studies which did not include yield risk. First, inclusion of yield risk increases revenue variability per acre substantially. Over the years 1973-78, the coefficient of variation (CV) under the cash strategy in Cooper's

research was 20 percent. When yield risk is included, the CV for revenue per acre is 47 percent, an increase of over 100 percent. Therefore, previous research into production hedges for growing crops greatly underestimates the actual risk level faced by producers. In addition, the relative rankings of various strategies in a mean-variance framework may change when yield risk is included. Therefore, studies which do not explicitly incorporate yield risk may be of limited value.

Second, yield per acre and harvest cash price in the northern neck area of Virginia are uncorrelated. Hence, there is no tendency for low yields to be associated with high prices and vice versa. This relationship should be kept in mind in terms of evaluating the remaining conclusions. The results of this study should not be generalized to regions where price and yield are correlated.

Third, based on the research performed, no single recommendation about the appropriate percentage of production to hedge at various stages during the growing season can be made. A widely used rule of thumb is to hedge up to 25 percent before planting, up to 50 percent after the critical silking stage, and up to 75 percent after the dough stage. This study indicates that for a given revenue level, strategies involving hedging 25 percent of expected production before June have a larger variance than strategies which involve hedging less than 25 percent before June. The one exception is hedging 100 percent at

planting time which had the smallest revenue variance of all strategies analyzed.

Hedging 70 to 100 percent of expected production in June produced the smallest revenue variance for a given revenue level. During the period of the study, the variance in December corn futures in June was smaller than during any other month during the growing season. Hence, hedging a large portion of production during June reduced revenue variation.

Those strategies that hedged more than 70 percent before June did not result in large drops in revenue or increases in revenue variance compared to hedging 70 to 100 percent in June. The loss in revenue or change in revenue variance from hedging from 0 to 100 percent between April and June are small. The largest change in revenue is $17 per acre, although the lower returns also have smaller variances. Hence, the percentage of the crop hedged before June did not substantially affect the results in terms of revenue per acre.

Fourth, revenue per acre increased steadily as the percentage of the crop hedged after June increased. However, the variance of revenue also increased steadily per dollar gained in revenue. Maximum revenue per acre with the smallest variance occurred when 90 percent was hedged in August and 10 percent in September. This strategy resulted in $3 per acre less revenue than not hedging at all but reduced revenue variance by 11 percent. Revenues and revenue variances per acre increase after

June because during the study period December futures prices were higher in July, August and September than June but also had larger variances.

Overall, the optimal percent of the crops to hedge at various stages of plant growth depends upon the producers objective. If his objective is to minimize risk, then hedging 100 percent at planting is the best strategy. If his objective is to maximize revenue per acre with a hedging program, 90 and 10 percent should be hedged in August and September respectively. These results demonstrate that the percent of the crop each individual producer should hedge depends upon his objective and degree of risk aversion. However, whether his objective was revenue maximization or variance minimization, the common 25-25-25 percent rule of thumb was never the best strategy.

All strategies that involved hedging more than 55 percent of expected yield subjected the producer to speculation in the futures market in at least one year (1977) in that more bushels were hedged than were produced. Those producers concerned about being over-committed in the futures market should, therefore, not hedge more than 55 percent of expected production. Of course, better yield prediction equations could permit this level to be increased.

The producer who is not in a good cash position could suffer severe cash flow problems if he participates in a speculative position in the futures market. Lenders who participate in hedge account maintenance do not encourage speculation and this could be viewed as a violation of the

agreement to meet margin calls for the producer. Also, speculative losses are only tax-deductible up to the amount of $3,000 while hedge losses are deductible regardless of size.[13]

In terms of the second objective of comparing the results of routine versus selective hedging strategies, several results are noteworthy. First, this research, like Cooper's, demonstrates that selective hedging strategies involving placing and lifting hedges generally produce higher revenues than place and hold strategies. The selective strategies also produce higher variances than routine strategies. However, unlike Cooper, the 4 and 10 day moving average incorporating yield risk did not produce higher revenues and lower variances compared to the cash market. When yield risk is included, the 4 and 10 day moving averages reduce revenue variance but also reduce revenue per acre. This fact reinforces the earlier statement that hedging strategy results that do not include yield risk should be interpreted cautiously.

All of the strategies analyzed reduced revenue per acre. Hence, producers would only use these strategies if they place a significant monetary value on reduction in revenue variation from year to year. A large percent of the strategies reduced revenue variance by 40 percent while only reducing revenue per acre by 4 percent. Many producers may find this attractive. Other producers who want to increase revenue per acre by hedging need to realize that simple mechanical rules probably

will not achieve this objective. These producers will need to become very knowledgeable concerning the factors that influence the price of corn and follow the markets closely on a frequent basis. By careful analysis of the futures and cash market on a continuous basis, disciplined hedgers may be able to increase revenues per acre.

V.1 FOOTNOTES

[13]"Farmer's Tax Guide", USDA, 1981.

Appendix A

CALCULATION OF ASKING PRICE, 1973-1979

Table A-1. Corn: Conventional Till, Northern Tidewater, Virginia, Asking Price, 1973

Category	Unit Per Acre	Price	Quantity Per Acre	Cost
Variable Costs				
Corn Seed	bu.	$22.39	0.28	$ 6.27
Nitrogen	lbs.	0.11	125	13.75
Phosphate	lbs.	0.07	30	2.10
Potash	lbs.	0.06	120	7.20
Lime	ton	9.44	0.33	3.12
Atrazine	lbs.	2.11	1.75	3.69
Fertilizer Spreader	ac.		1.0	1.37
Sprayer	ac.		1.0	1.37
Insecticide	ac.		1.0	4.17
Fuel and Lube	ac.		1.0	11.66
Equipment Repair	ac.		1.0	3.36
Machinery Labor	hr.	2.74	2.46	6.74
Interest on Operating Capital	ac.		1.0	1.55
Total Variable Costs				$ 66.35
Fixed Costs				
Machinery & Equipment	ac.			$ 22.84
Land	ac.			21.94
Total Fixed Costs				$ 44.78
Total Fixed & Variable Costs				$111.13
Return to Management				15.63
Profit				11.13
Asking Price Per Acre				$137.89
Asking Price Per Bushel (122 bu.)				$ 1.13

Table A-2. Corn: Conventional Till, Northern Tidewater, Virginia, Asking Price, 1974

Category	Unit Per Acre	Price	Quantity Per Acre	Cost
Variable Costs				
Corn Seed	bu.	$30.95	0.28	$ 8.67
Nitrogen	lbs.	0.19	125	23.75
Phosphate	lbs.	0.12	30	3.60
Potash	lbs.	0.10	120	12.00
Lime	ton	15.82	0.33	5.22
Atrazine	lbs.	2.44	1.75	4.27
Fertilizer Spreader	ac.		1.0	1.67
Sprayer	ac.		1.0	1.67
Insecticide	ac.		1.0	4.84
Fuel and Lube	ac.		1.0	16.49
Equipment Repair	ac.		1.0	3.76
Machinery Labor	hr.	3.08	2.46	7.58
Interest on Operating Capital	ac.		1.0	2.62
Total Variable Costs				$ 96.14
Fixed Costs				
Machinery & Equipment	ac.			$ 25.59
Land	ac.			26.77
Total Fixed Costs				$ 52.36
Total Fixed & Variable Costs				$148.50
Return to Management				21.56
Profit				14.85
Asking Price Per Acre				$184.91
Asking Price Per Bushel (125 bu.)				$ 1.48

Table A-3. Corn: Conventional Till, Northern Tidewater, Virginia, Asking Price, 1975

Category	Unit Per Acre	Price	Quantity Per Acre	Cost
Variable Costs				
Corn Seed	bu.	$35.24	0.28	$ 9.87
Nitrogen	lbs.	0.26	125	32.50
Phosphate	lbs.	0.17	30	5.10
Potash	lbs.	0.14	120	16.80
Lime	ton	21.38	0.33	7.06
Atrazine	lbs.	3.42	1.75	5.99
Fertilizer Spreader	ac.		1.0	2.01
Sprayer	ac.		1.0	2.01
Insecticide	ac.		1.0	6.76
Fuel and Lube	ac.		1.0	17.75
Equipment Repair	ac.		1.0	4.80
Machinery Labor	hr.	3.93	2.46	9.67
Interest on Operating Capital	ac.		1.0	3.73
Total Variable Costs				$124.05
Fixed Costs				
Machinery & Equipment	ac.			$ 31.77
Land	ac.			32.10
Total Fixed Costs				$ 63.87
Total Fixed & Variable Costs				$187.92
Return to Management				19.81
Profit				18.79
Asking Price Per Acre				$226.52
Asking Price Per Bushel (127 bu.)				$ 1.78

Table A-4. Corn: Conventional Till, Northern Tidewater, Virginia, Asking Price, 1976

Category	Unit Per Acre	Price	Quantity Per Acre	Cost
Variable Costs				
Corn Seed	bu.	$32.75	0.28	$ 9.17
Nitrogen	lbs.	0.20	125	25.00
Phosphate	lbs.	0.13	30	3.90
Potash	lbs.	0.11	120	13.20
Lime	ton	16.84	0.33	5.56
Atrazine	lbs.	3.46	1.75	6.06
Fertilizer Spreader	ac.		1.0	2.16
Sprayer	ac.		1.0	2.16
Insecticide	ac.		1.0	6.84
Fuel and Lube	ac.		1.0	19.22
Equipment Repair	ac.		1.0	5.04
Machinery Labor	hr.	4.12	2.46	10.14
Interest on Operating Capital	ac.		1.0	3.60
Total Variable Costs				$112.05
Fixed Costs				
Machinery & Equipment	ac.			$ 36.23
Land	ac.			34.52
Total Fixed Costs				$ 70.75
Total Fixed & Variable Costs				$182.80
Return to Management				17.71
Profit				18.28
Asking Price Per Acre				$218.79
Asking Price Per Bushel (130 bu.)				$ 1.68

Table A-5. Corn: Conventional Till, Northern Tidewater, Virginia, Asking Price, 1977

Category	Unit Per Acre	Price	Quantity Per Acre	Cost
Variable Costs				
Corn Seed	bu.	$37.17	0.28	$ 10.41
Nitrogen	lbs.	0.20	125	25.00
Phosphate	lbs.	0.13	30	3.90
Potash	lbs.	0.11	120	13.20
Lime	ton	16.75	0.33	5.53
Atrazine	lbs.	3.06	1.75	5.36
Fertilizer Spreader	ac.		1.0	2.37
Sprayer	ac.		1.0	2.37
Insecticide	ac.		1.0	6.05
Fuel and Lube	ac.		1.0	20.69
Equipment Repair	ac.		1.0	4.77
Machinery Labor	hr.	3.91	2.46	9.62
Interest on Operating Capital	ac.		1.0	3.86
Total Variable Costs				$113.13
Fixed Costs				
Machinery & Equipment	ac.			$ 40.01
Land	ac.			37.90
Total Fixed Costs				$ 77.91
Total Fixed & Variable Costs				$191.04
Return to Management				12.04
Profit				19.10
Asking Price Per Acre				$222.18
Asking Price Per Bushel (132 bu.)				$ 1.68

Table A-6. Corn: Conventional Till, Northern Tidewater, Virginia, Asking Price, 1978.

Category	Unit Per Acre	Price	Quantity Per Acre	Cost
Variable Costs				
Corn Seed	bu.	$38.67	0.28	$ 10.83
Nitrogen	lbs.	0.21	125	26.01
Phosphate	lbs.	0.135	30	4.06
Potash	lbs.	0.114	120	13.73
Lime	ton	17.43	.33	5.75
Atrazine	lbs.	3.18	1.75	5.57
Fertilizer Spreader	ac.		1.0	2.47
Sprayer	ac.		1.0	2.47
Insecticide	ac.		1.0	6.29
Fuel and Lube	ac.		1.0	21.53
Equipment Repair	ac.		1.0	4.96
Machinery Labor	hr.	4.07	2.46	10.01
Interest on Operating Capital	ac.	113.68		4.02
Total Variable Costs				$117.70
Fixed Costs				
Machinery & Equipment				$ 41.63
Land				39.43
Total Fixed Costs				$ 81.06
Total Fixed & Variable Costs				$198.13
Return to Management				13.54
Profit				19.87
Asking Price Per Acre				$231.54
Asking Price Per Bushel (172 bu.)				$ 1.72

Table A-7. Corn: Conventional Till, Northern Tidewater, Virginia, Asking Price, 1979

Category	Unit Per Acre	Price	Quantity Per Acre	Cost
Variable Costs				
Corn Seed	bu.	$38.67	0.28	$ 10.83
Nitrogen	lbs.	.21	125	26.25
Phosphate	lbs.	.13	30	3.90
Potash	lbs.	.11	120	13.20
Lime	ton	17.40	.33	5.74
Atrazine	lbs.	2.94	1.75	5.14
Fertilizer Spreader	ac.	2.64	1.0	2.64
Sprayer	ac.	2.64	1.0	2.64
Insecticide	ac.	5.82	1.0	5.82
Fuel and Lube	ac.	25.68	1.0	25.68
Equipment Repair	ac.	5.32	1.0	5.32
Machinery Labor	hr.	4.35	2.46	10.70
Interest on Operating Capital	%	10	118.13	5.91
Total Variable Costs				$124.04
Fixed Costs				
Machinery & Equipment	ac.	48.08	10	$ 48.08
Land	ac.	42.29	10	42.29
Total Fixed Costs				$ 90.37
Total Fixed & Variable Costs				$214.41
Return to Management				14.63
Profit				21.44
Asking Price Per Acre				$250.48
Asking Price Per Bushel (138 bu.)				$ 1.82

Appendix B

PRICE, YIELD, AND TOTAL REVENUE AND CORRESPONDING VARIANCES BY YEAR, LABEL, AND STRATEGY

Table B-1. Strategy 1 Labels, Price Yield, Total Revenue and Corresponding Means and Variances

Year	Label - Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.36	131	309.16
1974	3.60	163	586.80
1975	2.61	173	451.53
1976	2.30	162	372.60
1977	1.82	43	78.26
1978	2.09	113	236.17
1979	2.84	168	477.12

Mean Price	2.52
Price Var.	.34
Mean Rev.	358.81
Rev. Var.	28,496.31
Coeff. of Var.	47%

Table B-2. Strategy 2 Labels, Price, Yield, Total Revenue and Corresponding Means and Variances

Label 5%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.32	131	303.92
1974	3.55	163	578.65
1975	2.59	173	448.07
1976	2.30	162	372.16
1977	1.90	43	87.70
1978	2.10	113	237.30
1979	2.83	168	475.442

Mean Price	2.51
Price Var.	.30
Mean Rev.	356.74
Rev. Var.	27,435.92
Coeff. of Var.	46%

Label 10%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.27	131	297.37
1974	3.50	163	570.50
1975	2.56	173	442.88
1976	2.30	162	372.60
1977	1.98	43	85.14
1978	2.12	113	239.56
1979	2.82	168	473.76

Mean Price	2.51
Price Var.	.27
Mean Rev.	354.54
Rev. Var.	26,341.24
Coeff. of Var.	46%

Label 15%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.26	131	296.06
1974	3.45	163	562.35
1975	2.54	173	439.42
1976	2.30	162	372.60
1977	2.06	43	88.58
1978	2.13	113	240.69
1979	2.81	168	472.08

Mean Price	2.51
Price Var.	.24
Mean Rev.	353.11
Rev. Var.	25,272.27
Coeff. of Var.	45%

Label 20%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.18	131	285.58
1974	3.40	163	554.20
1975	2.52	173	435.96
1976	2.30	162	372.60
1977	2.15	43	92.45
1978	2.15	113	242.95
1979	2.80	168	470.40

Mean Price	2.50
Price Var.	.21
Mean Rev.	350.59
Rev. Var.	24,338.81
Coeff. of Var.	44%

Label 25%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.14	131	280.34
1974	3.35	163	546.05
1975	2.50	173	432.50
1976	2.31	162	374.22
1977	2.23	43	95.89
1978	2.16	113	244.08
1979	2.79	168	468.72

Mean Price	2.50
Price Var.	.19
Mean Rev.	348.83
Rev. Var.	23,426.13
Coeff. of Var.	44%

Label 30%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.09	131	273.79
1974	3.30	163	537.90
1975	2.47	173	427.31
1976	2.31	162	374.22
1977	2.31	43	99.33
1978	2.18	113	246.34
1979	2.78	168	467.04

Mean Price	2.49
Price Var.	.18
Mean Rev.	346.56
Rev. Var.	22,479.04
Coeff. of Var.	43%

Label 35%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.05	131	268.55
1974	3.25	163	529.75
1975	2.45	173	423.85
1976	2.31	162	374.22
1977	2.39	43	102.77
1978	2.19	113	247.47
1979	2.77	168	465.36

Mean Price	2.49
Price Var.	.16
Mean Rev.	344.57
Rev. Var.	21,620.17
Coeff. of Var.	43%

Label 40%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.00	131	263.00
1974	3.21	163	523.23
1975	2.43	173	420.39
1976	2.31	162	374.22
1977	2.47	43	106.21
1978	2.21	113	249.73
1979	2.76	168	463.68

Mean Price	2.48
Price Var.	.16
Mean Rev.	343.78
Rev. Var.	20,889.98
Coeff. of Var.	42%

Label 45%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.96	131	256.76
1974	3.16	163	515.08
1975	2.40	173	415.20
1976	2.31	162	374.22
1977	2.55	43	109.65
1978	2.22	113	250.86
1979	2.75	168	462.00

Mean Price	2.48
Price Var.	.15
Mean Rev.	340.54
Rev. Var.	20,049.50
Coeff. of Var.	42%

Label 50%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.90	131	248.90
1974	3.10	163	505.30
1975	2.37	173	415.20
1976	2.30	162	372.60
1977	2.62	43	112.66
1978	2.23	113	251.99
1979	2.73	168	458.64

Mean Price	2.46
Price Var.	.15
Mean Rev.	337.16
Rev. Var.	19,172.60
Coeff. of Var.	41%

Label 55%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.88	131	243.66
1974	3.05	163	497.15
1975	2.35	173	406.55
1976	2.30	162	372.60
1977	2.70	43	116.10
1978	2.24	113	253.12
1979	2.72	168	456.96

Mean Price	2.46
Price Var.	.15
Mean Rev.	335.16
Rev. Var.	18,444.06
Coeff. of Var.	41%

Label 60%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.81	131	237.11
1974	3.00	163	489.00
1975	2.33	173	403.09
1976	2.30	162	372.60
1977	2.79	43	119.97
1978	2.26	113	255.38
1979	2.71	168	455.27

Mean Price	2.46
Price Var.	.16
Mean Rev.	333.20
Rev. Var.	17,728.40
Coeff. of Var.	40%

Label 65%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.77	131	231.87
1974	2.95	163	480.85
1975	2.33	173	397.90
1976	2.30	162	372.60
1977	2.87	43	123.41
1978	2.27	113	256.51
1979	2.70	168	453.60

Mean Price	2.45
Price Var.	.17
Mean Rev.	330.96
Rev. Var.	17,026.85
Coeff. of Var.	39%

Label 70%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.72	131	225.32
1974	2.90	163	472.70
1975	2.28	173	394.44
1976	2.30	162	372.60
1977	2.97	43	127.71
1978	2.29	113	258.77
1979	2.69	168	451.92

Mean Price	2.45
Price Var.	.19
Mean Rev.	329.07
Rev. Var.	16,356.97
Coeff. of Var.	39%

Label 75%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.68	131	220.08
1974	2.85	163	464.55
1975	2.26	173	390.98
1976	2.31	162	374.22
1977	3.03	43	130.29
1978	2.30	113	259.90
1979	2.68	168	450.24

Mean Price	2.44
Price Var.	.20
Mean Rev.	327.18
Rev. Var.	15,843.36
Coeff. of Var.	38%

Label 80%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.63	131	213.53
1974	2.80	163	456.40
1975	2.23	173	385.79
1976	2.31	162	374.22
1977	3.11	43	133.73
1978	2.32	113	262.16
1979	2.67	168	448.56

Mean Price	2.44
Price Var.	.23
Mean Rev.	324.91
Rev. Var.	15,268.28
Coeff. of Var.	38%

Label 85%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.59	131	208.29
1974	2.75	163	448.25
1975	2.21	173	382.33
1976	2.31	162	374.22
1977	3.19	43	137.17
1978	2.33	113	263.29
1979	2.66	168	446.88

Mean Price	2.43
Price Var.	.25
Mean Rev.	322.92
Rev. Var.	14,738.96
Coeff. of Var.	38%

Label 90%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.55	131	203.05
1974	2.70	163	440.10
1975	2.19	173	378.87
1976	2.31	162	374.22
1977	3.27	43	140.61
1978	2.35	113	265.55
1979	2.65	168	445.20

Mean Price	2.43
Price Var.	.28
Mean Rev.	321.09
Rev. Var.	14,219.86
Coeff. of Var.	37%

Label 95%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.50	131	196.50
1974	2.65	163	431.95
1975	2.17	173	375.41
1976	2.31	162	374.22
1977	3.36	43	144.48
1978	2.36	113	266.68
1979	2.64	168	443.52

Mean Price	2.43
Price Var.	.32
Mean Rev.	318.97
Rev. Var.	13,782.52
Coeff. of Var.	37%

Label 100%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.46	131	191.26
1974	2.60	163	423.80
1975	2.14	173	370.22
1976	2.31	162	374.22
1977	3.44	43	147.92
1978	2.38	113	268.94
1979	2.63	168	441.84

Mean Price	2.42
Price Var.	.36
Mean Rev.	318.97
Rev. Var.	13,301.01
Coeff. of Var.	36%

Table B-3. Strategy 3 Labels, Price Yield, Total Revenue and Corresponding Means and Variances

Label - AO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.69	131	192.57
1974	2.59	163	422.17
1975	2.13	173	368.49
1976	2.31	162	374.22
1977	3.50	43	145.34
1978	2.37	113	267.81
1979	2.64	168	443.52

Mean Price	2.43
Price Var.	.33
Mean Rev.	316.30
Rev. Var.	13,393.27
Coeff. of Var.	37%

Label - BO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.52	131	199.12
1974	2.58	163	420.54
1975	2.12	173	366.76
1976	2.32	162	375.84
1977	3.31	43	142.33
1978	2.38	113	268.94
1979	2.66	168	446.88

Mean Price	2.42
Price Var.	.30
Mean Rev.	317.20
Rev. Var.	13,373.72
Coeff. of Var.	36%

Label - CO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.55	131	203.05
1974	2.62	163	427.06
1975	2.12	173	366.76
1976	2.34	162	379.08
1977	3.20	43	137.60
1978	2.37	113	267.81
1979	2.71	168	455.28

Mean Price	2.42
Price Var.	.26
Mean Rev.	319.52
Rev. Var.	14,184.785
Coeff. of Var.	37%

Label - DO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.70	131	222.70
1974	2.70	163	440.10
1975	2.16	173	373.68
1976	2.34	162	379.08
1977	3.03	43	130.29
1978	2.33	113	263.29
1979	2.72	168	456.96

Mean Price	2.43
Price Var.	.19
Mean Rev.	323.73
Rev. Var.	14,688.325
Coeff. of Var.	37%

Label - EO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.78	131	233.18
1974	2.78	163	453.14
1975	2.19	173	378.87
1976	2.36	162	382.32
1977	2.86	43	122.98
1978	2.30	113	259.90
1979	2.73	168	458.64

Mean Price	2.43
Price Var.	.15
Mean Rev.	327.00
Rev. Var.	15,653.33
Coeff. of Var.	38%

Label - FO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.85	131	242.35
1974	2.81	163	458.03
1975	2.21	173	382.33
1976	2.37	162	383.94
1977	2.74	43	117.82
1978	2.28	113	257.64
1979	2.74	168	460.32

Mean Price	2.43
Price Var.	.12
Mean Rev.	328.92
Rev. Var.	16,158.93
Coeff. of Var.	39%

Label - GO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.91	131	250.21
1974	2.84	163	462.92
1975	2.22	173	384.06
1976	2.38	162	385.56
1977	2.63	43	113.09
1978	2.27	113	256.51
1979	2.76	168	463.68

Mean Price	2.43
Price Var.	.11
Mean Rev.	330.86
Rev. Var.	16,726.57
Coeff. of Var.	39%

Label - HO

Year	Price $/bu.	Yield bu./ac.	Rev. $/ac.
1973	1.98	131	259.38
1974	2.88	163	469.44
1975	2.23	173	385.79
1976	2.39	162	387.18
1977	2.51	43	107.93
1978	2.25	113	254.25
1979	2.78	168	467.04

Mean Price	2.43
Price Var.	.10
Mean Rev.	333.00
Rev. Var.	17,430.47
Coeff. of Var.	40%

Label - IO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.04	131	267.24
1974	2.91	163	474.33
1975	2.24	173	387.52
1976	2.40	162	388.80
1977	2.39	43	102.77
1978	2.23	113	251.99
1979	2.80	168	470.40

Mean Price	2.43
Price Var.	.10
Mean Rev.	334.72
Rev. Var.	18,135.18
Coeff. of Var.	40%

Label - JO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.62	131	212.22
1974	2.47	163	402.61
1975	2.06	173	356.38
1976	2.30	162	372.60
1977	2.87	43	123.41
1978	2.29	113	258.77
1979	2.71	168	455.28

Mean Price	2.33
Price Var.	.17
Mean Rev.	311.61
Rev. Var.	13,789.31
Coeff. of Var.	38%

Label - KO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.65	131	216.15
1974	2.48	163	404.24
1975	2.05	173	354.65
1976	2.31	162	374.22
1977	2.86	43	122.98
1978	2.31	113	261.03
1979	2.72	168	456.96

Mean Price	2.34
Price Var.	.17
Mean Rev.	312.89
Rev. Var.	13,786.69
Coeff. of Var.	38%

Label - LO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.67	131	218.77
1974	2.52	163	410.76
1975	2.06	173	356.38
1976	2.33	162	377.46
1977	2.80	43	120.40
1978	2.31	113	261.03
1979	2.77	168	465.36

Mean Price	2.37
Price Var.	.12
Mean Rev.	320.57
Rev. Var.	15,107.93
Coeff. of Var.	38%

Label - MO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.80	131	235.80
1974	2.62	163	427.06
1975	2.11	173	365.03
1976	2.33	162	377.46
1977	2.69	43	115.67
1978	2.28	113	257.64
1979	2.77	168	465.36

Mean Price	2.35
Price Var.	.16
Mean Rev.	315.74
Rev. Var.	14,571.67
Coeff. of Var.	38%

Label - NO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.87	131	244.97
1974	2.71	163	441.73
1975	2.15	173	371.95
1976	2.36	162	382.32
1977	2.57	43	110.51
1978	2.26	113	255.38
1979	2.77	168	465.36

Mean Price	2.38
Price Var.	.10
Mean Rev.	324.60
Rev. Var.	16,012.22
Coeff. of Var.	39%

Label - OO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.93	131	252.83
1974	2.77	163	451.51
1975	2.17	173	375.41
1976	2.37	162	383.94
1977	2.50	43	107.50
1978	2.25	113	254.25
1979	2.78	168	467.04

Mean Price	2.40
Price Var.	.10
Mean Rev.	327.50
Rev. Var.	16,611.98
Coeff. of Var.	39%

Label - PO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.99	131	260.69
1974	2.83	163	461.29
1975	2.20	173	380.60
1976	2.39	162	387.18
1977	2.43	43	104.49
1978	2.24	113	253.12
1979	2.79	168	468.72

Mean Price	2.41
Price Var.	.10
Mean Rev.	330.88
Rev. Var.	17,312.35
Coeff. of Var.	40%

Label - QO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.05	131	268.55
1974	2.89	163	471.07
1975	2.22	173	384.06
1976	2.40	162	388.80
1977	2.35	43	101.05
1978	2.23	113	251.99
1979	2.80	168	470.40

Mean Price	2.42
Price Var.	.10
Mean Rev.	333.70
Rev. Var.	18,029.44
Coeff. of Var.	40%

Label - RO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.11	131	276.41
1974	2.95	163	480.85
1975	2.25	173	389.25
1976	2.41	162	390.42
1977	2.28	43	98.04
1978	2.22	113	250.86
1979	2.82	168	473.76

Mean Price	2.43
Price Var.	.10
Mean Rev.	337.08
Rev. Var.	18,862.16
Coeff. of Var.	41%

Label - SO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.17	131	284.27
1974	3.01	163	490.63
1975	2.27	173	392.71
1976	2.43	162	393.66
1977	2.21	43	95.03
1978	2.21	113	249.73
1979	2.83	168	475.44

Mean Price	2.45
Price Var.	.11
Mean Rev.	340.21
Rev. Var.	19,659.27
Coeff. of Var.	41%

Label - TO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.89	131	247.59
1974	2.53	163	412.39
1975	2.02	173	349.46
1976	2.44	162	395.28
1977	2.79	43	119.97
1978	2.46	113	277.98
1979	2.81	168	427.08

Mean Price	2.42
Price Var.	.12
Mean Rev.	324.96
Rev. Var.	14,275.93
Coeff. of Var.	37%

Label - UO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.89	131	247.59
1974	2.57	163	418.91
1975	2.03	173	351.19
1976	2.45	162	396.90
1977	2.73	43	117.39
1978	2.45	113	276.85
1979	2.84	168	477.12

Mean Price	2.42
Price Var.	.12
Mean Rev.	326.56
Rev. Var.	14,868.44
Coeff. of Var.	37%

Label - VO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.99	131	260.69
1974	2.66	163	433.58
1975	2.08	173	359.84
1976	2.43	162	393.66
1977	2.63	43	113.09
1978	2.40	113	271.20
1979	2.83	168	475.44

Mean Price	2.43
Price Var.	.09
Mean Rev.	329.64
Rev. Var.	15,355.83
Coeff. of Var.	38%

Label - WO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.03	131	265.93
1974	2.75	163	448.25
1975	2.13	173	368.49
1976	2.44	162	395.28
1977	2.52	43	108.36
1978	2.36	113	266.68
1979	2.82	168	473.76

Mean Price	2.44
Price Var.	.09
Mean Rev.	332.39
Rev. Var.	16,265.26
Coeff. of Var.	38%

Label - XO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.07	131	271.17
1974	2.82	163	459.66
1975	2.17	173	375.41
1976	2.44	162	395.28
1977	2.44	43	104.92
1978	2.32	113	262.16
1979	2.83	168	475.44

Mean Price	2.44
Price Var.	.09
Mean Rev.	334.86
Rev. Var.	17,141.13
Coeff. of Var.	39%

Label - YO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.12	131	277.72
1974	2.89	163	472.07
1975	2.20	173	380.60
1976	2.44	162	395.28
1977	2.35	43	101.05
1978	2.29	113	258.77
1979	2.83	168	475.44

Mean Price	2.45
Price Var.	.09
Mean Rev.	337.13
Rev. Var.	17,957.37
Coeff. of Var.	40%

Label - ZO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.16	131	282.96
1974	2.96	163	482.48
1975	2.24	173	387.52
1976	2.44	162	395.28
1977	2.26	43	97.18
1978	2.25	113	254.25
1979	2.84	168	477.12

Mean Price	2.45
Price Var.	.10
Mean Rev.	339.54
Rev. Var.	18,997.20
Coeff. of Var.	41%

Label - A1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.21	131	289.51
1974	3.03	163	493.89
1975	2.28	173	394.44
1976	2.44	162	395.28
1977	2.17	43	93.31
1978	2.22	113	250.86
1979	2.84	168	477.12

Mean Price	2.46
Price Var.	.12
Mean Rev.	342.06
Rev. Var.	19,970.85
Coeff. of Var.	41%

Label - B1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.25	131	294.75
1974	3.10	163	505.30
1975	2.31	173	399.63
1976	2.44	162	395.28
1977	2.09	43	89.87
1978	2.18	113	246.34
1979	2.85	168	478.80

Mean Price	2.46
Price Var.	.14
Mean Rev.	344.28
Rev. Var.	21,076.27
Coeff. of Var.	42%

Label - C1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.30	131	301.30
1974	3.17	163	516.71
1975	2.35	173	406.55
1976	2.44	162	395.28
1977	2.00	43	86.00
1978	2.15	113	242.95
1979	2.85	168	478.80

Mean Price	2.47
Price Var.	.17
Mean Rev.	346.80
Rev. Var.	22,180.92
Coeff. of Var.	43%

Label - D1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.84	131	241.04
1974	2.95	163	480.85
1975	2.10	173	363.30
1976	2.48	162	401.76
1977	2.25	43	96.75
1978	2.33	113	263.29
1979	3.14	168	527.52

Mean Price	2.44
Price Var.	.21
Mean Rev.	339.22
Rev. Var.	22,367.24
Coeff. of Var.	44%

Label - E1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.95	131	255.45
1974	3.00	163	489.00
1975	2.15	173	371.95
1976	2.47	162	400.14
1977	2.20	43	94.60
1978	2.30	113	259.90
1979	3.10	168	520.00

Mean Price	2.45
Price Var.	.19
Mean Rev.	341.69
Rev. Var.	22,215.52
Coeff. of Var.	44%

Label - F1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.99	131	260.69
1974	3.04	163	495.52
1975	2.19	173	378.87
1976	2.47	162	400.14
1977	2.15	43	92.45
1978	2.27	113	256.51
1979	3.06	168	514.08

Mean Price	2.45
Price Var.	.19
Mean Rev.	342.61
Rev. Var.	22,352.01
Coeff. of Var.	44%

Label - G1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.07	131	271.17
1974	3.08	163	502.04
1975	2.23	173	385.79
1976	2.47	162	400.14
1977	2.10	43	90.30
1978	2.24	113	253.12
1979	3.01	168	505.68

Mean Price	2.46
Price Var.	.18
Mean Rev.	344.03
Rev. Var.	22,323.71
Coeff. of Var.	43%

Label - H1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.14	131	280.34
1974	3.13	163	510.19
1975	2.27	173	392.71
1976	2.46	162	398.52
1977	2.05	43	88.15
1978	2.20	113	248.60
1979	2.97	168	498.96

Mean Price	2.46
Price Var.	.18
Mean Rev.	345.35
Rev. Var.	22,596.16
Coeff. of Var.	44%

Label - I1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.22	131	290.82
1974	3.17	163	516.71
1975	2.32	173	401.36
1976	2.45	162	396.90
1977	2.00	43	86.00
1978	2.17	113	245.21
1979	2.93	168	492.24

Mean Price	2.47
Price Var.	.18
Mean Rev.	347.03
Rev. Var.	22,829.92
Coeff. of Var.	44%

Label - J1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.29	131	299.99
1974	3.22	163	524.86
1975	2.36	173	408.28
1976	2.45	162	396.90
1977	1.95	43	83.85
1978	2.14	113	241.82
1979	2.88	168	483.84

Mean Price	2.47
Price Var.	.19
Mean Rev.	348.51
Rev. Var.	23,184.91
Coeff. of Var.	44%

Label - K1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.37	131	310.47
1974	3.26	163	531.38
1975	2.40	173	415.20
1976	2.44	162	395.28
1977	1.90	43	81.70
1978	2.10	113	237.30
1979	2.84	168	477.12

Mean Price	2.47
Price Var.	.21
Mean Rev.	349.78
Rev. Var.	23,601.33
Coeff. of Var.	44%

Label - L1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.44	131	319.64
1974	3.30	163	537.90
1975	2.44	173	422.12
1976	2.44	162	395.28
1977	1.85	43	79.55
1978	2.07	113	233.91
1979	2.80	168	470.40

Mean Price	2.48
Price Var.	.22
Mean Rev.	351.26
Rev. Var.	24,097.48
Coeff. of Var.	44%

Label - M1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.51	131	328.81
1974	3.35	163	546.05
1975	2.49	173	430.77
1976	2.43	162	393.66
1977	1.80	43	77.40
1978	2.04	113	230.52
1979	2.75	168	462.00

Mean Price	2.48
Price Var.	.25
Mean Rev.	352.74
Rev. Var.	24,732.02
Coeff. of Var.	45%

Label - N1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.86	131	374.66
1974	3.43	163	559.09
1975	2.54	173	439.42
1976	2.31	162	374.22
1977	1.79	43	76.97
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.52
Price Var.	.30
Mean Rev.	358.11
Rev. Var.	25,529.20
Coeff. of Var.	45%

Label - O1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.81	131	368.11
1974	3.42	163	557.46
1975	2.54	173	439.42
1976	2.34	162	379.08
1977	1.78	43	76.54
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.52
Price Var.	.30
Mean Rev.	357.57
Rev. Var.	25,461.58
Coeff. of Var.	45%

Label - P1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.75	131	360.25
1974	3.41	163	555.83
1975	2.54	173	439.42
1976	2.36	162	382.32
1977	1.77	43	76.11
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.51
Price Var.	.29
Mean Rev.	356.62
Rev. Var.	25,400.24
Coeff. of Var.	45%

Label - Q1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.70	131	353.70
1974	3.41	163	555.83
1975	2.53	173	437.69
1976	2.38	162	385.56
1977	1.76	43	75.68
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.50
Price Var.	.29
Mean Rev.	355.84
Rev. Var.	25,421.25
Coeff. of Var.	45%

Label - R1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.64	131	345.84
1974	3.40	163	554.20
1975	2.53	173	437.69
1976	2.40	162	388.80
1977	1.76	43	75.68
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.49
Price Var.	.28
Mean Rev.	354.95
Rev. Var.	25,361.85
Coeff. of Var.	45%

Label - S1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.59	131	339.29
1974	3.39	163	552.57
1975	2.53	173	437.69
1976	2.43	162	393.66
1977	1.75	43	75.25
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.49
Price Var.	.28
Mean Rev.	354.41
Rev. Var.	25,379.56
Coeff. of Var.	45%

Label - T1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.53	131	331.43
1974	3.38	163	550.94
1975	2.52	173	435.96
1976	2.45	162	396.90
1977	1.74	43	74.82
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.48
Price Var.	.27
Mean Rev.	353.05
Rev. Var.	25,404.90
Coeff. of Var.	45%

Label - U1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.48	131	324.88
1974	3.38	163	550.94
1975	2.52	173	435.96
1976	2.47	162	400.14
1977	1.73	43	74.39
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.47
Price Var.	.28
Mean Rev.	352.51
Rev. Var.	25,547.93
Coeff. of Var.	45%

Label - V1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.42	131	317.02
1974	3.37	163	549.31
1975	2.52	173	435.96
1976	2.49	162	403.38
1977	1.72	43	73.96
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.46
Price Var.	.28
Mean Rev.	351.56
Rev. Var.	25,615.28
Coeff. of Var.	46%

Label - W1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.37	131	310.47
1974	3.36	163	547.68
1975	2.52	173	435.96
1976	2.52	162	408.24
1977	1.71	43	73.53
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.46
Price Var.	.28
Mean Rev.	351.02
Rev. Var.	25,718.21
Coeff. of Var.	46%

Label - X1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.31	131	302.61
1974	3.36	163	547.68
1975	2.51	173	434.23
1976	2.54	162	411.48
1977	1.71	43	73.53
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.45
Price Var.	.28
Mean Rev.	350.12
Rev. Var.	25,848.85
Coeff. of Var.	46%

Label - Y1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.32	131	303.92
1974	3.38	163	550.94
1975	2.52	173	435.96
1976	2.51	162	406.67
1977	1.71	43	73.53
1978	2.01	113	227.13
1979	2.72	168	456.96

Mean Price	2.45
Price Var.	.28
Mean Rev.	350.72
Rev. Var.	26,010.78
Coeff. of Var.	46%

Label - Z1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.32	131	303.92
1974	3.40	163	554.20
1975	2.53	173	437.69
1976	2.49	162	403.38
1977	1.72	43	73.96
1978	2.02	113	228.26
1979	2.74	168	460.32

Mean Price	2.46
Price Var.	.29
Mean Rev.	351.68
Rev. Var.	26,254.92
Coeff. of Var.	46%

Label - A2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.33	131	305.23
1974	3.43	163	559.09
1975	2.54	173	439.42
1976	2.46	162	398.52
1977	1.74	43	74.82
1978	2.02	113	228.26
1979	2.75	168	462.00

Mean Price	2.47
Price Var.	.29
Mean Rev.	352.48
Rev. Var.	26,519.80
Coeff. of Var.	46%

Label - B2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.33	131	305.23
1974	3.45	163	562.35
1975	2.55	173	441.15
1976	2.44	162	395.28
1977	1.75	43	75.25
1978	2.03	113	229.39
1979	2.76	168	463.68

Mean Price	2.47
Price Var.	.30
Mean Rev.	353.19
Rev. Var.	26,723.62
Coeff. of Var.	46%

Label - C2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.33	131	305.23
1974	3.47	163	565.61
1975	2.56	173	442.88
1976	2.41	162	390.42
1977	1.76	43	75.68
1978	2.04	113	230.52
1979	2.77	168	463.56

Mean Price	2.48
Price Var.	.30
Mean Rev.	353.67
Rev. Var.	26,915.50
Coeff. of Var.	46%

Label - D2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.35	131	307.85
1974	3.51	163	572.13
1975	2.58	173	446.34
1976	2.40	162	388.80
1977	1.78	43	76.54
1978	2.06	113	232.78
1979	2.79	168	468.72

Mean Price	2.50
Price Var.	.31
Mean Rev.	356.17
Rev. Var.	27,375.74
Coeff. of Var.	46%

Label - E2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.35	131	307.85
1974	3.53	163	575.39
1975	2.58	173	446.34
1976	2.37	162	383.94
1977	1.79	43	76.97
1978	2.07	113	233.91
1979	2.80	168	470.40

Mean Price	2.50
Price Var.	.31
Mean Rev.	356.40
Rev. Var.	27,540.38
Coeff. of Var.	47%

Label - F2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.35	131	307.85
1974	3.55	163	578.65
1975	2.59	173	448.07
1976	2.35	162	380.70
1977	1.80	43	77.40
1978	2.07	113	233.91
1979	2.82	168	473.76

Mean Price	2.50
Price Var.	.32
Mean Rev.	357.19
Rev. Var.	27,893.30
Coeff. of Var.	47%

Label - G2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.36	131	309.16
1974	3.58	163	583.54
1975	2.60	173	449.80
1976	2.32	162	375.84
1977	1.81	43	77.83
1978	2.08	113	235.04
1979	2.83	168	475.44

Mean Price	2.51
Price Var.	.33
Mean Rev.	358.09
Rev. Var.	28,234.27
Coeff. of Var.	47%

Label - H2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.36	131	309.16
1974	3.60	163	586.80
1975	2.61	173	451.53
1976	2.30	162	372.60
1977	1.82	43	78.26
1978	2.09	113	236.17
1979	2.84	168	477.12

Mean Price	2.52
Price Var.	.34
Mean Rev.	358.81
Rev. Var.	28,496.31
Coeff. of Var.	47.05%

Label - J2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.25	131	294.75
1974	3.39	163	552.57
1975	2.50	173	432.50
1976	2.33	162	377.46
1977	2.02	43	86.86
1978	2.14	113	241.82
1979	2.83	168	475.44

Mean Price	2.49
Price Var.	.23
Mean Rev.	351.63
Rev. Var.	24,718.28
Coeff. of Var.	45%

Label - K2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.14	131	280.34
1974	3.17	163	516.71
1975	2.38	173	411.74
1976	2.35	162	380.70
1977	2.21	43	95.03
1978	2.18	113	246.34
1979	2.80	168	470.40

Mean Price	2.46
Price Var.	.15
Mean Rev.	343.04
Rev. Var.	21,218.49
Coeff. of Var.	42%

Table B-4. Strategy 1 Labels, Price Yield, Total Revenue and Corresponding Means and Variances

Label - AO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.47	131	192.57
1974	2.59	163	422.17
1975	2.13	173	368.49
1976	2.31	162	374.22
1977	3.38	43	145.34
1978	2.37	113	267.81
1979	2.64	168	443.52

Mean Price	2.41
Price Var.	.33
Mean Rev.	316.30
Rev. Var.	13,393.27
Coeff. of Var.	37%

Label - BO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.52	131	199.12
1974	2.58	163	420.54
1975	2.12	173	366.76
1976	2.32	162	375.84
1977	3.31	43	142.33
1978	2.38	113	268.94
1979	2.66	168	446.88

Mean Price	2.41
Price Var.	.30
Mean Rev.	317.20
Rev. Var.	13,373.72
Coeff. of Var.	36%

Label - CO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.55	131	203.05
1974	2.62	163	427.06
1975	2.12	173	366.76
1976	2.34	162	379.08
1977	3.15	43	135.45
1978	2.37	113	267.81
1979	2.71	168	455.28

Mean Price	2.42
Price Var.	.25
Mean Rev.	319.21
Rev. Var.	14,315.82
Coeff. of Var.	37%

Label - DO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.70	131	222.70
1974	2.70	163	440.10
1975	2.16	173	373.68
1976	2.34	162	379.08
1977	2.99	43	128.57
1978	2.33	113	263.29
1979	2.72	168	456.96

Mean Price	2.42
Price Var.	.18
Mean Rev.	323.48
Rev. Var.	14,799.65
Coeff. of Var.	38%

Label - EO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.78	131	233.18
1974	2.78	163	453.14
1975	2.19	173	378.87
1976	2.36	162	382.32
1977	2.83	43	121.69
1978	2.30	113	259.90
1979	2.28	168	383.04

Mean Price	2.36
Price Var.	.13
Mean Rev.	316.02
Rev. Var.	13,235.91
Coeff. of Var.	36%

Label - FO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.85	131	242.35
1974	2.81	163	458.03
1975	2.21	173	382.33
1976	2.37	162	383.94
1977	2.70	43	116.10
1978	2.28	113	257.64
1979	2.74	168	460.32

Mean Price	2.42
Price Var.	.12
Mean Rev.	328.67
Rev. Var.	16,280.38
Coeff. of Var.	39%

Label - GO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.91	131	250.21
1974	2.84	163	462.92
1975	2.22	173	384.06
1976	2.38	162	385.56
1977	2.58	43	110.94
1978	2.27	113	256.51
1979	2.76	168	463.68

Mean Price	2.42
Price Var.	.11
Mean Rev.	330.55
Rev. Var.	16,883.30
Coeff. of Var.	39%

Label - HO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.98	131	259.38
1974	2.88	163	469.44
1975	2.23	173	385.79
1976	2.39	162	387.18
1977	2.46	43	105.78
1978	2.25	113	254.25
1979	2.78	168	467.04

Mean Price	2.42
Price Var.	.10
Mean Rev.	332.69
Rev. Var.	17,592.43
Coeff. of Var.	40%

Label - IO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.04	131	267.24
1974	2.91	163	474.33
1975	2.24	173	387.52
1976	2.40	162	388.80
1977	2.34	43	100.62
1978	2.23	113	251.99
1979	2.80	168	470.40

Mean Price	2.42
Price Var.	.10
Mean Rev.	334.41
Rev. Var.	18,302.08
Coeff. of Var.	40%

Label - JO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.62	131	212.22
1974	2.47	163	401.61
1975	2.06	173	356.38
1976	2.30	162	372.60
1977	2.87	43	123.41
1978	2.29	113	258.77
1979	2.71	168	455.28

Mean Price	2.33
Price Var.	.17
Mean Rev.	311.61
Rev. Var.	13,789.31
Coeff. of Var.	38%

Label - KO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.65	131	216.15
1974	2.48	163	404.24
1975	2.05	173	354.65
1976	2.31	162	374.22
1977	2.86	43	122.98
1978	2.31	113	261.03
1979	2.72	168	456.96

Mean Price	2.34
Price Var.	.17
Mean Rev.	312.89
Rev. Var.	13,786.69
Coeff. of Var.	38%

Label - LO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.67	131	218.77
1974	2.52	163	410.76
1975	2.06	173	356.38
1976	2.33	162	377.46
1977	2.76	43	118.68
1978	2.31	113	261.03
1979	2.77	168	465.36

Mean Price	2.35
Price Var.	.15
Mean Rev.	315.49
Rev. Var.	14,684.08
Coeff. of Var.	38%

Label - MO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.80	131	235.80
1974	2.62	163	427.06
1975	2.11	173	365.03
1976	2.33	162	377.46
1977	2.65	43	113.95
1978	2.28	113	257.64
1979	2.77	168	465.36

Mean Price	2.37
Price Var.	.12
Mean Rev.	320.33
Rev. Var.	15,225.83
Coeff. of Var.	39%

Label - NO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.87	131	244.97
1974	2.71	163	441.73
1975	2.15	173	371.95
1976	2.36	162	382.32
1977	2.54	43	109.22
1978	2.26	113	255.38
1979	2.77	168	465.36

Mean Price	2.38
Price Var.	.10
Mean Rev.	324.42
Rev. Var.	16,104.52
Coeff. of Var.	39%

Label - OO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.93	131	252.83
1974	2.77	163	451.51
1975	2.17	173	375.41
1976	2.37	162	383.94
1977	2.46	43	105.78
1978	2.25	113	254.25
1979	2.78	168	467.04

Mean Price	2.39
Price Var.	.10
Mean Rev.	327.25
Rev. Var.	16,738.54
Coeff. of Var.	40%

Label - PO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.99	131	260.69
1974	2.83	163	461.29
1975	2.20	173	380.60
1976	2.39	162	387.18
1977	2.38	43	102.34
1978	2.24	113	253.12
1979	2.79	168	468.72

Mean Price	2.40
Price Var.	.10
Mean Rev.	330.56
Rev. Var.	17,475.25
Coeff. of Var.	40%

Label - QO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.05	131	268.55
1974	2.89	163	471.07
1975	2.22	173	384.06
1976	2.40	162	388.80
1977	2.30	43	98.90
1978	2.23	113	251.99
1979	2.80	168	470.40

Mean Price	2.41
Price Var.	.10
Mean Rev.	333.40
Rev. Var.	18,196.83
Coeff. of Var.	40%

Label - RO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.11	131	276.41
1974	2.95	163	480.85
1975	2.25	173	389.25
1976	2.41	162	390.42
1977	2.22	43	95.46
1978	2.22	113	250.86
1979	2.82	168	473.76

Mean Price	2.43
Price Var.	.11
Mean Rev.	336.72
Rev. Var.	19,068.69
Coeff. of Var.	41%

Label - SO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.17	131	284.27
1974	3.01	163	490.63
1975	2.27	173	392.71
1976	2.43	162	393.66
1977	2.14	43	92.02
1978	2.21	113	249.73
1979	2.83	168	475.44

Mean Price	2.44
Price Var.	.12
Mean Rev.	339.78
Rev. Var.	19,906.56
Coeff. of Var.	42%

Label - TO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.89	131	247.59
1974	2.53	163	412.39
1975	2.02	173	349.46
1976	2.44	162	395.28
1977	2.79	43	119.97
1978	2.46	113	277.98
1979	2.81	168	472.08

Mean Price	2.44
Price Var.	.12
Mean Rev.	324.96
Rev. Var.	14,174.60
Coeff. of Var.	37%

Label - UO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.89	131	247.59
1974	2.57	163	418.91
1975	2.03	173	351.19
1976	2.45	162	396.90
1977	2.69	43	115.67
1978	2.45	113	276.85
1979	2.84	168	477.12

Mean Price	2.42
Price Var.	.12
Mean Rev.	326.32
Rev. Var.	14,988.79
Coeff. of Var.	37.52%

Label - VO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.99	131	260.69
1974	2.66	163	433.58
1975	2.08	173	359.84
1976	2.43	162	393.66
1977	2.59	43	111.37
1978	2.40	113	271.20
1979	2.83	168	475.44

Mean Price	2.43
Price Var.	.09
Mean Rev.	329.40
Rev. Var.	15,480.41
Coeff. of Var.	38%

Label - WO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.03	131	265.93
1974	2.75	163	448.25
1975	2.13	173	368.49
1976	2.44	162	395.28
1977	2.49	43	107.07
1978	2.36	113	266.68
1979	2.82	168	473.76

Mean Price	2.43
Price Var.	.09
Mean Rev.	332.31
Rev. Var.	16,361.83
Coeff. of Var.	39%

Label - XO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.07	131	271.17
1974	2.82	163	459.66
1975	2.17	173	375.41
1976	2.44	162	395.28
1977	2.40	43	103.20
1978	2.32	113	262.16
1979	2.83	168	475.44

Mean Price	2.44
Price Var.	.09
Mean Rev.	334.62
Rev. Var.	17,273.38
Coeff. of Var.	39%

Label - YO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.12	131	277.72
1974	2.89	163	471.07
1975	2.20	173	380.60
1976	2.44	162	395.28
1977	2.30	43	98.90
1978	2.29	113	258.77
1979	2.83	168	475.44

Mean Price	2.44
Price Var.	.09
Mean Rev.	336.83
Rev. Var.	18,127.23
Coeff. of Var.	40%

Label - ZO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.16	131	282.96
1974	2.96	163	482.48
1975	2.24	173	387.52
1976	2.44	162	395.28
1977	2.20	43	94.60
1978	2.25	113	254.25
1979	2.84	168	477.12

Mean Price	2.44
Price Var.	.11
Mean Rev.	339.17
Rev. Var.	19,206.58
Coeff. of Var.	41%

Label - A1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.21	131	289.51
1974	3.03	163	493.89
1975	2.28	173	394.44
1976	2.44	162	395.28
1977	2.10	43	90.30
1978	2.22	113	250.86
1979	2.84	168	477.12

Mean Price	2.45
Price Var.	.13
Mean Rev.	341.63
Rev. Var.	20,221.72
Coeff. of Var.	41%

Label - B1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.25	131	294.75
1974	3.10	163	505.30
1975	2.31	173	399.63
1976	2.44	162	395.28
1977	2.01	43	86.43
1978	2.18	113	246.34
1979	2.85	168	478.80

Mean Price	2.45
Price Var.	.18
Mean Rev.	343.79
Rev. Var.	21,369.68
Coeff. of Var.	42%

Label - YO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.12	131	277.72
1974	2.89	163	471.07
1975	2.20	173	380.60
1976	2.44	162	395.28
1977	2.30	43	98.90
1978	2.29	113	258.77
1979	2.83	168	475.44

Mean Price	2.44
Price Var.	.09
Mean Rev.	336.83
Rev. Var.	18,127.23
Coeff. of Var.	40%

Label - ZO

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.16	131	282.96
1974	2.96	163	482.48
1975	2.24	173	387.52
1976	2.44	162	395.28
1977	2.20	43	94.60
1978	2.25	113	254.25
1979	2.84	168	477.12

Mean Price	2.44
Price Var.	.11
Mean Rev.	339.17
Rev. Var.	19,206.58
Coeff. of Var.	41%

Label - A1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.21	131	289.51
1974	3.03	163	493.89
1975	2.28	173	394.44
1976	2.44	162	395.28
1977	2.10	43	90.30
1978	2.22	113	250.86
1979	2.84	168	477.12

Mean Price	2.45
Price Var.	.13
Mean Rev.	341.63
Rev. Var.	20,221.72
Coeff. of Var.	41%

Label - B1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.25	131	294.75
1974	3.10	163	505.30
1975	2.31	173	399.63
1976	2.44	162	395.28
1977	2.01	43	86.43
1978	2.18	113	246.34
1979	2.85	168	478.80

Mean Price	2.45
Price Var.	.18
Mean Rev.	343.79
Rev. Var.	21,369.68
Coeff. of Var.	42%

Label - C1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.30	131	301.30
1974	3.17	163	516.71
1975	2.35	173	406.55
1976	2.44	162	395.28
1977	1.91	43	83.03
1978	2.15	113	242.95
1979	2.85	168	478.80

Mean Price	2.45
Price Var.	.18
Mean Rev.	346.25
Rev. Var.	22,519.49
Coeff. of Var.	43%

Label - D1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.84	131	241.04
1974	2.95	163	480.85
1975	2.10	173	363.30
1976	2.48	162	401.76
1977	1.81	43	77.83
1978	2.33	113	263.29
1979	3.14	168	527.52

Mean Price	2.38
Price Var.	.27
Mean Rev.	336.51
Rev. Var.	23,947.53
Coeff. of Var.	46%

Label - E1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.95	131	255.45
1974	3.00	163	489.00
1975	2.15	173	371.95
1976	2.47	162	400.14
1977	1.81	43	77.83
1978	2.30	113	259.90
1979	3.10	168	520.80

Mean Price	2.40
Price Var.	.25
Mean Rev.	339.30
Rev. Var.	23,636.94
Coeff. of Var.	45%

Label - F1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	1.99	131	260.69
1974	3.04	163	495.52
1975	2.19	173	378.87
1976	2.47	162	400.14
1977	1.81	43	77.83
1978	2.27	113	256.51
1979	3.06	168	514.01

Mean Price	2.40
Price Var.	.24
Mean Rev.	340.52
Rev. Var.	23,601.65
Coeff. of Var.	45%

Label - G1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.07	131	271.17
1974	3.08	163	502.04
1975	2.23	173	385.79
1976	2.47	162	400.14
1977	1.81	43	77.83
1978	2.24	113	253.12
1979	3.01	168	505.68

Mean Price	2.42
Price Var.	.22
Mean Rev.	342.25
Rev. Var.	23,400.61
Coeff. of Var.	45%

Label - H1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.14	131	280.34
1974	3.13	163	510.19
1975	2.27	173	392.71
1976	2.46	162	398.52
1977	1.81	43	77.83
1978	2.20	113	248.60
1979	2.97	168	498.96

Mean Price	2.43
Price Var.	.22
Mean Rev.	343.88
Rev. Var.	23,496.16
Coeff. of Var.	45%

Label - I1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.22	131	290.82
1974	3.17	163	516.71
1975	2.32	173	401.36
1976	2.45	162	396.90
1977	1.81	43	77.83
1978	2.17	113	245.21
1979	2.93	168	492.24

Mean Price	2.44
Price Var.	.22
Mean Rev.	345.87
Rev. Var.	23,550.34
Coeff. of Var.	44%

Label - J1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.29	131	299.99
1974	3.22	163	524.86
1975	2.36	173	408.28
1976	2.45	162	396.90
1977	1.81	43	77.83
1978	2.14	113	241.82
1979	2.88	168	483.84

Mean Price	2.45
Price Var.	.22
Mean Rev.	347.65
Rev. Var.	23,721.16
Coeff. of Var.	44.30%

Label - K1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.37	131	310.47
1974	3.26	163	531.38
1975	2.40	173	415.20
1976	2.44	162	395.28
1977	1.81	43	77.83
1978	2.10	113	237.30
1979	2.84	168	477.12

Mean Price	2.46
Price Var.	.22
Mean Rev.	349.23
Rev. Var.	23,949.29
Coeff. of Var.	44%

Label - L1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.44	131	319.64
1974	3.30	163	537.90
1975	2.44	173	422.12
1976	2.44	162	395.28
1977	1.81	43	77.83
1978	2.07	113	233.91
1979	2.80	168	470.40

Mean Price	2.47
Price Var.	.23
Mean Rev.	351.01
Rev. Var.	24,253.68
Coeff. of Var.	44%

Label - M1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.51	131	328.21
1974	3.35	163	546.05
1975	2.49	173	430.77
1976	2.43	162	393.66
1977	1.81	43	77.83
1978	2.04	113	230.52
1979	2.75	168	462.00

Mean Price	2.48
Price Var.	.25
Mean Rev.	352.81
Rev. Var.	24,692.58
Coeff. of Var.	45%

Label - N1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.86	131	374.66
1974	3.43	163	559.09
1975	2.54	173	439.42
1976	2.31	162	374.22
1977	1.81	43	77.83
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.52
Price Var.	.30
Mean Rev.	358.23
Rev. Var.	24,448.71
Coeff. of Var.	45%

Label - O1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.81	131	368.11
1974	3.42	163	557.46
1975	2.54	173	439.42
1976	2.34	162	377.08
1977	1.81	43	77.83
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.52
Price Var.	.29
Mean Rev.	357.76
Rev. Var.	25,340.88
Coeff. of Var.	45%

Label - P1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.75	131	360.25
1974	3.41	163	555.83
1975	2.54	173	439.42
1976	2.36	162	382.32
1977	1.81	43	77.83
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.51
Price Var.	.28
Mean Rev.	356.87
Rev. Var.	25,239.84
Coeff. of Var.	45%

Label - Q1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.70	131	353.70
1974	3.41	163	555.83
1975	2.53	173	437.69
1976	2.38	162	385.56
1977	1.81	43	77.83
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.51
Price Var.	.27
Mean Rev.	356.15
Rev. Var.	25,221.23
Coeff. of Var.	45%

Label - R1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.64	131	345.84
1974	3.40	163	554.20
1975	2.53	173	437.69
1976	2.40	162	388.80
1977	1.81	43	77.83
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.50
Price Var.	.27
Mean Rev.	355.25
Rev. Var.	25,162.37
Coeff. of Var.	45%

Label - S1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.59	131	339.29
1974	3.39	163	552.57
1975	2.53	173	437.69
1976	2.43	162	393.66
1977	1.81	43	77.83
1978	2.01	113	227.13
1979	2.71	168	455.28

Mean Price	2.50
Price Var.	.26
Mean Rev.	354.78
Rev. Var.	25,140.44
Coeff. of Var.	45%

Label - T1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.53	131	331.43
1974	3.38	163	550.94
1975	2.53	173	435.96
1976	2.45	162	396.90
1977	1.81	43	77.83
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.49
Price Var.	.26
Mean Rev.	353.48
Rev. Var.	25,127.04
Coeff. of Var.	45%

Label - U1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.48	131	324.88
1974	3.38	163	550.94
1975	2.52	173	435.96
1976	2.47	162	400.14
1977	1.81	43	77.83
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.48
Price Var.	.26
Mean Rev.	353.00
Rev. Var.	25,230.71
Coeff. of Var.	45%

Label - V1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.42	131	324.88
1974	3.37	163	550.94
1975	2.52	173	435.96
1976	2.49	162	400.14
1977	1.81	43	77.83
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.48
Price Var.	.26
Mean Rev.	353.00
Rev. Var.	25,230.71
Coeff. of Var.	45%

Label - W1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.38	131	311.78
1974	3.36	163	547.68
1975	2.52	173	435.96
1976	2.52	162	408.24
1977	1.81	43	77.83
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.47
Price Var.	.25
Mean Rev.	351.82
Rev. Var.	25,305.38
Coeff. of Var.	45.21%

Label - X1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.31	131	302.61
1974	3.36	163	547.68
1975	2.51	173	434.23
1976	2.54	162	411.48
1977	1.81	43	77.83
1978	2.00	113	226.00
1979	2.71	168	455.28

Mean Price	2.46
Price Var.	.26
Mean Rev.	350.73
Rev. Var.	25,455.06
Coeff. of Var.	45%

Label - Y1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.32	131	303.92
1974	3.38	163	550.94
1975	2.52	173	435.96
1976	2.51	162	406.62
1977	1.81	43	77.83
1978	2.01	113	227.13
1979	2.72	168	456.96

Mean Price	2.47
Price Var.	.26
Mean Rev.	351.34
Rev. Var.	25,616.11
Coeff. of Var.	46%

Label - Z1

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.32	131	303.92
1974	3.40	163	554.20
1975	2.53	173	437.69
1976	2.49	162	403.38
1977	1.81	43	77.83
1978	2.02	113	228.26
1979	2.74	168	460.32

Mean Price	2.47
Price Var.	.27
Mean Rev.	352.23
Rev. Var.	25,898.81
Coeff. of Var.	46%

Label - A2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.33	131	305.23
1974	3.43	163	559.09
1975	2.54	173	439.42
1976	2.46	162	398.52
1977	1.81	43	77.83
1978	2.02	113	228.26
1979	2.75	168	462.00

Mean Price	2.48
Price Var.	.28
Mean Rev.	352.91
Rev. Var.	26,242.51
Coeff. of Var.	46%

Label - B2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.33	131	305.23
1974	3.45	163	562.35
1975	2.55	173	441.15
1976	2.44	162	395.28
1977	1.81	43	77.83
1978	2.03	113	229.39
1979	2.76	168	463.68

Mean Price	2.48
Price Var.	.28
Mean Rev.	353.56
Rev. Var.	26,485.54
Coeff. of Var.	46%

Label - C2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.33	131	305.23
1974	3.47	163	565.61
1975	2.56	173	442.88
1976	2.41	162	390.42
1977	1.81	43	77.83
1978	2.04	113	230.52
1979	2.77	168	465.36

Mean Price	2.48
Price Var.	.29
Mean Rev.	353.98
Rev. Var.	26,716.93
Coeff. of Var.	46%

Label - D2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.35	131	307.85
1974	3.51	163	572.13
1975	2.58	173	446.34
1976	2.40	162	388.80
1977	1.82	43	78.26
1978	2.06	113	232.78
1979	2.80	168	470.40

Mean Price	2.50
Price Var.	.30
Mean Rev.	356.65
Rev. Var.	27,279.14
Coeff. of Var.	46%

Label - E2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.35	131	307.85
1974	3.53	163	575.39
1975	2.58	173	446.34
1976	2.37	162	383.94
1977	1.82	43	78.26
1978	2.07	113	233.91
1979	2.80	168	470.40

Mean Price	2.50
Price Var.	.31
Mean Rev.	356.58
Rev. Var.	27,420.47
Coeff. of Var.	46%

Label - F2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.35	131	307.85
1974	3.55	163	578.65
1975	2.59	173	448.07
1976	2.35	162	380.70
1977	1.82	43	78.26
1978	2.08	113	235.04
1979	2.82	168	473.76

Mean Price	2.51
Price Var.	.32
Mean Rev.	357.48
Rev. Var.	27,766.90
Coeff. of Var.	47%

Label - G2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.36	131	309.16
1974	3.58	163	583.54
1975	2.60	173	449.80
1976	2.32	162	375.84
1977	1.82	43	78.26
1978	2.08	113	235.04
1979	2.83	168	475.44

Mean Price	2.51
Price Var.	.33
Mean Rev.	358.15
Rev. Var.	28,194.13
Coeff. of Var.	47%

Label - H2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.36	131	309.16
1974	3.60	163	586.80
1975	2.61	173	451.53
1976	2.30	162	372.60
1977	1.82	43	78.26
1978	2.09	113	236.17
1979	2.84	168	477.12

Mean Price	2.52
Price Var.	.34
Mean Rev.	358.81
Rev. Var.	28,496.31
Coeff. of Var.	47%

Label - J2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.25	131	294.75
1974	3.39	163	552.57
1975	2.50	173	432.50
1976	2.33	162	377.46
1977	2.00	43	86.00
1978	2.14	113	241.82
1979	2.83	168	475.44

Mean Price	2.49
Price Var.	.33
Mean Rev.	351.51
Rev. Var.	24,794.28
Coeff. of Var.	45%

Label - K2

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.14	131	280.34
1974	3.17	163	516.71
1975	2.38	173	411.71
1976	2.35	162	380.70
1977	2.18	43	93.74
1978	2.18	113	246.34
1979	2.80	168	470.40

Mean Price	2.46
Price Var.	.15
Mean Rev.	342.85
Rev. Var.	21,325.37
Coeff. of Var.	43%

Table B-5. Strategy 5 Labels, Price Yield, Total Revenue and Corresponding Means and Variances

Label - 0%

Year	Price $/bu.	Yield bu./ac.	Rev. $/ac.
1973	2.36	131	309.16
1974	3.60	163	586.80
1975	2.61	173	451.53
1976	2.30	162	372.60
1977	1.82	43	78.26
1978	2.09	113	236.17
1979	2.84	168	477.12

Mean Price	2.52
Price Var.	.34
Mean Rev.	358.81
Rev. Var.	28,496.31
Coeff. of Var.	47%

Label - 5%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.38	131	311.78
1974	3.58	163	583.54
1975	2.59	173	448.07
1976	2.30	162	372.60
1977	1.88	43	80.84
1978	2.10	113	237.30
1979	2.84	168	477.12

Mean Price	2.52
Price Var.	.31
Mean Rev.	358.75
Rev. Var.	27,817.07
Coeff. of Var.	46%

Label - 10%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.39	131	313.09
1974	3.56	163	580.28
1975	2.56	173	442.88
1976	2.28	162	369.36
1977	1.93	43	82.99
1978	2.10	113	237.30
1979	2.83	168	475.44

Mean Price	2.52
Price Var.	.30
Mean Rev.	357.33
Rev. Var.	27,124.50
Coeff. of Var.	46%

Label - 15%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.40	131	314.40
1974	3.54	163	577.02
1975	2.53	173	437.69
1976	2.28	162	369.36
1977	1.98	43	85.14
1978	2.11	113	238.43
1979	2.82	168	473.76

Mean Price	2.52
Price Var.	.28
Mean Rev.	356.54
Rev. Var.	26,414.22
Coeff. of Var.	46%

Label - 20%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.41	131	315.71
1974	3.53	163	575.39
1975	2.51	173	434.23
1976	2.28	162	369.36
1977	2.04	43	87.72
1978	2.13	113	240.69
1979	2.82	168	473.76

Mean Price	2.53
Price Var.	.26
Mean Rev.	356.69
Rev. Var.	25,864.71
Coeff. of Var.	45%

Label - 25%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.43	131	318.33
1974	3.50	163	570.50
1975	2.48	173	429.04
1976	2.26	162	366.12
1977	2.09	43	89.87
1978	2.13	113	240.69
1979	2.81	168	472.08

Mean Price	2.53
Price Var.	.24
Mean Rev.	355.23
Rev. Var.	25,076.43
Coeff. of Var.	45%

Label - 30%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.44	131	319.64
1974	3.49	163	568.87
1975	2.46	173	425.58
1976	2.26	162	366.12
1977	2.15	43	92.45
1978	2.14	113	241.82
1979	2.81	168	472.08

Mean Price	2.54
Price Var.	.23
Mean Rev.	355.22
Rev. Var.	24,590.92
Coeff. of Var.	44%

Label - 35%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.46	131	322.26
1974	3.47	163	565.61
1975	2.43	173	420.39
1976	2.26	162	366.12
1977	2.20	43	94.60
1978	2.15	113	242.95
1979	2.81	168	472.08

Mean Price	2.54
Price Var.	.22
Mean Rev.	354.86
Rev. Var.	23,983.16
Coeff. of Var.	44%

Label - 40%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.46	131	322.26
1974	3.44	163	560.72
1975	2.41	173	416.93
1976	2.25	162	364.50
1977	2.26	43	97.18
1978	2.15	113	242.95
1979	2.80	168	470.40

Mean Price	2.54
Price Var.	.20
Mean Rev.	353.56
Rev. Var.	23,274.54
Coeff. of Var.	43%

Label - 45%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.48	131	324.88
1974	3.43	163	559.09
1975	2.38	173	411.74
1976	2.24	162	362.88
1977	2.31	43	99.33
1978	2.16	113	244.08
1979	2.79	168	468.72

Mean Price	2.54
Price Var.	.20
Mean Rev.	352.96
Rev. Var.	22,735.83
Coeff. of Var.	43%

Label - 50%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.49	131	326.19
1974	3.40	163	554.20
1975	2.36	173	408.28
1976	2.23	162	361.26
1977	2.37	43	101.91
1978	2.17	113	245.21
1979	2.78	168	467.04

Mean Price	2.54
Price Var.	.18
Mean Rev.	352.01
Rev. Var.	21,997.92
Coeff. of Var.	42%

Label - 55%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.51	131	328.81
1974	3.39	163	552.57
1975	2.33	173	403.09
1976	2.23	162	361.26
1977	2.43	43	104.49
1978	2.18	113	246.34
1979	2.78	168	467.04

Mean Price	2.55
Price Var.	.18
Mean Rev.	351.94
Rev. Var.	21,520.24
Coeff. of Var.	42%

Label - 60%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.52	131	330.12
1974	3.37	163	549.31
1975	2.30	173	397.90
1976	2.22	162	359.64
1977	2.47	43	106.21
1978	2.10	113	247.47
1979	2.78	168	467.04

Mean Price	2.55
Price Var.	.17
Mean Rev.	351.10
Rev. Var.	21,023.82
Coeff. of Var.	41%

Label - 65%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.53	131	331.43
1974	3.35	163	546.05
1975	2.28	173	394.44
1976	2.21	162	358.02
1977	2.53	43	108.79
1978	2.19	113	247.47
1979	2.77	168	465.36

Mean Price	2.55
Price Var.	.17
Mean Rev.	350.22
Rev. Var.	20,470.32
Coeff. of Var.	41%

Label - 70%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.54	131	332.74
1974	3.33	163	542.79
1975	2.26	173	390.98
1976	2.21	162	358.02
1977	2.59	43	111.37
1978	2.20	113	248.60
1979	2.77	168	465.36

Mean Price	2.56
Price Var.	.16
Mean Rev.	349.98
Rev. Var.	19,957.29
Coeff. of Var.	40%

Label - 75%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.56	131	335.36
1974	3.31	163	539.53
1975	2.23	173	385.79
1976	2.20	162	356.40
1977	2.64	43	113.52
1978	2.21	113	249.73
1979	2.77	168	465.36

Mean Price	2.56
Price Var.	.16
Mean Rev.	349.38
Rev. Var.	19,456.66
Coeff. of Var.	40%

Label - 80%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.57	131	336.67
1974	3.29	163	536.27
1975	2.20	173	380.60
1976	2.19	162	354.78
1977	2.69	43	115.67
1978	2.21	113	249.73
1979	2.75	168	462.00

Mean Price	2.56
Price Var.	.16
Mean Rev.	347.96
Rev. Var.	18,885.48
Coeff. of Var.	39%

Label - 85%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.59	131	339.29
1974	3.26	163	531.38
1975	2.28	173	377.14
1976	2.19	162	354.78
1977	2.75	43	118.25
1978	2.23	113	251.99
1979	2.75	168	462.00

Mean Price	2.56
Price Var.	.16
Mean Rev.	347.83
Rev. Var.	18,266.33
Coeff. of Var.	39%

Label - 90%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.60	131	340.60
1974	3.26	163	531.38
1975	2.16	173	373.68
1976	2.18	162	353.16
1977	2.18	43	120.83
1978	2.81	113	253.12
1979	2.75	168	462.00

Mean Price	2.57
Price Var.	.17
Mean Rev.	347.82
Rev. Var.	17,995.55
Coeff. of Var.	39%

Label - 95%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.61	131	341.91
1974	3.23	163	526.49
1975	2.13	173	368.49
1976	2.17	162	351.54
1977	2.86	43	122.98
1978	2.24	113	253.12
1979	2.74	168	460.32

Mean Price	2.57
Price Var.	.17
Mean Rev.	346.41
Rev. Var.	17,427.06
Coeff. of Var.	38%

Label - 100%

Year	Price $/bu.	Yield bu./ac.	Total Rev. $/ac.
1973	2.63	131	344.53
1974	3.22	163	524.86
1975	2.10	173	363.30
1976	2.17	162	351.54
1977	2.92	43	125.56
1978	2.25	113	254.25
1979	2.74	168	460.32

Mean Price	2.58
Price Var.	.18
Mean Rev.	346.34
Rev. Var.	17,067.19
Coeff. of Var.	38%

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THE IMPACT OF YIELD RISK ON SELECTED HEDGING STRATEGIES FOR EASTERN VIRGINIA CORN PRODUCERS

by

Jonathan Lee McCanless

(ABSTRACT)

The primary objectives of this study were to:

1. find those levels of hedging, in terms of percent of expected yield, that are most efficient for each hedging strategy; and

2. compare and contrast the trade-off between revenue received and revenue variance between certain routine hedges and certain selective hedging strategies that include yield risk.

Data from 1951-1979 were used to estimate the relationship between yield and certain moisture and temperature data. Predictions of expected yield were made at planting and after the first week of July. Percentages of these predictions were hedged at selected intervals using routine and selected hedge programs including a 4 and 10 day moving average.

Price and yield were uncorrelated in the northern neck region of Virginia. Hedging 100 percent of expected yield at planting generated the smallest revenue variance and mean revenue per acre. Using moving averages to place and lift hedges increased the mean and variance of revenue per acre.

None of the strategies analyzed generated revenues per acre greater than selling for cash at harvest.

The overall conclusion is that no simple guidelines in terms of percentage of expected yield to hedge at various stages of plant growth can be recommended.